Rise of the Machine:
The Making of the Video Game Industry and Military Simulation

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ABSTRACT

Rise of the Machine assesses the history and development of the home video game industry and its technological evolution from a military industrial structure that has its roots in the Second World War. The thesis focuses on career of Ralph H. Baer and the work conducted at Sanders Associates. Baer's innovative video game work progressed through three distinct phases of development that acted as a primary component in what would become known as the military-entertainment complex.

The first phase of video game development occurred from 1966-72 and resulted in the invention of the world's first home video game console, the Magnavox *Odyssey*. Following a brief period of commercial success, the second phase of video game development commenced from 1974-79. The second phase yielded great results in the form of the Telesketch, HEC terminal, and the Cable-Mate programs that demonstrated the flexibility associated with video game technology. The third and final phase of video game development contributed towards the establishment of the military-entertainment complex. The softening of the video game industry combined with a re-invigoration of conventional warfare resulted in the development of the Interactive Video Game Training System (IVTS). In recognizing these three phases of video game development, it can be seen how the IVTS system acted as the catalyst that brought the entertainment industry into close proximity with the United States military and set the precedent for contemporary military simulations programs to come.

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TABLE OF CONTENTS

TABLE OF ILLUSTRATIONS

Introduction

The earliest prototypes of television video games were simplistic in nature and primitive by design. Player one controlled a single red square representing a fox that was chased around the screen by player two, who controlled a series of white squares simulating hounds. The objective of the game was to test the wit and coordination of the two players by utilizing both the vertical and horizontal directional knobs of a controller to see how long the fox could evade the hounds before it was caught.[1] Similar to childhood playground games such as 'tag,' the chase-game, appropriately entitled *Fox & Hounds*, was the first video game played on a television screen.[2] The video game technology was developed in 1967 by engineer/inventor Ralph H. Baer and a small production team at the New Hampshire based Sanders Associates Incorporation, a widely renowned military defense contractor. The decision to further develop video game technology not only caused Sanders to stray from its typical industrial pursuits but also marks the beginning of an era where war, simulation, and techno-culture each intersect with the common factor of video games.[3]

Void of any type of commercial experience to market a gaming device on its own, Sanders' success of manufacturing what ultimately would be the first video game rested upon contractual negotiations with prospecting companies. The grueling five-year process yielded the Magnavox *Odyssey* and marked the beginning of a technological

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[1] David Winter, "*Once Upon A Time the Video Game...*," Pong-Story, http://www.pong-story.com/sanders.htm [accessed March 10, 2012].
[2] Van Burnham, *Supercade: A Visual History of the Videogame Age 1971-1984* (Cambridge: The MIT Press, 2003), 52.
[3] Patrick Crogan, introduction to *Gameplay Mode: War, Simulation and Technoculture*, by Patrick Crogan (Minneapolis: University of Minnesota Press, 2011), xvii.

revolution. Although the *Odyssey* was by no means the first video game system invented, it allowed for the massive expansion of video game technology that had been restricted to computer mainframes in laboratories across the United States. The success of the home video game console placed Baer and his patented technology at a crossroads between entertainment product and militaristic armament. Continuous technological innovation stemming from the *Odyssey* not only fathered a multi-billion dollar home video game industry but would be utilized to alter and improve upon the practices of modern military training through simulation.

Emerging as one of the highest grossing media outlets in the world, the video game industry enjoys a multi-national clientele with a vast array of mediums to provide its games and services. The industry has developed so rapidly that the total consumer spending of gaming content (comprising console and personal computer games, used games, rentals, subscriptions, digital downloads, social network games, downloadable content, and mobile games) had an approximate value in the United States alone of $16.3 to $16.6 billion USD in 2011.[4] Despite the continued posting of losses in the American market, the gaming industry is projected to hit $70 billion globally in 2012, up from $65 billion a year before.[5] The figures represent a healthy and fruitful industry that continues to grow annually and has come to rival both the music and Hollywood film industries. It is apparent that video games continue to challenge technological limitations and

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[4] NPD Group, "2011 Total Consumer Spend on All Games Content in the U.S. Estimated Between $16.3 to $16.6 Billion," The NPD Group, Inc., https://www.npd.com/wps/portal/npd/us/news/pressreleases/pr_120116 [accessed February 15, 2012].
[5] Quinton Bronkhorst, "Games vs. Movies: Who Wins?" Business Technology, http://businesstech.co.za/news/general/19901/games-vs-movies-who-wins/ [accessed April 15, 2013].

successfully provide its creative, high-resolution potential to a growing international market.

Thriving upon continuous innovation, creativity, and diversity amongst its titles and consoles, the flexibility of the industry has allowed video games to become inter-disciplinary in nature. Not only do video games span a wide variety of platforms in which they operate but their influence is also spreading beyond the bounds of the games produced. Video games continue to play an influential role in popular culture and production companies even adopt their star characters to act as a type of advertising logo. Originally appearing as 'Jumpman' in the hit arcade game *Donkey Kong* (1981), Nintendo continues to utilize Mario to gain foothold in the realms of film, television shows, books, graphic novels, magazines, comics, a wide variety of merchandise, and even professional sports.[6] The success of the video game industry and the advent of 'gamer culture' continues to impact the development of the digital experience.

As technology continues to evolve, the video game industry naturally follows suit. Video game consoles and their outputs are highly interactive and communicative in nature while offering a variety of possibilities to the user. One simply has to inspect the creative capabilities associated with the Playstation *Move*, Xbox *Kinect*, or Nintendo *Wii* to gather as an ample demonstration of the medium's seemingly limitless technological breakthroughs. One of the greatest beneficiaries of this technological innovation is the United States Armed Forces.

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[6] Jeff Ryan, *Super Mario: How Nintendo Conquered America* (New York: The Penguin Group, 2011), 90-91.

Rise of the Machines will assess the tight knitted, reciprocal relationship between entertainment product and militaristic simulation with a specific focus on the career of Ralph Baer, the father of home video games. The engineering works of Baer mark the first attempt to break the technological limitations of the time and bring video games to the home. Video game pursuits at Sanders resulted in three separate phases of video game development projects from 1966-1984. The phases not only provided the technological foundation for the video game industry but also they doubled in function to establish the formal relationship between the entertainment industry and the defense simulation modeling community that is best described as the military-entertainment complex.

The concept of adopting games for the purposes of military simulation is by no means a new phenomenon. The United States Department of Defense (DoD) has been the primary proponent of war game design since the 1950s.[7] The emergence of video game technology in the 1970s spurred an initial relationship between the two conglomerates stemming from the commercial works of Baer. A report on Modeling and Simulation identified the military-entertainment complex as the linkage between the media industries and the Pentagon in 1997.[8] The proposal determined that five main areas of research/development interests bound the two communities. Shared areas of interest included technologies for immersion, networked simulation, interoperability, computer generated characters, and hardware and software tools for creating synthetic

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[7] Tim Lenoir and Henry Lowood, "All but War is Simulation: The Military-Entertainment Complex," *Configurations* 8 (2000): 238.

[8] Committee on Modeling and Simulation: Opportunities for Collaboration Between the Defense and Entertainment Research Communities, Computer Science and Telecommunications Board, and National Research Council, *Modeling and Simulation: Linking Entertainment and Defense* (Washington, DC: National Academies Press, 1997).

environments.[9] The National Research Council's recommendation, found in the Modeling and Simulation report, encouraged the merger of commercial and military simulations technology. The decision represented the final push needed to formally amalgamate entertainment with the military.

The signing of a forty-five million dollar contract between the United States Army and the University of Southern California in 1999 officially established the Institute for Creative Technologies (ICT). The institution houses both movie producers and video game developers to improve realism in training simulations through the development of new computer technologies.[10] It is apparent that great potential laid in collaborative work between the two communities to enrich the current technology behind modeling and simulation for both commercial and military purposes. The success of the merger is best evidenced by the current makeup of the two, now inter-related, industries.

The current video game market is saturated with a wide arrangement of First Person Shooter (FPS) and Real-Time Strategy (RTS) military themed games. These mainstream gaming genres allow the player to participate in a wide variety of combat roles ranging from seasoned generals overlooking the whole of the battlefield, to the lowly private first needing to complete basic training. Such games offer an artificial experience in which the user becomes assimilated into the practices of war for the price tag of sixty dollars or less. The commercial success of games falling under the military

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[9] Committee on Modeling and Simulation: Opportunities for Collaboration Between the Defense and Entertainment Research Communities, Computer Science and Telecommunications Board, and National Research Council, *Modeling and Simulation: Linking Entertainment and Defense* (Washington, DC: National Academies Press, 1997), 4.

[10] Bob Brewin, "Hollywood, DOD Join Forces to Create Realistic Simulations for Military Officers," *CNN*, August 31, 1999.

themed umbrella generally rests on the ability to seamlessly immerse the player into a realistic combat environment. Consumer demand for high intensity, quick paced action is met by incorporating life-like graphics, highly communicative interactions, and realistic weapons and tactics. The new capabilities double as an essential asset for military recruitment and training, one of the earliest examples being id Software's 1994 release entitled *Doom*.[11]

The commercial success of *Doom* radically altered the landscape of video game culture as it promoted a new breed of game that popularized the FPS genre and allowed users to compete not solely as players but as creators as well.[12] Gamers were given the ability to craft their own modified versions of *Doom* following the public release of the source code. This development spilled over to the military theatre as the U.S. Marine Corps Modeling and Simulation Management Office adopted *Doom 1.9* for the purposes of training four person fire-teams.[13] The development represented one of the earlier military-video game ports and gave way to other controversial releases such as *Virtual Battlespace Systems 1*, *America's Army*, and *Full Spectrum Warrior* to name a few. The commercial and military influence of these games speaks volumes to the mutually beneficial relationship that publicly surfaced in the 1990s. Of course, video games did not originate with these high-powered capabilities at hand. When exploring the historical development of the video game industry, a deep-rooted relationship exists between entertainment and military dating back to the works of Ralph Baer.

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[11] Seth McLaughlin, "U.S. Army Expands the Use of Video Games for Training," *World Politics Review* (May 2009).
[12] Jessie Cameron Herz, *Joystick Nation: How Video Games Ate Our Quarters, Won Our Hearts, and Rewired Our Minds* (New York: Little, Brown and Co., 1997), 84.
[13] Robin Andersen, *A Century of Media, A Century of War* (New York: Peter Lang Publishing Inc., 2006), 246.

Existing literature covering the history and development of the video game industry falls under one of two over-arching theories. The first theory views the development of the industry as a form of Natural Progression. Continuous modifications in electronics technology allowed the entertainment industry to gradually improve its equipment thus leading to the contemporary video game. The second theory views the development of video games as a form of computational-offspring stemming from Cold War technology. The latter offers a Military Development approach that can be broken down into two further sub-categories: the first of which concerns long term histories linking war and games back to ancient civilizations, while the second focuses on time specific influences that highlight the correlation between diplomatic and military policies with the virtual revolution.

Although both perspectives vary widely in their approaches to the study of video games, a similar point of interest that connects the two theories concerns profitability. On one hand, the theory of Natural Progression determines that entertainment software and hardware developers compete on the basis of product innovation in order to produce a more compelling experience for the consumer.[14] Video game technology continues to move through a mode of natural progression based upon issues of consumer demand. On the other hand, the theory of Military Development determines that the United States military looks to adopt video game technology to reduce the costs of training, reach out to new recruits, and prepare for real and hypothetical virtual crises. The concept of 'profitability' for the U.S. military is to develop a series of virtual systems that will act as

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[14] Robert W. Crandall and James G. Sidak, "Video Games: Serious Business for America's Economy," *Entertainment Software Association Report*, 2006.

the next stage in a long lineage of war preparation. The objective of this thesis is not to refute either theory's contributions to understanding the development of the video game industry. Rather, this work will focus on the visionary works of Ralph Baer and his role not only as the father of home video games but also the catalyst that contributed towards the establishment of the military-entertainment complex.

THEORY OF NATURAL PROGRESSION

The theory of Natural Progression argues that a gradual development of electronic devices originating from the 1870s led to the eventual construction of the video game console in the 1960s. The late nineteenth century marked a period when the landscape of public amusements began to undertake a drastic transformation. Before the technological developments that altered social customs, public amusements were highly reflective of the socio-political construct of a given town and generally owed their 'publicity' to its reception in local newspapers.[15] As Michel S. Beaulieu explains, socially elite individuals controlled the means and methods of information dissemination in the early nineteenth century. Certain forms of entertainment were suppressed while others were granted approval in an attempt to preserve the moral and political order of the town as they saw fit.[16] The freedom to differentiate between what public amusements would be acknowledged and those that would not often impacted the socio-political makeup of those in attendance.

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[15] Michel S. Beaulieu, "'Not that I lov'd Fleas less, but that I lov'd England more,' Entertainment in Kingston, 1816-1837," *Ontario History* CII, no. 2 (2010): 199-200.
[16] Ibid., 200.

The stigmas associated with social elitism combined with the high price of admission to enter theatre performances or traveling exhibitions acted to comb certain societal members from attending such events. Price restrictions generally constrained the average worker to attending the occasional show or to enjoy more affordable doings at the local tavern.[17] Tavern entertainment ranged from men throwing "sticks, stones, and mud at each other," to men engaged in "confabulations" over drink, to moments when a tavern company all "fell to dancing."[18] Though class distinction was not as prevalent in pubs or taverns, the same could not be said for more public amusements.

It was the electrification of the metropolis that acted as the primary factor in changing both the social and technological dynamic of North America.[19] The newly established entertainment industry provided a cultural impact that radically altered the social norm. David Nasaw explains that the electrification of towns not only made going-out at night easier and cheaper than ever before but such advances in technology also allowed for the expansion of commercial amusements.[20] Electric devices provided machines that spoke, sang, showed moving pictures and even told stories to its customers. What resulted was the birth of the electronic entertainment industry.

One of the earliest and most popular amusement machines of the late nineteenth century was the phonograph. Patented by Thomas Edison in 1877, the phonograph was originally designed to operate as a dictation machine for business solutions. Due to the

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[17] Beaulieu, "'Not that I lov'd Fleas less, but that I lov'd England more,' 200.
[18] Julia Roberts, "The Games People Played: Tavern Amusements and Colonial Social Relations," *Ontario History* CII, no. 2 (2010): 174.
[19] David Nasaw, *Going Out: The Rise and Fall of Public Amusements* (New York: Harper Collins Publishers, Inc., 1993).
[20] Ibid., 9.

machines limited ability to house audio playback, the phonograph was eventually re-fitted to operate as a 'coin-in-the-slot' machine that provided the operator with short audio commentary.[21] The ensuing success of the phonograph machines in the public domain led to erection of permanent exhibition sites in high traffic areas throughout towns, informally establishing the first 'parlour.' Primitive commercial amusements such as the phonograph incrementally influenced both the technological and social components involved with the evolution of video arcade games and screen technology.[22]

The history of the video game industry demonstrates that the latter benefitted from a close relationship with a well-established amusement industry.[23] Stemming from the early success of the phonograph, new technologies do not simply spring out of thin air but rather they need to be associated with familiar industries or ideas and develop in a form of subtle progression.[24] Once the entertainment industry had been established in correlation with the electrification of the metropolis, the main contributor to the establishment of the video game industry was David Gottlieb's invention of the penny-arcade game known as *Baffle Ball* in 1931.

Drawing inspiration from the mid-nineteenth century tabletop game *Bagatelle*, *Baffle Ball* allowed user to project a series of marbles into scoring pockets, protected by

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[21] Walter L. Welch and Leah Brodbeck Stenzel Burt, *From Tinfoil to Stereo: The Acoustic Years of the Recording Industry, 1877-1929* (Gainesville: University Press of Florida, 1994), 87.
[22] For more information on the history, development, and impact of the phonograph, see; Roland Gelatt, *The Fabulous Phonograph, 1877-1977* (New York: MacMillan Publishing Company, 1977), 28-29, 46-57; Martin W. Laforse and James A. Drake, *Popular Culture and American Life: Selected Topics in the Study of American Popular Culture* (Chicago: Nelson-Hall, 1981), 25-33.
[23] Steven Kent, *The Ultimate History of Video Games: From Pong to Pokemon and Beyond...*, 1st ed. (New York: Random House Digital, Inc., 2001).
[24] Ibid., 2.

wooden pins that housed pre-determined scores.[25] The machine utilized no electricity and scores had to be kept by hand. Void of any type of levers to propel the ball back into the field of play after the initial launch, the game was based on notions of luck as opposed to skill. It was this very notion of luck that caused Chicago, Los Angeles, and New York to ban the games as a type of gambling.[26] Apart from tilting the cabinet in an attempt to alter the path of the ball, the machines had a lack of user control that greatly impacted the decision to ban such games.

Despite some of the harsh reactions from prominent municipalities, Gottlieb's creation maintains the title of the world's first pinball machine - a highly touted invention. The machine was quite revolutionary for its time and gave rise to a successful pinball industry.[27] Modified versions of the game added electronic scoreboards and spring-powered levers that forced the user to propel the ball back into the field of play successfully bringing the modern pinball machine to life.[28] The sheer success of *Baffle Ball* proved the entertainment industry to be a fruitful investment for prospecting companies. In an attempt to enter the market, a wide variety of imitations and modifications to Gottlieb's invention shortly followed.[29]

Upon the continued development of more sophisticated cabinet games, black light and projection screen games began to replace the pinball craze.[30] The change in dynamic

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[25] Roger Sharpe, "Pinball!" *Popular Mechanics*, December 1994, 63-65.
[26] Peter Townshend, "Pinball Wizard," *Professional Safety*, December 2012, 56.
[27] Sharpe, "Pinball!" 64.
[28] Robert R. Craven, *Billiards, Bowling, Table Tennis, Pinball, and Video Games: A Bibliographical Guide* (Connecticut: Greenwood Press, 1983), 122.
[29] Kent, *The Ultimate History of Video Games*, 8.
[30] For more on the history of pinball, see; Edward Trapunski, *Special When Lit: A Visual and Anecdotal History of Pinball* (New York: Doubleday, 1979); Marco Rossignoli, *The Complete Pinball Book: Collecting the Game & Its History* (Pennsylvania: Schiffer Publishing, Ltd., 2011).

derived from the perfection of Cathode Ray Tube (CRT) technology in the 1930s.[31] CRT technology quickly became the foundation for all television systems and the first game to utilize this technology was the *Cathode Ray Tube Amusement Device* developed by Dr. Thomas Goldsmith Jr. and Estle Ray Man. The technology devised a system of manipulating the electron beam by controlling a set of variable resistors to simulate a simple missile shooting game.[32] The CRT simulation marked the first of many technological advancements that contributed to the gradual development of video game consoles. It provided the technological foundation for pivotal contributions to the industry, including: Alexander Douglas' dissertation on human-computer interactions entitled *Noughts & Crosses*, a game entitled *Tennis for Two* developed by William Higinbotham at Brookhaven National Labs, Steve Russell's use of the PDP-1 computer to create *Spacewar!* and Nolan Bushnell's cofounding of both *Pong* and the famed video game company, Atari.[33] The lasting influence and significance of the aforementioned will be discussed at greater length in later chapters.

It was only natural that video was to become the immediate successor to pinball. The industry found its roots in establishing screen representations of old games: *Pong* is to *Ping Pong,* as *Space Invaders* is to *Bowling.*[34] By utilizing a combination of existing technologies and implementing sound effects to enhance the simulation, the transition

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[31] Roberto Dillon, *The Golden Age of Video Games: The Birth of a Multi-Billion Dollar Industry* (Florida: CRC Press, 2011), 2.
[32] Ibid., 3.
[33] For more information on early video game developments, see; Roberto Dillon, *The Golden Age of Video Games: The Birth of a Multi-Billion Dollar Industry* (Florida: CRC Press, 2011), 2-10; Tristan Donovan, *Replay: The History of Video Games* (New Jersey: Yellow Ant, 2010), 3-13; Gerard Kraus, "Video Games: Platforms, Programmes and Players," in *Digital Cultures: Understanding New Media*, edited by Glen Creeber and Royston Martin (United States: Crown Business, 2010), 76-77; and Morgan Ramsay, "Nolan Bushnell: Cofounder, Atari," in *Gamers at Work: Stories Behind the Games People Play* (United States: Apress, 2012), 17-36.
[34] Craven, *Billiards, Bowling, Table Tennis, Pinball, and Video Games*, 128.

from a simplistic luck-induced game in the form of *Baffle Ball* to that of a primitive arcade game such as the *Cathode Ray Tube Amusement Device* was complete. The release of the Magnavox *Odyssey* represents a period of great change for the entertainment industry. The system marked the first of eight generations of video game console development that improved graphical, auditory, and memory-based capabilities incrementally. Though the profitability of the video game industry is driven through cycles of consumer demand and fatigue, technological progression remained at the fore. The bit wars between Nintendo and Sega in the early 1990s marked the first time that graphical capabilities were used as a marketing tool. Over twenty years later, the implementation of improved graphics to enhance the user's experience is still being utilized as an attempt to improve market position for video game companies.

The theory of Natural Progression dictates that the advent of arcade games and their console translations derived from a collection of innovative developments within the entertainment industry and the pinball world.[35] The early machines may have lacked the fast paced, rapid wrist action present in contemporary games, but they certainly paved the way in terms of both social construct and in technological development, spurring continuous innovation.

Theory of Military Development

The long-term Theory of Military Development argues that the interoperability between war and game is by no means a recent development but dates back to ancient civilizations. Video games are representative of the universal feature in which human

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[35] Herz, *Joystick Nation*, 24.

societies adopt and integrate warfare into their respected cultural games. Ranging from the *Call of Duty* video game franchise to school ground games of 'cops and robbers,' theorists conclude that war can play a significant role in play. With this thought in mind, it has become readily apparent that the concept of 'wargaming' is not limited to modern military professionals and government think tanks.[36] Military themed games have remained popular as a form of leisure activity throughout the ages. The training and forecasting of war holds strong ties to nearly every human civilization and it is evident that the electronic militarization of games is the next step in a lineage of influential combat simulators.

The link between war and games is exceedingly complex and dates back to the oldest records of civilization. In his exploration of war and society, Ed Halter explains that as long as humans have waged war, they have also played it.[37] A variety of games made for entertainment inspired professional games designed to teach and wage war. The relationship would once again come full circle as strategic games greatly influenced novel innovations in games for pleasure.[38] Halter deduces that the reciprocal relationship between leisure based games and professional simulations originates from the common board game.

One of the most influential war simulation board games *Chaturanga*, better known as *Chess*, was developed in India sometime before 600 A. D.[39] *Chess* was utilized

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[36] Philip A. G. Sabin, "Playing at War: The Modern Hobby of Wargaming," in War and Games: Studies in the Nature of War, 3rd volume, ed. T. J. Cornell and T. B. Allen (San Marino: The Boydell Press, 2002), 193.
[37] Ed Halter, *From Sun Tzu to Xbox: War and Video Games* (New York: Thunder's Mouth Press, 2006).
[38] Ibid., 5.
[39] Ibid., 23.

as a manner in which to depict war as it provided the players with the opportunity to learn not by being instructed but through the consequences of their actions. Games that simulate reality allow the users to experience the cause and effect of their decisions in a simulated environment prior to the, potentially devastating, 'real' experience.[40] A variety of combat environments were simulated in an attempt to change the way military leaders thought about war. Bound to the rules and customs similar to those found in war, board games allowed strategists to sharpen their wits and prepare for hypothetical scenarios.

A gradual evolution in the mimicry of war continued well into the nineteenth century. It was at this point that Lieutenant Georg Leopold von Reisswitz published a new type of war-game known as *Kriegsspiel* in 1824. Based on a model developed by Johann Christian Ludwig Helwig in 1780, von Reisswitz's new Prussian war-game considerably altered the concept of gaming as a military procedure.[41] The logistics game consisted of a wide variety of rules in which time restrictions were taken into consideration and battle outcomes were determined by the roll of a die to simulate chance. The playing surface was scaled to embody four miles of terrain, and troops were represented by metallic pieces coloured red and blue. Pieces were delicately painted with the appropriate symbols to depict both their encampment and their branch of service.[42] The simulator offered the complete package, as far as board games can go, and numerous countries adopted *Kriegsspiel* as a military training aid.[43] It became apparent that war

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[40] James S. Coleman, "Learning Through Games," in *The Study of Games*, ed. Elliott M. Avedon and Brian Sutton Smith (New York: Krieger Publishing Company, 1979), 324.
[41] Ibid., 273-274.
[42] Ibid., 274.
[43] Sabin, "Playing at War: The Modern Hobby of Wargaming," 198.

games offered strategic insights to its trainees and allowed players to acquire "battle experience" in the absence of real war.[44]

The advancement of computer technology in the twentieth century allowed war games to develop on the technological front – making their board game equivalencies obsolete. The era of computerized war games was ushered in throughout 1950s and continues to play a heavy role on Western military thought.[45] It is at this point that long-term Military Development historians determine that current simulations technology and the recurrent video game industry emerged as an accidental product of war and transformed the way militaries think about war through innovation and simulation. Short-term Military Development historians however focus not on the long-term adoption of games as military practice but in the wake of the computerization of such techniques.

Short-term histories regarding the Military Development of video games focus on two main periods of interest. The first period reviews the development of the computer and the origins of video game technology itself. The second period surrounds the adoption, usage, and coverage of the technology into the United States military from the First Persian Gulf War through the turn of the twenty-first century. The contemporary studies on the video game industry reflect the transition of a military-industrial society to that of a military-entertainment complex. A fiscally efficient U.S. military built on sound business practices, combined with military procurement interfacing seamlessly linked

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[44] Manuel de Landa, *War in the Age of Intelligence Machines* (New York: Swerve Editions, 1991), 2.
[45] For more information on computerized war games, see; Thomas B. Allen, War Games: The Secret World of the Creators, Players, and Policy Makers Rehearsing World War III Today (New York: Mcgraw-Hill, 1987), 21-41, 307-321; Barry J. Carter, Naval War Games: World War I and World War II (New York: Arco Publishing Company, Inc., 1975); Peter P. Perla, The Art of Wargaming: A Guide for Professionals and Hobbyists (Annapolis, MD: US Naval Institute Press, 1990) 105-160, 163-182; Philip Sabin, Simulating War: Studying Conflict Through Simulation Games (London: Bloomsbury Academic, 2012), 67-132.

with industrial manufacturing processes created the formula for industrial transition.[46] Video game technology provides new alternatives to combat training and simulation, a characteristic that makes them extremely attractive to Western militaries.

Works concerning the history of the computer and its technological offspring often stem from socio-political ramifications associated with the Great Depression. The continued position of American isolationism resulted in a drastic reduction of wartime production and government contracting in the 1930s. Following the Japanese air raid on the United States Pacific Fleet at Pearl Harbor, President Franklin Roosevelt issued his declaration of war on 8 December 1941. Upon the entrance of the United States in Second World War, the American economy strengthened and top industrial employees began to work for the American government to develop high-tech weaponry and weapons delivery systems.[47] The U.S. economy developed as a system built on the practice of putting people to work for the government. The new economic system ushered in by the Eisenhower Administration planted its roots in war production, resulting in the establishment of the military-industrial complex.[48] So long as wars continued to be fought, American companies would develop its machinery based upon a self-sustaining system of industry, banking, technological research, and the armed forces.[49] It was through this system that the United States would enter the Cold War, setting the stage for the birth of video games.

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[46] Timothy Lenoir, "Fashioning the Military Entertainment Complex," *Corresponsence: An International Review of Culture and Society* 10 (Winter 2002): 14.
[47] Victor Archibong, "The Military-Industrial Complex and the Persian Gulf War: Ike's Caveat," in *The Gulf War as Popular Entertainment: An Analysis of the Military-Industrial Complex*, ed. Paul Leslie (Lewiston: The Edwin Mellen Press, 1997), 35.
[48] Ibid., 35.
[49] Ibid., 36.

By using the power of video games to recruit, train, and motivate soldiers, the diplomatic and military policies of the United States have become increasingly based on technological and representational forms best described as 'virtuous war.'[50] The weapons used in combat no longer influence the modern soldier but the soldier's function is to be reconstructed and reprogrammed to fit integrally into a specifically engineered weapons system.[51] Due to the industrial development and technological gains of the United States in the latter half of the twentieth century, historians argue that video games emerged as a result of direct military involvement and comment on its earliest application, demonstrated throughout the Persian Gulf War.

Spawning from the industrial development of corporate business during the Second World War, media and entertainment firms began to receive government funding in the reformation of military technological innovation. Military funded research on computerized hardware and software inevitably led to the inception of the contemporary video game.[52] Due to the success of their integrated programming into the military, video games continue to act as the primary driving force in war and simulation.

A New Vision on the Development of the Video Game Industry

This thesis is intended for readers looking to analyze the history and development of the video game industry in relation to early military-entertainment relations. The work will be heavily influenced by archival research conducted at two primary locations: *The*

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50 James Der Derian, introduction to *Virtuous War: Mapping the Military-Industrial-Media-Entertainment-Network*, by James Der Derian, 2nd ed. (New York: Routledge, 2009), xxxi.
51 Chris Hables Gray, *Postmodern War: The New Politics of Conflict* (New York: The Guilford Press, 1997), 195.
52 Patrick Crogan, introduction to *Gameplay Mode: War, Simulation and Technoculture*, by Patrick Crogan (Minneapolis: University of Minnesota Press, 2011), xvii.

Ralph H. Baer Collection located at the Lemelson Center in the Smithsonian Museum of American History and the *Ralph H. Baer Papers, 1960s-2009* found at the Brian Sutton-Smith Library and Archives of Play at The Strong in Rochester, New York.

The material located at the Smithsonian Museum provides great insight into the process of developing the Magnavox *Odyssey*. The archives offer a plethora of diagrams and schematics concerning the various stages in completing the Brown Box prototype and highlight the negotiations between Sanders and prospecting companies in manufacturing the modern innovation. An unpublished autobiography of Ralph Baer is also provided, not only outlining his experiences in the United States Army but his early life and career as an engineer/inventor. The material illustrates how early life experiences provided Baer with the familiarity and practical knowledge necessary to develop the original concept of video games and then re-engineer the technology to function for the purpose of simulation. The material was instrumental in developing a base knowledge of Baer's contributions to the video game industry as a whole.

The Library and Archives of Play house the personal career-works of Ralph Baer from the time he was working at Sanders and completing contracting work for Marvin Glass Associates and a variety of video game production/manufacturing companies. The material consists of company memorandums, research and development objectives, and annual reports regarding the success of simulations technology. Schematics are also provided for the development of the *Odyssey's Shooting Gallery*, the Light Anti-Tank Weapon, and VIPER firearms simulators. An extensive collection of video game industry magazines, educational films, and photographs are available to develop a better understanding of generational video game console development.

An examination of the existing secondary literature was utilized to develop a fundamental understanding of existing theories and stages of developments concerning the history of the video game industry as a whole. A wealth of material exists in terms of understanding the key individuals, production companies, and influential games responsible for the success, and at times, demise of the industry. Works describing both the Natural Development and the Military Development theories concerning the birth of the industry were taken into careful consideration. As a result of the analyses of the primary and secondary materials, it is the intention of this thesis to revisit the significance of the Magnavox *Odyssey* and the console's impact on the development of the digital culture that has shaped the very fabric of contemporary society. In order to convey the argument, this thesis will be divided into four separate sections.

The first chapter will review the importance behind the development of the computer and the atomic bomb. It is evident that nuclear development dramatically altered the international scene at the end of the Second World War as it furthered the relationship between science and technology for the war effort. In the early stages of the Cold War, it became apparent that the emergence of several nuclear powers not only altered who fought wars but how they were fought as well. A new focus on the development of high-tech, conventional weapons began to replace the method of atomic diplomacy. The change in policy would impact the works of engineers at military contracting companies such as Ralph Baer. The commercial technology found in the Magnavox *Odyssey* would later be adopted to establish the first weapons simulators to increase the efficiency of such devices, lower training costs, and shorten the overall length of training programs. The introductory chapter will explain the militaristic climate

that allowed for the three separate phases of video game development to occur in the post-war era.

The second chapter will provide an in-depth analysis of the life and career of Ralph H. Baer and both first and second phase of video game development from 1966-72 and 1974-79. The chapter will evaluate the experience Baer gained from cataloguing a wide variety of firearms during the Second World War that provided the young engineer with a strong affiliation with weapons technology. Combined with a degree from the American Television Institute of Technology (ATIT) in the post-war years, the experience proved beneficial as he was offered a senior position job at Sanders Associates. Possessing the freedom to work on projects of his choosing, it was at this point in time that the first phase of video game development occurred and the fundamental technology associated with both the Brown Box prototype and simulations technology was created. The hardware, in what would become the Magnavox *Odyssey*, would later be applied to simulations technology for the United States Army, a fruitful endeavour for both the military and the video game industry. The second phase of video game development witnessed the adaptation of various console applications of the original Brown Box technology. The development of the Telesketch, HEC terminal, and the Cable-Mate programs stimulated a great evolution in video game capabilities.

The third chapter will draw attention to the third phase of video game development that directly contributed towards the establishment of the military-entertainment complex. It was a softening of the video game industry in the form of video game market crashes in 1977 and 1983 combined with a re-invigoration of conventional warfare that sparked the third and final phase in the late 1970s. The Interactive Video

Game Training System (IVTS) was a four-year program that cemented the relationship between the video game industry and the modern Western military. Commencing with the development of interactive video game technology at Sanders in 1979, relations between the two flourished and were seamlessly linked by 1984.

A concluding chapter commenting on the current makeup of the video game industry is the point of focus for the fourth and final chapter of the thesis. This section will assess the new generation of warriors and its overall impact on all facets of society that often remains clouded. The chapter will touch on the development of war as both game and entertainment but will also focus on the continued development of the military-entertainment complex and the future applications behind war games and simulations.

Chapter 1
The Development of Modern Computer Technology

The relationship between science and warfare has continuously pushed technological innovation to extreme heights. The invention of gunpowder, for example, is regarded as one of the most lethal phenomena the world has ever known. The integration of firearms pushed the history of the battlefield towards a grand new chapter in which the creation of a wide variety of machines to advance the art of war ensued. It was not until the emergence of the Second World War that technological developments peaked at a level beyond comparison. The advancement of high-speed computation proved to be of the utmost importance throughout the course of the war. The resulting innovations in computer technology not only altered the international landscape in the post-war world but dynamically changed the socio-industrial makeup of nations as well.[53]

The application of new technology into a significant number of military streams fundamentally altered the character and conduct of conflict.[54] The technological breakthroughs developed throughout the Second World War hastened a type of fascination with computer technology. The United States government continued to place emphasis on technological innovation and recruited technicians from a wide variety of scientific fields to work on an assortment of projects. This new economic system ushered in by the administration of Dwight Eisenhower embedded itself into what has since

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[53] Andrew F. Krepinevich, *Cavalry to Computer: The Pattern of Military Revolutions* (New York: National Affairs, 1994), 30.
[54] Ibid., 30.

become known as the military-industrial complex.[55] The emergence of the Cold War in the late 1940s accelerated the industrial practice due to the escalating tensions between the United States and the Soviet Union. Cold War hostilities facilitated the continued need for individuals, organizations, and companies to improve upon the machinery of war. Whether the contributions benefitted the Space Race or the development of Intercontinental Ballistic Missiles (ICBMs), supremacy over the enemy was to be expressed through technological and economic superiority.[56]

The overloading of government work resulted in a decentralized network of computer laboratories across the country that contributed towards a variety of technological innovations. At this moment it is important to recognize the history of the computer, its adoptive function as war machinery, and the technological offspring it produced that fostered a reciprocal relationship between war and game. In a few short years the United States military progressed from a heavy reliance on hand calculators and punch card systems to intricate computer systems capable of developing primitive, yet extremely influential computer games. What emerged was a creative explosion of computational capabilities from a variety of individuals that would collectively lead to the establishment of "hacker culture." Hackers emerged as isolated groups of technology obsessed college and graduate students that found interesting ways to solve computer related problems.[57] The interactions stimulated the development of primitive computer

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[55] Victor Archibong, "The Military-Industrial Complex and the Persian Gulf War: Ike's Caveat," in *The Gulf War as Popular Entertainment: An Analysis of the Military-Industrial Complex*, ed. Paul Leslie (Lewiston: The Edwin Mellen Press, 1997), 35.
[56] William E. Burrows, *This New Ocean: The Story of the First Space Age* (New York: Modern Library, 1999), 147-149.
[57] For an extensive history on the development of 'hacker culture,' see Douglas Thomas, *Hacker Culture* (Minnesota: University of Minnesota Press, 2002), 5-46.

games and eventually, the home video game industry itself. Now the single largest entertainment medium in the world, the video game industry was forged out of war technology stemming from the birth of the computer, international hostilities, the emergence of human-computer interactions, and the economic structure that housed them.

A Brief History of the Computer

The electronic computer originates from early attempts at developing mechanical and electrical computing machines. One of the earliest representations of performing rapid calculations on industrial machinery derives from Charles Babbage and his idea of a "Difference Engine" in the nineteenth century.[58] His punch card system was designed to both calculate and tabulate polynomial functions that automatically prints the results in a table; the user can then utilize the table to complete a variety of relevant mathematical functions.[59] Although his design was never completed, Babbage is often credited as the father of the modern computer as his machine eventually influenced the production of more complex designs.[60] Shortly after Babbage's death, Herman Hollerith adopted the punch card system that was being utilized in the aforementioned project. Hollerith's design was outfitted to sort the results of the United States 1880 census and its successful application made it the staple of data processing.[61] Modest improvements to the punch card system followed, but at the outbreak of the Second World War computing

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[58] Computer History Museum, "The Babbage Engine: The Age of Machinery," Computer History Museum, http://www.computerhistory.org/babbage/history/ [accessed November 3, 2012].
[59] Ibid.
[60] Leonard Herman, *Phoenix: The Fall and Rise of Video Games*, 2nd ed. (New Jersey: Rolenta Press, 1997), 4.
[61] Andrew Wilson, *The Bomb and the Computer* (London: Barrie and Rockliff – The Cresset Press, 1968), 79.

technologies were still limited to differential analyzers, punch card installations, and teams of human computers that were equipped with desktop calculators.[62] It was apparent that there was a dire need for improvement in mathematical computation techniques.

Providing drastic improvements to calculation speeds were at the forefront of military research around the world in the 1940s, but the United States held a significant advantage. During the First World War, a research centre had been established and assigned with the task of conducting artillery and munitions test firing, as well as performing calibration diagnoses.[63] Formally re-named the Ballistics Research Lab (BRL) in 1938, it continued to conduct its research into the 1940s. The scale of operations escalated greatly after the United States entered the war. Intellects were recruited to the BRL and the practice of hiring large groups of individuals to work for the government began to take shape. The BRL and the Moore School of Electrical Engineering at the University of Pennsylvania were brought together due to the university's possession of a "Bush Differential Analyzer."[64] A mechanically operated computer, a differential analyzer utilizes a variety of mechanisms to perform mathematical integrations to calculate artillery and bombing trajectories. The decision to utilize such a machine marked the beginning of a shift in dynamic between human-computer interactions.

The incorporation of differential analyzers, such as the *Mark I* electromechanical calculator found at the University of Pennsylvania, failed to produce the desired results

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[62] Martin Campbell-Kelly and William Aspray, *Computer: A History of the Information Machine*, 2nd ed. (Colorado: Westview Press, 2004), 69.
[63] Ibid., 71.
[64] Ibid., 71.

sought by the BRL. The calculations averaged fifteen minutes in length and had to be conducted by highly trained individuals slowing the process further.[65] While teaching a class in wartime electronics at the Moore School, physicist John Mauchly described an electrical computer that would be able to calculate each ballistic table in thirty seconds.[66] A computer project similar to Mauchly's had surfaced once before under the construction of John Vincent Atanasoff and Clifford Berry in 1937. The Atanasoff-Berry Computer (ABC) was a rudimentary electronic computing device that failed to come to fruition but provided a sound foundation for Mauchly's revised version.[67] The Army Ordnance Department quickly approved of the necessary funding for Mauchly and graduate student J. Presper Eckert to develop the Electronic Numerical Integrator and Calculator (ENIAC) the first general-purpose digital electronic computer in April of 1943.

The primary computing function surrounding the development of the ENIAC was to rapidly produce "firing tables" for artillery strikes. After being given the range of the target, a firing table would allow a gunner to determine the angles to fire the gun in the air (elevation) and the angle to the target (azimuth).[68] While such calculations were a tedious task, their significance to the war cannot be overlooked. Long-range weapons were rendered ineffective until such tables were completed so the gunner could determine exactly how far the projectile would fall en route to the target.[69] A typical firing table contains data for approximately 3,000 trajectories. Calculating a single trajectory by hand could take anywhere from 10-20 minutes while a complete table could take up to thirty

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[65] Herman, *Phoenix*, 4.
[66] Ibid., 4.
[67] Campbell-Kelly and Aspray, *Computer*, 73.
[68] Les Freed, *The History of Computers* (New York: Ziff-Davis Press, 1995), 43.
[69] Ibid., 43.

days to finish.[70] Before the development of the ENIAC it was evident that a severe lack of calculating technology existed and the situation had to be remedied.

Despite the desperate need to improve calculation speeds, the ENIAC was completed six weeks after the signing of the Nazi German Instrument of Surrender on 8 May 1945 marking the end of the war in Europe. The final product consisted of 18,000 tubes, 70,000 resisters, 10,000 capacitors, 6,000 switches and 1,500 relays and was outfitted to operate with a punch-card system.[71] The ENIAC's capabilities were immediately utilized for a variety of scientific and militaristic purposes. The ENIAC represented the birth of the electronic computer and acted as the prototype to all modern computers.[72] Despite the notable successes of the computer, there were also major flaws associated with the machine. The calculating device had less than optimal storage and analysts had to go through great lengths to reprogram the computer. The inflexibility of the design ensured that the technology would not last long, encouraging Mauchly and Eckert to begin working on its successor.

Captivated by the logical and mathematical issues regarding computer design, famed mathematician John von Neumann became a consultant to the ENIAC group. He was brought to the team to resolve differences and to develop a new design known as the stored-program computer.[73] With von Neumann now consulting, the project began to develop what eventually became the Electronic Discrete Variable Computer (EDVAC) to improve upon the ENIAC's deficiencies. On 30 June 1945, von Neumann composed *A*

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[70] Herman, *Phoenix*, 4.
[71] Campbell-Kelly and Aspray, *Computer*, 77.
[72] Freed, *The History of Computers*, 44.
[73] Herman, *Phoenix*, 5.

First Draft of a Report on the EDVAC that has served as the technological basis for the worldwide computer industry.[74] The agenda for the newly formed production group concerned the development of a computer that could simultaneously run a variety of programs to suit virtually any task that required data collection and computation.[75]

The computer technology developed by the production group played a significant role in the war effort. In September 1943, von Neumann made the first of many visits to the Los Alamos National Laboratory in New Mexico. The mathematician had been asked to visit the facility by Laboratory Director J. Robert Oppenheimer to serve as a consultant in hydrodynamics. The result of the collaborative effort would play a major role in the direction the Second World War would take in terms of both atomic and computational capabilities. Not only did Mauchly and Eckert produce the world's first general electronic computer to calculate ballistics tables, but it also figured significantly in the development of the atomic bomb. The same desk calculators that were being used to produce ballistics tables before the development of the ENIAC were utilized in the early stages of the calculations needed to produce nuclear weaponry.

The Manhattan Project was a nuclear research and development program headquartered at the Los Alamos National Laboratory and operated in affiliation with the Radiation Laboratory (RadLab) found at the Massachusetts Institute of Technology (MIT). Influenced by the work of Mauchly, Eckert, and von Neumann at the University of Pennsylvania, the program determined that the calculation difficulties encountered at

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[74] John von Neumann, "A First Draft of a Report on the EDVAC" (paper presented for the United States Army Ordnance Department and the University of Pennsylvania, June 30, 1945), http://virtualtravelog.net.s115267.gridserver.com/wp/wp-content/media/2003-08-TheFirstDraft.pdf [accessed April 5, 2013].

[75] Freed, *The History of Computers*, 52.

Los Alamos could be solved by the adoption of electronic computers similar to the ENIAC.[76] While working on a way to translate mathematical procedures, von Neumann formulated a language of instructions for the computer.[77] The mathematician recommended that the computational problems associated with the bomb's design could be tested on the ENIAC. Such calculations would be much more demanding than the ballistic trajectories the machine was designed to calculate. Members of the Manhattan Project traveled to the University of Pennsylvania to discuss potential problems with Mauchly and Eckert early in 1945.

The transition between utilizing the ENIAC to calculate ballistics tables to that of atomic weaponry was successful due to the machine's ability to provide a much more detailed analysis and modeling of physical problems. By July of 1945, the first atomic bomb had been tested in New Mexico.[78] On 6 August, the first atomic bomb was dropped on Hiroshima, while the second was deployed three days later at Nagasaki. The sheer destruction of the weapons forced Japan to surrender on 14 August. The development of such an instrument radically altered the international dynamic as the nature of war and the conditions of peace are now made through recognition.[79]

The bombings of Japan not only brought an end to the war in the Pacific but also highlighted the new consequences of war. The United States was the only nuclear power in a conventionally armed world, providing a sense of militaristic superiority. The

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[76] Los Alamos National Laboratory, "From Calculators to Computers: History at Los Alamos," http://www.lanl.gov/history/story.php?story_id=82 [accessed November 7, 2012].
[77] Ibid.
[78] Lawrence Freedman, "The First Two Generations of Nuclear Scientists," in *Makers of Modern Strategy: From Machiavelli to the Nuclear Age*, ed. Peter Paret (New Jersey: Princeton University Press, 1986), 735.
[79] Gwynne Dyer, *War: The New Edition*, 1st ed. (Canada: Random House Canada, 2005), 294.

development of Soviet nuclear arms dramatically altered the international scene in 1949. Now that the enemy possessed the ability to strike back with its own nuclear weapons, any attempt to exert military or political dominance could be both unconvincing and extremely dangerous.[80] The potential threats associated with two nuclear powers changed the way in which war is conducted. The Cold War represented the single greatest accumulation of nuclear armaments the world has ever seen yet it yielded several conventional wars. Despite the harsh tensions between the Soviet Union and the United States, neither party directly engaged in combat or resorted to nuclear war with one another largely due to the threat of mutual destruction.[81] The international landscape forced the expansion of the United States military after the Second World War primarily due to the fears of the Soviet Union and the expansion of communism. The development resulted in the establishment of a military-industrial complex stemming from the sophisticated technology needed to win the Second World War.

The sobering recognition of atomic destruction forced the United States to continue its wartime measures of utilizing a system built on the practice of funneling a wide assortment of professionals to work for the government. It was through this system of continuous technological and industrial development that the United States would enter the Cold War. Electronic components became the new instruments of war and the production, design, and maintenance of complicated weaponry reflects the closest cooperation and communication between the military that requires them and the

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[80] Dyer, *War: The New Edition*, 297.
[81] John Lewis Gaddis, *The Long Peace: Inquiries into the History of the Cold War* (New York: Oxford University Press, 1987), 218.

industries that provide them.[82] Cooperation amongst the military, industry, university, and labour hierarchy was even more necessary in the post-war era.[83] The policy of mutually assured destruction coupled with the arrival of a new enemy in communism, encouraged the United States government to further its pursuit of technological innovation. What ensued was a drastic increase in human-computer interaction, both professionally in terms of the birth of the computer industry and socially surrounding the creation of primitive computer games.

Maintaining a strong foothold in the corporate business world, International Business Machines Corporation (IBM) was supplying punch card equipment, typewriters, alarm clocks and other office equipment globally by 1950. The majority of IBM's product lines provided electro-mechanical equipment as opposed to electronically powered devices as the implementation of digital technology associated with computers seemed out of the question.[84] The industry was turned on its head as IBM's new president Thomas Watson Jr. opted to commence an electronic computer project in 1952. The computer project was named the Defense Calculator project in an attempt to alleviate internal tensions. Watson gave the project a militaristic name to give his employees the impression that it was a governmentally funded program.

The Defense Calculator was formally renamed the IBM 701 upon its completion and the machine soon found its way into general-purpose data processing applications. The 701 was utilized not only for scientific and engineering work but it was flexible enough to branch out into fields including accounting, payroll, inventory control, and

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[82] Sidney Lens, *Military-Industrial Complex* (Philadelphia: Pilgrim Press, 1970), 15.
[83] Ibid., 15.
[84] Freed, *The History of Computers*, 56.

college admissions.[85] The machine was a smashing success and the commercialization of electronic computers was rapidly developing. The success of the machine allowed IBM to become synonymous with business machines and the company pioneered a world that was becoming increasingly computerized.

Industrial computerization fostered a type of change in human-computer interactions, stemming from war production that provided both the technical (hardware and software) and the artistic interactions (early tinkering with the idea of electronic screen games) necessary for the emergence of the home video game industry. The military-industrial complex fostered this new interaction that produced a variety of "dual use" offspring technologies.[86] Simplistic computer games emerged out of the new interactions and began to expand outside the confines of the laboratory in the form of arcade games, finding its application as a commercial product.[87] The combined elements of nuclear development and an increase in human-computer interactions allowed wartime technology to develop the foundational platform for the emergence of primitive games.

INSIDE THE LABORATORY: EARLY ATTEMPTS AT CREATING VIDEO GAMES

The most direct representation of early human-computer interactions stems from Alexander Douglas' creation of *Noughts and Crosses* on the EDSAC in 1952. Douglas created a "Tic-Tac-Toe" type of game for his doctoral thesis regarding the interaction between humans and computers on the very same computer used to calculate ballistics

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[85] Freed, *The History of Computers*, 57.
[86] Giovanni Peri, "Technology Spillovers," in *The Princeton Encyclopedia of the World Economy*, ed. Kenneth A. Reinert, Rajan S. Ramkishen, Amy Joycelyn Glass, and Lewis S. Davis, 2 vols. (Princeton: Princeton University Press, 2009), 2.
[87] Mark J. P. Wolf, introduction to *Before the Crash: Early Video Game History*, edited by Mark J. P. Wolf (Michigan: Wayne State University Press, 2012), 1-4.

tables during the war. Due to the expense and robust size of computers at the time, the game could never be appreciated outside the confines of Cambridge University.[88] However the game did provide an example of the early tinkering of screens technology that led to the production of games deriving from the technological developments of the Second World War. It is apparent that the computational need to calculate and store data not only impacted the course of the war but it provided the fundamental technology necessary for the development of the video game industry.

Another early example of the human-computer dynamic can be seen in the chronicling of the work of physicist William Higinbotham. Initially working on advanced radar systems for the Manhattan Project, Higinbotham transferred to the Brookhaven National Laboratory (BNL) in Upton, New York upon the conclusion of the war. The BNL was tasked with the role of producing excelled science and advanced technology with the cooperation, support, and appropriate involvement of local communities.[89] The laboratory was dedicated to help promote the peaceful and practical uses of nuclear power. After witnessing the destructive force behind the atomic bombings of Japan and experiencing the anti-communist fears associated with the Red Scare, United States citizens had become wary of nuclear technology.

In an attempt to alleviate tensions found throughout the general populace, the BNL declared an annual visitor's day where the local community could tour the facility and learn about the positive aspects of nuclear power. In order to entertain the crowds,

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[88] Roberto Dillon, *The Golden Age of Video Games: The Birth of a Multi-Billion Dollar Industry* (Florida: CRC Press, 2011), 4.
[89] Brookhaven National Laboratory, "About Brookhaven National Lab," http://www.bnl.gov/bnlweb/about_BNL.asp [accessed March 3, 2012].

Higinbotham developed a hands-on simulation of a tennis game in 1958.[90] *Tennis for Two* emerged as one of the first games to utilize graphical display and was developed on an Oscilloscope. The scope featured a two dimensional graph capable of visually plotting trajectories on both the vertical and horizontal axis electronically. Players used a knob to control the angle of the ball while simultaneously pressing a button to send it back over the net.[91] The simplistic game caught the attention of hundreds of tourists whom often stood in line for hours waiting for a turn.

Although the game was well received by visitors, it failed to expand beyond the borders of the lab. Higinbotham realized he had made something incredibly entertaining but simply did not pursue the project any further.[92] No adaptations were made to display the game on any external device such as a television or a monitor, no patent attempts were pursued, and it would not have been feasible to attempt any sort of distribution process as computer technology remained in the science lab and the business world.[93] While Higibotham's work successfully demonstrates the adoption of wartime technology and its application to commercial 'game' products, it is still very much limited by its time. What the game does represent however is the idea that a computer can be used for something other than mere number crunching. The concept of computer games began to emerge elsewhere and it was a group of unlikely individuals that would make their mark on the development of the video game industry.

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[90] Van Burnham, *Supercade: A Visual History of the Videogame Age 1971-1984* (Cambridge: The MIT Press, 2003), 28.
[91] David H. Ahl, "25 Years Since the Invention of the Transistor," *Creative Computing Video & Arcade Games* (Spring 1983). http://www.atarimagazines.com/cva/v1n1/editorial.php [accessed June 18, 2013].
[92] U.S. Department of Energy, "Video Games – Did They Begin at Brookhaven?" http://www.osti.gov/accomplishments/videogame.html [accessed April 10, 2013].
[93] Ralph H. Baer, *Videogames: In the Beginning* (New Jersey: Rolenta Press, 2005), 17.

The birthplace of recreational computing occurred within the walls of Building 20 located at the heart of MIT's central campus. The three-tiered structure was established as a temporary solution due to space shortages throughout the Second World War and became home to the RadLab for researching new technology, such as air-to-air missiles and experiments regarding stroboscopic flash photography.[94] The work conducted in Building 20 brought MIT into close affiliation with a military development facility known as Lincoln Labs.[95] The intimate relationship between the two made the RadLab fortunate enough to receive a state of the art Transistorized Experimental Computer Zero (TX-0) developed in the late 1950s. The three million dollar machine utilized encoded data on long strips of paper and was even outfitted with a monitor. The TX-O was the world's first online computer and it proved to be the testing ground for revolutionary reprogramming techniques.[96] The newly donated equipment made its way to Building 20 that doubled as the home for the Tech Model Railroad Club (TMRC) and the birth of hacker culture.

The TMRC was founded in 1947 and moved into Building 20, the location of the TX-0 supercomputer monitored by John Mackenzie and Jack Dennis. It was within this setting that Wayne Witanen, J. Martin Graetz and Steve Russell revolutionized the computer world. Utilizing Edward E. "Doc" Smith's novel *The Skylark of Space* for inspiration, the invention of special effects and sequences for a series of space epics were developed by the group in 1961. Spending the late hours of the night in the computer lab, the group began to brainstorm ways of utilizing the computer's capabilities in new and

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[94] Burnham, *Supercade*, 34.
[95] Steven Levy, *Hackers: Heroes of the Computer Revolution* (New York: Penguin Books Ltd., 2001), 27.
[96] J. Martin Graetz, "The Origin of Spacewar," *Creative Computing Magazine* (August, 1981). http://www.wheels.org/spacewar/creative/SpacewarOrigin.html [accessed March 5, 2012].

interesting ways. It was this mindset that led to the development of hacker culture, the technicians of computer science. Hackers are the ones who translate human demands into the code that the machines can understand and act upon, "it is a term of derision and also the ultimate compliment."[97] Hackers and their emergent hacker culture were a product of training on the TX-0 computer at MIT. Without it, and them, the world would not have seen one of the most influential computer games of all time, *Spacewar!*[98]

Spacewar! consists of two human players, two sets of control buttons or joysticks, and a TV-like display connected to the computer. Two spaceships are displayed in motion on the screen, controllable for thrust, yaw, pitch and the firing of torpedoes. Whenever a spaceship and torpedo meet, they disappear in an attractive explosion.[99] The computer game involves a simulated scenario of battle, took approximately six weeks to complete, and was finalized by April 1962.[100] Within weeks of its invention, *Spacewar!* was spreading across the country to other research centres whose computer technicians added their own modifications to the game. This was achieved through the adoption of program tapes that allowed users to upload the game to any computer that had a programmable CRT. Though the game had a major impact in hacker circles, the circulation of *Spacewar!* suffered a similar fate to that of Douglas' *Noughts and Crosses* and Higinbotham's *Tennis for Two*. It remained impractical to market any sort of computer game in the 1960s due to the hardware's cost and size. As a result, no

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[97] Steward Brand, "Spacewar: Fanatic Life and Symbolic Death Among the Computer Bums," *Rolling Stone* (December 7, 1972). http://www.wheels.org/spacewar/stone/rolling_stone.html [accessed March 5, 2012].
[98] Gerard Kraus, "Video Games: Platforms, Programmes and Players," in *Digital Cultures: Understanding New Media*, ed. Glen Creeber and Royston Martin (United States: Crown Business, 2010), 77.
[99] Steward Brand, "Spacewar: Fanatic Life and Symbolic Death Among the Computer Bums," *Rolling Stone* (December 7, 1972). http://www.wheels.org/spacewar/stone/rolling_stone.html [accessed March 5, 2012].
[100] Ibid., 77.

commercial attempt was made to market *Spacewar!* and it remained hidden in the province of computer labs. Although this may be the case, it still represented things to come with computer technology.

What started as isolated forms of computer entertainment for a doctoral thesis, entertaining touring crowds at a nuclear laboratory, and college students in a computer club, the primitive games would eventually emerge as an established practice of game design. As technology continued to develop, an endless parade of computer driven devices stemming from the calculator and its silicon chip would flood the commercial markets.[101] The technology would no longer be withheld to the laboratory, "as competition and cost-sharing developments drive down equipment prices, this equipment is becoming readily available to the average consumer for use in a host of applications."[102] The computer technology needed to win the war was now splintering into a type of pastime for various individuals at government-funded institutions. The final hurdle to clear was transforming the technology in a way that would make it more accessible to the general public.

The spreading of *Spacewar!* amongst technological institutions throughout the United States eventually brought the game to the University of Utah. It was here that Nolan Bushnell began revolutionizing the entertainment industry by utilizing his experiences of playing *Spacewar!* first hand at college to build a state of the art computer game.[103] Bushnell began his career as an associate engineer at an electronics company known as Ampex. While working on a videotape project, Bushnell saw an advertisement,

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[101] Gary Selnow, "The Fall and Rise of Video Games," *Journal of Popular Culture* 21 (1987): 53.
[102] Ibid., 54.
[103] Baer, *Videogames*, 14.

which placed a $5,000 Data General Nova 800 computer for sale.[104] It was at this moment that Bushnell turned to his passion for games and determined that if he could build an appropriate monitor for the computer, he would have no problem starting an arcade business. Bushnell, along with Ted Dabney and Larry Bryant, began working on the design of a commercialized coin-operated arcade video game.

In March 1971, Bushnell quit his job at Ampex to begin working on the game project full time. The original vision of the yet-to-be-named company was to build the technical foundation and then expand outwards and license the games to other coin-op manufacturers.[105] After failing to contribute his portion of the funds, Bryant was removed from the project but the duo of Bushnell and Dabney continued without the aid of their lead programmer.[106] The final product was the development of a single-player version of *Spacewar!* Production responsibilities were sold to game manufacturer Nutting Associates under the title *Computer Space*.

After Nutting Associates had approved the Computer Space prototype for production, Bushnell was immediately hired to oversee the project as Chief Engineer. At the time, Nutting was a struggling company and were more than willing to venture out and attempt to hit a new market.[107] The company knew nothing about computer game technology as, before *Computer Space*, computer games had remained in the dormitory of computer labs across the country. It was a logical decision to hire Bushnell full time to assist with the venture. Although the idea was revolutionary and acted as the first coin-

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[104] Morgan Ramsay, "Nolan Bushnell: Cofounder, Atari," in *Gamers at Work: Stories Behind the Games People Play* (New York: Apress, 2012), 18-19.
[105] Ibid., 20.
[106] Dillon, *The Golden Age of Video Games*, 8-9.
[107] Ibid., 10.

operated video game, it was by no means the first successful one. The first *Computer Space* cabinet was placed inside a pub named *The Dutch Goose* near Stanford University. One thing Nutting had overlooked was that the pub was a hang out for students that used computers similar to those that were used to create the game. The students were already familiar with *Spacewar!* and the concept/controls came easy to them. This was not true for an inexperienced individual who bumped into one of the other 1, 500 cabinets.[108]

Following a proposition to launch a more simplistic remake of the game in exchange for a large stake of the company, further talks between Bushnell and Nutting Associates were tabled. Bushnell's entrepreneurial mindset led him to pursue his agenda without the backing of Nutting and set out to develop a simpler game, where no explicit instructions were needed.[109] Many video game historians argue that 27 June 1972 marks the beginning of a technological revolution in video entertainment.[110] It was on that summer day that Atari Incorporated officially entered the entertainment industry. Headed by Nolan Bushnell and Ted Dabney, the small operation pursued their aspirations of bringing videogames to the arcade environment. It is without a doubt that Bushnell, in large part due to the help of head engineer and game designer Al Alcorn, made innovative strides with their contributions to the video game world.

Atari stamped its mark on the arcade world and pioneered the coin-operated video game industry with its tennis themed hit, *Pong*. The original prototype of *Pong* was so successful, the machine malfunctioned after one day of use due to an abundance of

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[108] Dillon, *The Golden Age of Video Games*, 10.
[109] Herman, *Phonenix*, 13.
[110] For more information on the history, development, and impact of Atari and *Pong*, see; George Jones, *Gaming 101: A Contemporary History of PC and Video Games* (United States: Wordware Publishing Inc., 2005); Curt Vendel and Marty Goldberg, *Atari Inc.: Business Is Fun* (New York: Syzygy Press, 2012).

quarters that prevented the machine from performing properly.[111] The immediate success of *Pong* at a bar named *Andy Capps* in Sunnyvale, California encouraged the fledgling company to expand its empire by August 1972. In order to accommodate for mass cabinet production, Bushnell purchased an old roller-skating rink and the company began to manufacture up to one hundred *Pong* machines per day.[112]

The significance of Atari and *Pong* in the history of the video game industry cannot be stressed enough. The brand is responsible for the mass exposure of arcade technology to the general public, so much so, it often became synonymous with the term video game.[113] Although Atari was preceded by a variety of mainframe games, *Pong* was the first to break through the confines of the laboratory and attract large audiences to play. Mainframe games were generally complex to play and required expensive hardware and software.[114] On the other hand, *Pong* was easy to play, used much less technology that did not require software, and the game was modeled after tennis which made it easy to comprehend for all.[115] 1973 was a great year for Atari, as the company released over 10,000 units of their coin-operated machines and continued to expand its horizons.

Atari quickly became the staple of the arcade game industry and even developed a reputation as the party company. It became common for Bushnell to throw a large hot-tub party if the company met its production quota.[116] *Pong* even made its way to the household in 1975 as the engineers at Atari found a way to integrate all of the necessary

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[111] *Ralph Baer Interview - Raw Footage*. VHS (Lockheed Sanders, 1991).
[112] *Ralph Baer Interview - Raw Footage*. VHS (Lockheed Sanders, 1991).
[113] Mark J. P. Wolf, *Encyclopedia of Video Games: The Culture, Technology, and Art of Gaming* (Santa Barbara: Greenwood, 2012), 66.
[114] Ibid., 66.
[115] Ibid., 66.
[116] David Carr and David Comtois, *The Game Invasion: The History of a Global Obsession*, VHS (Game Show Network, 2004).

circuitry for the game onto a single silicon chip.[117] The enjoyed success of Atari in the early stages of its establishment was soon met with controversy concerning the legitimacy of its signature hit. On 22 April 1972, Magnavox would demonstrate their upcoming product line for the holiday season. An engineer by the name of Ralph H. Baer was invited to introduce his innovative product at the Bowling Greene Restaurant, located in New York City.

The Magnavox product demonstration revealed the *Odyssey 1TL-200* television video game console. The system launched with six plug-in cartridge games, twelve plastic television overlays and placed controllers in the hands of thousands in the comfort of their own home. The presentation was a smashing success and according to Baer, the innovative system was the hit of the show.[118] The console was the first commercially available home video game system but it also yielded alternative applications. Through an examination of his personal experiences, education, career choices, and innovative works, it will be demonstrated how Baer single-handedly shaped the video game industry and adapted the associated technology to suit the needs of the United States military.

The Second World War provided the industrial structure and created the fundamental technology necessary to establish the home video game industry. The desperate need to calculate ballistics tables and the manipulation of complex data related to the development of the atomic bomb required the use of powerful computational machines.[119] Traditional hand calculation methods used to perform complex sequences of

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[117] Scott Cohen, *Zap! The Rise and Fall of Atari* (New York: McGraw-Hill, 1984), 48-49.
[118] Ralph H. Baer, *Videogames: In the Beginning* (New Jersey: Rolenta Press, 2005), 14-15.
[119] Dillon, *The Golden Age of Video Games*, 2.

operations for both procedures proved inadequate, costly, and time consuming.[120] The United States was able to achieve the necessary computational capabilities based upon the practice of putting people to work for the government.[121] The outcome of the war was decided by the effective deployment of scientific research and technological development that solidified the nation's infrastructure but it also produced unintentional by-products.[122] A heavy concentration of like-minded individuals led to the concept of using computers for something other than complex calculations. Creative alternatives to computer activity inspired the development of primitive computer games that informally established the concept of hacker culture. The technical capabilities found in such games were then adopted for the commercial product known as video games.

Much the same as the history of the computer, it is under the umbrella of the military-industrial complex that Baer invented the Magnavox *Odyssey*. Baer worked as an engineer for Sanders Associates, a military contracting company that hired experts for the drafting of complex programs that were moving through successive phases of research, development, and production for militaristic purposes.[123] Baer was able to build upon existing computer game technologies while utilizing the assets and resources available at Sanders to develop the *Odyssey*. Video game consoles owe their existence to the American war effort that pushed for continuous technological innovation. The relationship would later come full circle, as Baer would bring the associated technology back to its roots in war production.

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[120] Freed, *The History of Computers*, 5-7.
[121] Archibong, "The Military-Industrial Complex and the Persian Gulf War," 35.
[122] Campbell-Kelly and Aspray, *Computer*, 69.
[123] Ralph H. Baer, "One Inventor's Odyssey: The Life Story of an Engineer and Inventor ... The Father of Home Video Games" [ca. 2006], MSS, Ralph Baer Collection, Lemelson Center at the Smithsonian Museum of American History, D.C., 212-220.

Chapter 2
Initiating the Odyssey

The inspiration behind the concept of home video game consoles stemmed from Ralph H. Baer's interpretation of the commercial electronics market. There were over forty million television sets in the United States alone by 1966, all of which were simply waiting to be used for something other than mainstream broadcasting.[124] The fundamental concept was to build upon existing technology to form the basis of his innovation. In detailing electronic equipment and their accessories, Baer explains how consumer electronics equipment are often characterized as entertainment instruments with a high degree of investment by the user, which does not necessarily appeal to a wide population of viewers.[125] The problem with televisions, for example, is that the user is limited to viewing the programming chosen by the broadcasting stations. Television games could avoid this problem by starting with a base of family-directed games that would expand outwards to meet the appeal of niche specific groups such as action-adventure enthusiasts and sports fans.[126] The new medium would allow users to select their choice of entertainment utilizing the console as a mere extension of the television set.

The production of the Magnavox *Odyssey* rendered Baer's vision a complete success. Using his knowledge of television engineering in combination with military-grade components, employees, and corporate funding, Baer developed a commercial

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[124] Ralph H. Baer, "One Inventor's Odyssey," MSS, Ralph Baer Collection, Lemelson Center at the Smithsonian Museum of American History, D.C., 228.
[125] Licensing Program Files, 1969-1970, Collection Number 854, Box 8, Folder 12, Ralph Baer Collection, Lemelson Center at the Smithsonian Museum of American History, D.C.
[126] Licensing Program Files, 1969-1970, Collection Number 854, Box 8, Folder 12, Ralph Baer Collection, Lemelson Center at the Smithsonian Museum of American History, D.C.

product that sold over 100,000 units in the first year alone.[127] Despite the success of the *Odyssey*, Baer would continue to push the boundaries of the innovation and, in doing so, he would transcend three distinct phases of video game development at Sanders. The focus of this chapter is to assess the first two phases of video game development, their commercial impact, and to detail how they set the stage for video game related military programming at Sanders.

The discussion of the first phase of video game development will cover two key points when evaluating the history and development of the video game industry. The first section provides an in-depth assessment of the life and career of engineer/inventor Ralph Baer. Not often credited by historians for his contributions to the video game industry, Baer's experiences are conducive to understanding how he first attempted to break the technological limitations of the time by bringing video game technologies from the laboratory and the arcade cabinet to the home. The second section covers the development of the "TV Games" project from 1966-72. Baer developed the Brown Box prototype from a succession of eight developmental phases in screens technology that provided the technological foundation for all video game related pursuits at Sanders. The Brown Box was the end product of the TV Games project that would enter production as the Magnavox *Odyssey*.

The discussion of the second phase of video game development at Sanders will focus on three separate TV Games projects that were in the works from 1972-1978. The projects aimed at extending the techniques and capabilities of the video game industry

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[127] Ralph H. Baer, *Videogames: In the Beginning* (New Jersey: Rolenta Press, 2005), 7.

beyond the bounds achieved with the development of the Brown Box.[128] The Telesketch, Home Electronics Center (HEC), and the Cable-Mate programs spearheaded Baer's attempt to maintain Sanders success in the video game industry. Although the success of the projects were relatively diffident, offspring technology stemming from these works would open the gateway to an electronic endeavour that forever change the dynamic of the military-industrial complex.

THE BROWN BOX: BRINGING VIDEO GAMES TO THE HOME

The first phase of video game development begins with the life and career experiences of Ralph H. Baer. Born near the Alsace-Lorraine borders and raised in Cologne, Baer's family emigrated from Germany to New York in August of 1938. Having distant relatives already in the United States, the family was able to escape the horrors of Nazi aggression against the Jewish population only a few months before the pogrom of Kristallnacht. Baer was drafted into the United States Army in 1943 and served as a Combat Engineer. During his three years of military service, Baer became an expert of small arms during his tours in England, France, and Germany.[129]

Upon his arrival to Western Europe, Baer and a small band of colleagues were made cadre, a core group of military personnel assigned with the task of training others. The position meant that Baer held the task of training troops in intelligence subjects including the recognition of uniforms, weapons and aircrafts, the process of interrogating

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[128] TV Game Development – Final Report FY 1977, August 31, 1977, Ralph H. Baer Papers, Box 6, File: FY '77 IR+D Data, FY '78 NPUBA, Brian Sutton-Smith Library and Archives of Play at The Strong, Rochester, NY, 3.

[129] Ralph H. Baer, interview by Bebito Jackson, The 'Odyssey' of Ralph Baer: Interview with the Father of Videogames, Diehard Gamefan, March 19, 2009.

soldiers, the handling and firing weapons, and how to properly run messages.[130] The instructional programs brought Baer into close contact with a wide variety of firearms. Baer maintained a thorough documentation of the history and characteristics of a wide variety of weapons, ranging from pistols to sub-machine guns and even high caliber light machine guns.[131] The hobby made Baer a self-taught expert on small arms technology and upon the conclusion of the war, he returned home with over eighteen tons of weapons that were fully researched and catalogued in 1946.[132]

Baer found it quite difficult to get accepted into an electrical engineering program following the war. The majority of colleges had already filled their enrollment slots with ex-soldiers as a component of the General Infantry Bill whom had been discharged from their military services before him.[133] Chicago's American Television Institute of Technology (ATIT) offered Baer a conditional entrance to their engineering program upon the successful completion of a written exam. Graduating from the program in 1949, Baer was one of the first individuals in the United States to graduate with a degree in television engineering.[134] Baer benefitted from the industrial practices of the Second World War as the technological breakthroughs associated with the war effort brought down the cost of manufacturing televisions. At the same time, factories had halted television production to develop screens for radar displays and other military equipment

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[130] Ralph H. Baer, interview by Gardner Hendrie, Oral History of Ralph Baer, Computer History Museum, October 12, 2006.
[131] Ralph H. Baer, letter to W. H. B. Smith. August 12, 1950. Lemelson Center at the Smithsonian Museum of American History, Collection 854. Box 1, Folder 1. Ralph Baer Collection, Smithsonian, D.C.
[132] Ralph H. Baer, "Recovering the History of the Video Game," Lemelson Center at the Smithsonian Museum of American History, http://invention.smithsonian.org/resources/online_articles_detail.aspx?id=531 [accessed March 13, 2012].
[133] Ralph H Baer, letter to W. H. B. Smith. August 12, 1950. Lemelson Center at the Smithsonian Museum of American History, Collection 854. Box 1, Folder 1. Ralph Baer Collection, Smithsonian, D.C.
[134] Leonard Herman, "The Baer Essentials," *Electronic Gaming Monthly*, January 2000, 169.

during the war. As a result a production shortage existed and companies prepared for immediate assembly.[135] After working at Wappler Incorporated, Baer replied to an advertisement in the *New York Times* looking for an engineer to develop a state of the art television set from scratch.

Hired on the spot following a short interview, Baer's work on the project took the better part of a year to complete. It was in the midst of designing the television receiver that he came up with an idea that a television set should be used for something other than simply watching often-boring network programming.[136] In an attempt to improve upon the television set, Baer approached upper management at Loral Incorporated to develop some sort of gaming device to be packaged with it. The proposition of adding a type of "TV Game" to the project was immediately turned down by management, which encouraged him to finish the television set as the job advertisement warranted.[137] By developing a modern television set from scratch however, Baer developed the fundamental concept of TV Games and foresaw what the medium was capable of. In the midst of his work at Loral, Baer was unaware that the company was in the process of shifting into the defense electronics industry.

Loral's transition from a television production company to that of a military defense company allowed Baer to learn the ropes and adapt to the new elements associated with working in a new industry. After taking a new job at Transitron Incorporated, Baer remained within the confines of the defense electronics industry. It

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[135] Tristan Donovan, *Replay: The History of Video Games* (New Jersey: Yellow Ant, 2010), 7.
[136] Baer, "One Inventor's Odyssey," MSS, Ralph Baer Collection, Lemelson Center at the Smithsonian Museum of American History, D.C., 161.
[137] Leonard Herman, Jer Horwitz, Steven Kent, and Skyler Miller, "The History of Video Games," *Gamespot*, http://www.gamespot.com/gamespot/features/video/hov/index.html [accessed March 30, 2012].

was at Loral and Transitron that Baer credits his eventual success in the electronics defense industry. It was at Transitron that Baer learned the appropriate networking finishes and hardware components, the military nomenclature affiliated with them, and had access to both commercial and military grade components that were eventually used to develop both the Brown Box and Interactive Video Training Systems prototypes.[138] It was at Sanders Associates however that Baer spent the better part of thirty years working on military grade electronics, turned a military contracting company into a video game hardware designer, and sparked a prolific relationship between military and entertainment.

Sanders Associates hired Baer in 1956 and placed him on a variety of projects that propelled him up the corporate ladder. Due to his strong skill set in military electronics, upper management quickly recognized his work and placed him in charge of critical contracts. Responsible for a number of significant projects, Baer's department played a key role in the development of Airborne Electronic Counter Measure equipment, Signal Intelligence, Anti-Submarine Warfare, Identification of 'Friend or Foe Equipment' for airplanes, and aspects of the Saturn V program for the National Aeronautics and Space Administration (NASA).[139] The success of the projects and the leadership capabilities he displayed led to Baer's promotion to Chief Engineer and Manager of the Equipment Design Division (EDD) in 1961. According to Baer, this promotion provided him with

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[138] Baer, "One Inventor's Odyssey," MSS, Ralph Baer Collection, Lemelson Center at the Smithsonian Museum of American History, D.C., 183.
[139] Baer, "One Inventor's Odyssey," MSS, Ralph Baer Collection, Lemelson Center at the Smithsonian Museum of American History, D.C., 220.

the ability to expand on his earlier thoughts of developing alternative ways to utilize a television set.[140]

Video game enthusiasts have long heard the romanticized story behind the pivotal date of 1 September 1966.[141] During a business trip to New York City, Baer spent his time jotting some notes on four separate pieces of paper while waiting for a colleague to arrive at the bus terminal. The notes had nothing to do with the upcoming meeting, but contained the schematics for the developmental stages of the Brown Box prototype.[142] The stand-alone system was to act as a low-cost data entry device that could be used by an operator to communicate with a monochrome, or color television set.[143] Baer detailed eight separate categories for the TV Game system that could be utilized to reach a large commercial market. Baer's suggested categories included *action* games, *board/skill based* games, *artistic* games, *instructional* games, *chance* games, *card* games, game monitoring, and *sports* games.[144] The game genres depicted in the late 1960s accurately reflects the contemporary video game market and doubled as the basis for the patent application filed by Sanders in 1967.

Upon his return to the office at Sanders on 6 September 1966, Baer asked his co-worker Bob Solomon to read, date, and sign the four page document crafted during his

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[140] Baer, *Videogames*, 18.
[141] See, for example, Mark J. P. Wolf, *Encyclopedia of Video Games: The Culture, Technology, and Art of Gaming* (Santa Barbara: Greenwood, 2012), 63.
[142] Background Material – Conceptual TV Gaming Display, September 1, 1966, Collection Number 854, Box 6, Folder 29, Ralph Baer Collection, Lemelson Center at the Smitsonian Museum of American History, D.C.
[143] Background Material – Conceptual TV Gaming Display, September 1, 1966, Collection Number 854, Box 6, Folder 29, Ralph Baer Collection, Lemelson Center at the Smitsonian Museum of American History, D.C.
[144] Background Material – Conceptual TV Gaming Display, September 1, 1966, Collection Number 854, Box 6, Folder 29, Ralph Baer Collection, Lemelson Center at the Smithsonian Museum of American History, D.C.

business trip, a simple, standard procedure for legalizing work documents.[145] Baer began assembling TV receiver and transmitter design knowledge to draw elementary schematics in the early weeks of September.[146] Now acting as Chief Engineer and Manager of the EDD, Baer was able to utilize a few members of his division of 500 technicians and engineers on the TV Games project. With a ten million dollar direct labour payroll at his expense, Baer held no reservations with putting one or two technicians on something he wanted done personally. Such a decision was virtually insignificant to Sanders as it would not even ripple his overhead.[147]

Baer continued to use Sanders seemingly limitless amounts of resources to continue the necessary research and commence with the developmental stages of the Brown Box. In order to avoid any suspicion, any scripts and drafts that were produced were carefully designed to avoid the use of words such as 'gaming,' replaced with terms such as 'display' that were commonly found in military documents.[148] Over the next three years, eight different and progressively innovative console devices, referred to as TV Game #1-8, were built that housed new and increasingly complex games.

The unit schematics for TV Game #1 were built by technicians Bob Tremblay and Bill Harrison in accordance with Baer's original designs written on the four-page document composed in New York. A fully functional model was completed in four weeks and the machine was capable of displaying two moving blips on a television

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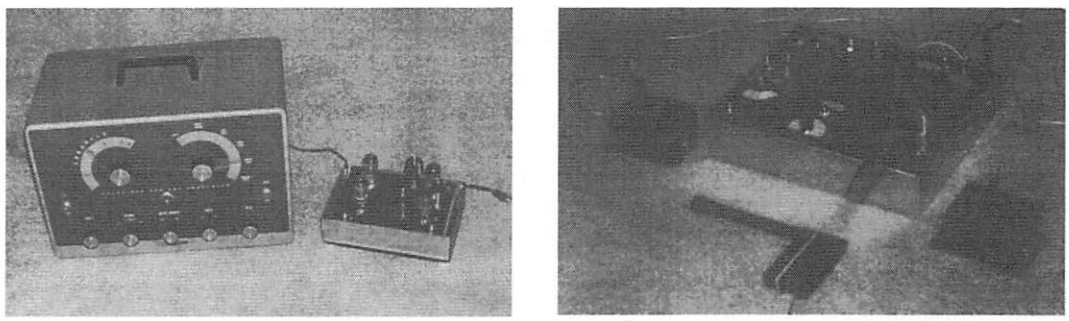
[145] Baer, "One Inventor's Odyssey," MSS, Ralph Baer Collection, Lemelson Center at the Smithsonian Museum of American History, D.C., 229.
[146] TV Game Manual File, Ralph H. Baer Papers, Box 2, TVG File #1, Brian Sutton-Smith Library and Archives of Play at The Strong, Rochester, NY.
[147] Ralph H. Baer, interview by Bebito Jackson, The 'Odyssey' of Ralph Baer: Interview with the Father of Videogames, Diehard Gamefan, March 19, 2009.
[148] Ralph Baer, interview by David Allison, April 22-23, 2003, Collection 854, Box 5, File 8, Ralph Baer Collection, Lemelson Center at the Smithsonian Museum of American History, D.C.

screen.[149] The blips were crude but successfully demonstrated the ability to replicate images on a television screen from an external source. In order to make a game of it however, the console was modified into TV Game unit #2 early in 1967. The second unit contained the additional use of joysticks, a light gun, and allowed the user to select from one of seven games that were available on a rotary switch. Initial games included *Chess*, *Steeple Chase*, *Target Shooting*, a *Color Wheel Game*, a *Bucket Filling Game*, a *Pumping Game,* and a modified version of *Fox & Hounds*.[150] The games were announced before playing occurred through the use of a pre-recorded audiotape that provided explicit rules and instructions.[151] Now that the development team had produced something tangible, Baer and Tremblay proceeded to demonstrate the unit to the Director of Research and Development (R+D) Herb Campman.



TV Game #1 (left) shown with single controller. TV Game #2 (right) shown with two separate controllers and first version of the light gun to add multi-player capabilities and game variety.

Throughout the demonstration the TV Game #2 unit worked flawlessly and Campman was extremely impressed with the product. It took very little time for the Director of R+D operations to encourage Baer to fill out a formal request for internal

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[149] Herman, "The 'Baer' Essentials," 169.
[150] TV Game Manual File – Functional Description TVG #2, Ralph H. Baer Papers, Box 2, File: TVG File #2, Brian Sutton-Smith Library and Archives of Play at The Strong, Rochester, NY.
[151] TV Game Manual File – Functional Description TVG #2, Ralph H. Baer Papers, Box 2, File: TVG File #2, Brian Sutton-Smith Library and Archives of Play at The Strong, Rochester, NY.

funding from Sanders.[152] The small production team received a modest cheque for twenty-five hundred dollars for general parts and labour. It may not have seemed like much at the time, but it was more than enough to officially keep the project afloat. The next stage in development was to produce something that Sanders could license. In an attempt to produce a saleable gaming device, two versions of TV Game #3 were produced. The first model incorporated a 'spot-wipe-out-on-coincidence' feature for the gun target game, while the second transferred this ability to the chase game as well.[153] The spot-wipe-out feature allowed the target to 'disappear' when accurately hit by the gun as opposed to remaining on-screen.

While the early additions made to the third unit were beneficial on a participatory level, according to Baer the games were already growing stale. The games were simplistic in nature, primitive by design, and were in need of some creative rejuvenation. In order to add some flare to the group, engineer Bill Rusch from Campman's R+D division, joined the project team on 18 August 1967. It was Rusch's suggestion of adding a third spot on the screen to act as a ball (with the original spots representing paddles) that led to the creation of *Ping-Pong*.[154] The three-man team of Baer, Harrison, and Rusch led the development of a final prototype to be presented to high-ranking officials at Sanders in June of 1967.[155]

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[152] Herman, "The 'Baer' Essentials," 169.
[153] TV Game Manual File – Functional Description TVG #3, Ralph H. Baer Papers, Box 2, File: TVG File #3, Brian Sutton-Smith Library and Archives of Play at The Strong, Rochester, NY.
[154] Baer, *Videogames*, 45.
[155] Baer, "One Inventor's Odyssey," MSS, Ralph Baer Collection, Lemelson Center at the Smithsonian Museum of American History, D.C., 229.

The TV Game unit would remain a tough sell even with the support of Herb Campman. After all, Sanders was in the military contracting business not commercial electronics. The company had no experience in marketing such a device, especially one that had never been market tested before. Adding to these challenges, companies in the defense electronics industry were also struggling economically in the late 1960s and early 1970s. A sense of nuclear maturity eased tensions between the United States and the Soviet Union following the events of the Cuban Missile Crisis. It became apparent that resorting to nuclear war would leave no victor, whether they were communist or capitalist in nature.[156] General rules of engagement were established to cap levels of acceptable international behaviour growing out of a mixture of custom, precedent, and mutual interest between the two superpowers.[157]

The thawing of the Cold War led to a drying up of military contracts and public debates concerning the expenditures of the Pentagon severely hampered the success of the industry.[158] Sanders itself had downsized from over eleven thousand employees to four thousand in the span of a few years.[159] However, despite recent struggles and a lack of experience in the toy industry, the gaming device impressed management who gave the green light to further pursue development. The research and development sector of

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[156] John Lewis Gaddis, *The Long Peace: Inquiries into the History of the Cold War* (New York: Oxford University Press, 1987), 235.
[157] Ibid., 238.
[158] Victor Archibong, "The Military-Industrial Complex and the Persian Gulf War: Ike's Caveat," in *The Gulf War as Popular Entertainment: An Analysis of the Military-Industrial Complex*, ed. Paul Leslie (Lewiston: The Edwin Mellen Press, 1997), 39.
[159] Baer, "One Inventor's Odyssey," MSS, Ralph Baer Collection, Lemelson Center at the Smithsonian Museum of American History, D.C., 249.

Sanders awarded the project another $8,000 and a private laboratory on the fifth floor of the Canal Street building for the next phase of development.[160]

A completed version of TV Game #4 was produced by November of 1967 and Sanders sought a return on their TV Game investment. The combining factors of the economic downturn and a lack of commercial experience in marketing such an item forced them to be creative with their pursuits. The best option for Sanders was to seek out a manufacturer that had experience in producing something similar to television games and possessed the ability market the item well. An initial sales pitch was made to Irving Kahn, the chairman of the board of TelePrompTer, one of the largest cable providers in the country.[161] Additions to a modified TV Game #5 were incorporated to demonstrate the ability to add a variety of new and improved ball games to the system.

While Kahn was impressed with the engineering behind the working prototype, the idea of developing a game console was still an uneasy decision for the cable company to get behind. It was a brand new technology that nobody knew anything about and it was difficult to project profit margins, as there was nothing comparable. In addition, a certain amount of hesitation rested with fears (fueled by unsubstantiated paranoia circulating in the industry) that this new and relatively untested technology would cause users to go blind and potential break television sets after prolonged use.[162] It was a large risk for TelePrompTer to take and the company eventually turned down the licensing offer from Sanders. As the business negotiations with TelePrompTer halted, so to did the

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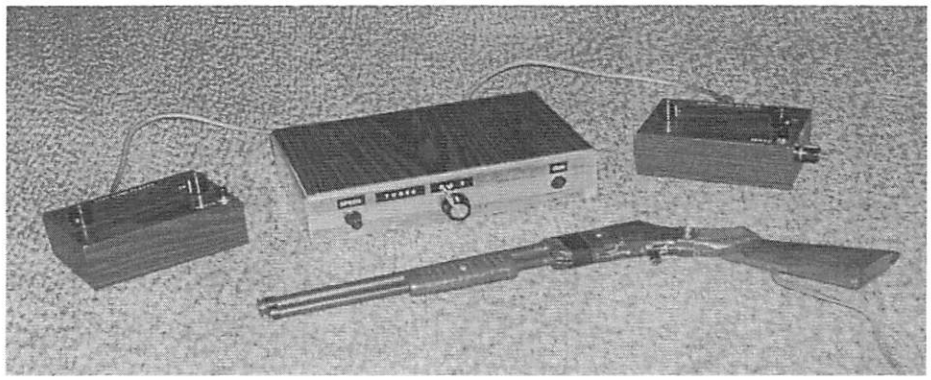
[160] TV Game Manual File – Functional Description TVG #3, Ralph H. Baer Papers, Box 2, File: TVG File #3, Brian Sutton-Smith Library and Archives of Play at The Strong, Rochester, NY.
[161] Herman, "The 'Baer' Essentials," 170.
[162] Burnham, *Supercade*, 56.

development of TV Game prototypes. Herb Campman issued a Stop Order in January 1968 that shut off all lab money and activity. Bill Harrison went to work elsewhere in the Equipment Design division and Bill Rusch returned to the R+D sector.[163]

The eight-month hiatus on the TV Games project was lifted in September 1968 as Herb Campman still believed in the potential of the project. He reallocated money from his R+D division towards the program and even reassigned Bill Harrison to the project.[164] By the end of the fiscal year, a stand-alone version of TV Game #6 (see image below) was developed and incorporated a three position rotary switch that allowed the user to choose from one of four games. The project met its objectives in terms of game output and production costs as the cost of labour and materials associated with the prototype came in at fifteen dollars per unit, an acceptable figure given the company wanted to market the product at a retail price of fifty dollars.[165]



TV Game #6 (above) shown with wood-grain vinyl and pump-action light gun for the *Shooting Gallery*.

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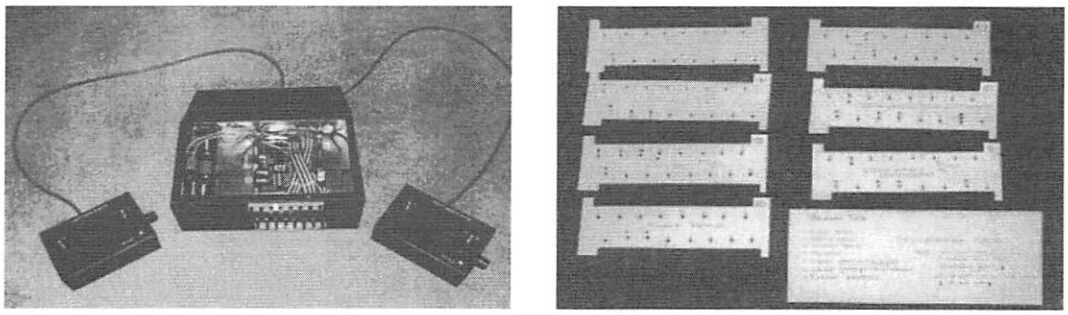
[163] Baer, *Videogames*, 52.
[164] TV Game Manual File – Functional Description: Replica TV Game #6, Ralph H. Baer Papers, Box 2, File: TVG File #6, Brian Sutton-Smith Library and Archives of Play at The Strong, Rochester, NY.
[165] Ralph Baer, interview by David Allison, April 22-23, 2003, Collection 854, Box 5, File 8, Ralph Baer Collection, Lemelson Center at the Smithsonian Museum of American History, D.C. Although, these figures did not include the shooting gallery light gun that launched with the *Odyssey* and would add another five dollars to production costs.

The seventh television game prototype provided circuit improvements and is better known as the Brown Box due to the wood-grain vinyl that formed the case.[166] The machine now resembled that of a modern video game system. The Brown Box was programmed by inserting cards between two rows of switches as opposed to the rotary switch method applied to previous models. When a game card was inserted between the slots, red dots indicated which switches had to be flipped in order to activate that specific game.[167] The Brown Box was the first programmable, multi-game system and came packaged with *Ping Pong*, *Handball*, *Hockey*, *Soccer*, *Football*, *Volleyball*, *Golf Putting*, *Checker Games*, and even utilized *Target Shooting* games. The system possessed the capability to display coloured backgrounds but this feature was later omitted in order to cut production costs.[168]



The Brown Box prototype (left) with open case and two controllers. Game cards (right) with toggle arrows to select preferred game.

The final production stages of the Brown Box were completed in the closing weeks of 1968. Slight alterations were made to TV Game unit #8 to incorporate a method of manipulating the ball with a paddle in a realistic manner. Sanders had invested fifty to

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[166] Baer, *Videogames*, 54-55.
[167] TV Game Manual File – Functional Description: Replica TV Game #7, Ralph H. Baer Papers, Box 2, File: TVG File #7 Brown Box, Brian Sutton-Smith Library and Archives of Play at The Strong, Rochester, NY.
[168] TV Game Manual File – Functional Description: Replica TV Game #7, Ralph H. Baer Papers, Box 2, File: TVG File #7 Brown Box, Brian Sutton-Smith Library and Archives of Play at The Strong, Rochester, NY.

sixty thousand dollars worth of revenue into the research and development of the system by this time.[169] Baer determined that these figures represent a relatively low production cost but the company urged him to do something productive with the technology. It was this version that would be used to enter the commercial market as the Magnavox *Odyssey*, marking the end of the first phase of video game development at Sanders.

After a healthy first year of sales, the success of Ralph Baer's creation began to tail-off due to the advertising campaign devised by Magnavox. The console was sold through an exclusive network of Magnavox dealers that severely limited the breadth of their market. The maneuver gave the impression that the video game console was only compatible with Magnavox televisions and their vague advertisement campaigns only reinforced this notion.[170] The sales decision dampened the success of the *Odyssey* and the arrival of second-generation video game consoles compounded the situation. Graphically improved eight bit architectural systems including the Fairchild *Channel F Video Entertainment System* and the Atari *Video Computer System* (VCS) quickly replaced the *Odyssey*. The *Odyssey* met its demise and Magnavox proceeded to pull the product from the shelves in 1975. The decision spurred the second phase of video game development at Sanders that looked to improve and expand upon the existing commercial capabilities found within the Brown Box.

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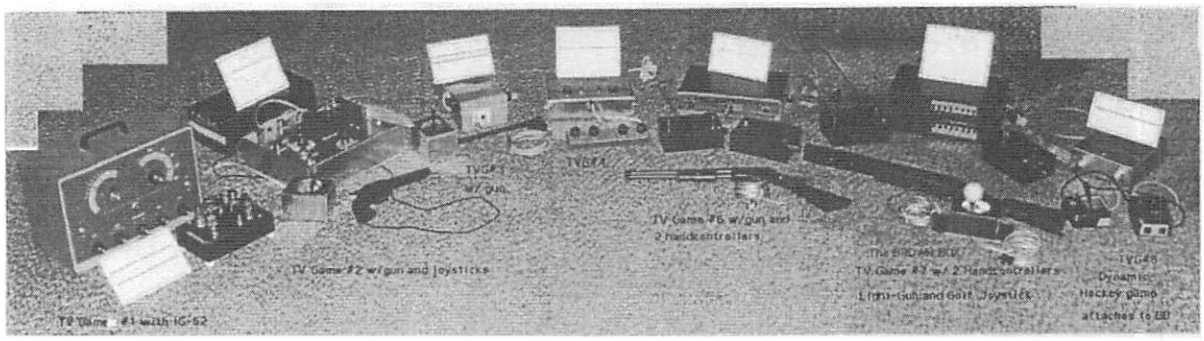
[169] Ralph Baer, interview by David Allison, April 22-23, 2003, Collection 854, Box 5, File 8, Ralph Baer Collection, Lemelson Center at the Smithsonian Museum of American History, D.C.
[170] Burnham, *Supercade*, 82.



(Above) The seven developmental stages leading to the Brown Box prototype.

VIDEO TECHNOLOGY ACTIVITIES: A SHIFT IN ENTREPRENEURIAL CLIMATE

The second phase of video game development at Sanders commenced with the Telesketch project. The system was initiated in 1976 and aimed at providing a new element of control to the user. The basic premise behind the Telesketch system was revolutionary as it enabled the self-development and construction of games by allowing users to sketch portions of their own playing field.[171] This new method also allowed gamers to draw 'active' symbology within the confines of the sketched portions of the screen.[172] For example, players possessed the ability to build different types of walls in a ball game that would hit the ball back in the direction from which it came. At the same time, the 'hit' wall would disappear after contact in a similar fashion to the popular arcade game *Breakout*. The player had an arsenal of shapes, letters, and numbers at their expense, leaving the users imagination as the only form of limitation. Although it would never enter the market as a stand-alone system, the technology developed in the Telesketch project later found a home in the form of a Pinball Game with player-programmable bumper positions for the Magnavox *Odyssey*^{2} in 1978.

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[171] Disclosure of Invention, 6 April, 1971, Ralph H. Baer Papers, Box 2, Brian Sutton-Smith Library and Archives of Play at The Strong, Rochester NY, 3.
[172] Baer, *Videogames*, 135.

Following the successful marketing of the Telesketch technology, the conceptual design behind the programmable Home Electronics Center video game system surfaced in 1977. The HEC employed a Random Access Memory (RAM) intensive structure that was suitable for complex, processor controlled, programmable television games.[173] The system was capable of housing both microprocessor and plug-in Read Only Memory (ROM) cartridges and could even be outfitted with a variety of plug-in accessories including joysticks, keyboards, rifles, and steering wheels. Perhaps the most interesting component of the HEC was that it also expanded into the standalone computer terminal market. Not only would this allow the system to play home television games but its function was doubled as an entrance to both the home business and the education market.[174] The terminal was more than capable of storing data, balancing checkbooks, performing calculating functions and providing homework aid for students. Though the HEC system would never enter the open market, the techniques and capabilities developed within the program would impact future endeavours at Sanders.

The third and final commercial project during the second phase of video game development was entitled Cable-Mate: CATV Game System designed to act as a Cable Casting Game Show system. The Cable-Mate product was similar in nature to the Brown Box prototype first presented to TelePrompTer in 1967-68. The prototype system presented to Irving Khan, now known as the Magnavox *Odyssey*, would undertake a small overhaul with the intention of enabling cable broadcasted video games. The Cable-Mate unit was a handheld device that attached to a modified *Odyssey 1TL-200*. The

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[173] TV Game Development – Final Report FY 1977, August 31, 1977, Box 6, Brian Sutton-Smith Library and Archives of Play at The Strong, 3-4.
[174] TV Game Development – Final Report FY 1977, August 31, 1977, Box 6, Brian Sutton-Smith Library and Archives of Play at The Strong, 9.

controller was designed to both appear and operate much the same as a common four-function calculator and was completed by 1974.[175] The calculator design provided the user with some form of familiarity in using the product, seeing as how the spreading of video game technology was relatively limited in the early stages of the industry's materialization.

The Cable-Mate system was designed to plug directly into the television unit and operated on the premise of monthly subscription rates. Television providers were to add a small billing increment of $5.00/month to subscribers in exchange for in-home video games that could be changed every six months.[176] The system had the ability to present game instructions both graphically on-screen and through a variety of voice announcements. Once the channel was accessed, the user could participate in an assortment of items including: *quiz games* with electronic scoring, *races* (with available betting options), *cable scrabble*, *guess my line*, *monopoly*, and a wide assortment of gambling themed games such as *roulette*, *black jack*, and *craps*.[177] The system attempted to play to the convenience factor of consumers never having to leave your home to purchase new games or consoles.

The original design for the Cable-Mate project was to work directly with the *Odyssey* system. Baer was convinced that Magnavox would hold an interest in entering the interactive cable video game business since the company held a strong television

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[175] Cable Mate: CATV Game System, August 1974, Ralph H. Baer Papers, Box 6, File: CATV Games, Brian Sutton-Smith Library and Archives of Play at The Strong, Rochester, NY, 3.
[176] Cable Mate: CATV Game System, August 1974, Ralph H. Baer Papers, Box 6, File: CATV Games, Brian Sutton-Smith Library and Archives of Play at The Strong, Rochester, NY, 3.
[177] Cable Mate: CATV Game System, August 1974, Ralph H. Baer Papers, Box 6, File: CATV Games, Brian Sutton-Smith Library and Archives of Play at The Strong, Rochester, NY, 5.

product line and was becoming increasingly renowned in the home video game market as the *Odyssey* sold over 350,000 consoles in its entirety.[178] Such a move would allow Magnavox to expand their product base, a necessity given the success enjoyed by Atari after entering the coin-operated video arcade market in November 1972.

Despite the possibilities that lay before them, Magnavox never really showed any interest in the add-on Cable-Mate system, bringing an informal conclusion to the relations between Sanders and Magnavox.[179] The engineer would continue to invite the licensing company to Sanders to discuss the next generation of items but no further projects between the two ensued.[180] Baer expressed a change in direction for the project on 11 January 1974. Entertainment conglomerate Warner Communications expressed interest in the Cable-Mate product and wished to entertain a sampling of the systems functionality. Baer notes how Warner wanted to explore new avenues in expanding its market exposure and wanted to test the potential effectiveness of CATV games.[181]

A sales pitch promoting the capabilities of the Cable-Mate system was given to Warner Communications and Baer noted that the company's interest in the *Odyssey* add-on product was virtually zero unless the functionality of CATV games could be proven.[182] In order to further Warner's interest, Baer thought it would be necessary to improve the basic functionality of the *Odyssey* as a whole. As opposed to using the graphical overlays the *Odyssey* was outfitted with at launch, he thought it would be more

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[178] Baer, *Videogames*, 7.
[179] Ibid., 107.
[180] Ralph H. Baer, interview by Gardner Hendrie, Oral History of Ralph Baer, Computer History Museum, October 12, 2006.
[181] Ralph H. Baer, "Letter to Robert E. Fritsche," in *Videogames: In the Beginning* (New Jersey: Rolenta Press, 2005), 108-109.
[182] Ibid.

beneficial to produce video game footage on a colour videotape cassette for use in CATV games. An adjustment of the sort would improve upon the primitive plastic overlay backgrounds that came with the system. The modification would also enable the integration of additional characters on screen. Players would be given the opportunity to interact with pre-recorded characters as if they were generated within the console itself: a primitive version of the artificial intelligence seen in contemporary video games.[183] Intrigued by the concept, Warner suggested developing some form of gaming tape by using one of their cable colour studios. Warner even offered the manpower and equipment necessary to produce such a device.

Though the early work with videotape technology yielded some productive results, discussions with Warner failed to come to fruition. Warner opted to head in a different direction rather than support the CATV games system. In October 1976, Warner Communications completed the purchase of Nolan Bushnell's Atari for $28 million.[184] Bushnell approved of the purchase because Atari needed the financial support to bring his coin-op arcade business to the home video game market.[185] The company immediately made a large splash in the industry as the Warner/Atari conglomerate released the *Video Computer System* (*VCS*) by the end of 1977. The attempted relations between Sanders and Warner had greater implications despite their failure to come to any sort of agreement. The relationship represented the first attempt at establishing cross-pollination

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[183] Ralph H. Baer, "Letter to Robert E. Fritsche," in *Videogames: In the Beginning* (New Jersey: Rolenta Press, 2005), 108-109.
[184] John Davison, "Its Time to Say Goodbye to Atari, Once and for All," *Gamespot*, http://www.gamespot.com/features/its-time-to-say-goodbye-to-atari-once-and-for-all-6402808/ [accessed February 16, 2013]
[185] Ibid.

works between video games and film studios that would act as a core component of the military-entertainment complex.

The development of the Cable-Mate video game system continued at Sanders even without the support of Warner Communications. Negotiations with a variety of developers and cable operators carried forward into April 1978. The system was on its second production draft known as the Cable-Mate II which featured a black box that was able to extract synchronized signals, video, and digital data required to play games through the television set.[186] The result was a TV game identical to the types of microprocessor plug-in programmable games current in the market at the time such as the Atari *VCS* (commonly known as the *2600* following the release of their second console), the Bally *Astrocade,* the Fairchild *Channel F*, and the Magnavox *Odyssey*^{2}. The system, though, was more than capable of replicating the graphics, sound effects, and colour display found in modern consoles. What also differentiated it was that the cable system offered games on a TV channel though which the operator could play new versions at a fixed monthly rate and there is no need to purchase new games in store. The Cable-Mate II also remained hand held and was capable of housing up to six resident games.

An interesting element to the Cable-Mate II system involved the user's ability to select different skill levels within the same game title.[187] This feature was attractive to all types of gamers as it was simple enough for those looking to purchase their first console and could be made increasingly difficult for the more seasoned video game aficionado. It

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[186] Cable Mate II: Cable TV Games, The Alternatives – Problems and Promise, April 20, 1978, Ralph H. Baer Papers, Box 6, File: CATV Games, Brian Sutton-Smith Library and Archives of Play at The Strong, Rochester, NY, 1.

[187] Brief Rationale Behind Cable Mate II, April 25, 1978, Ralph H. Baer Papers, Box 6, File: CATV Games, Brian Sutton-Smith Library and Archives of Play at The Strong, Rochester, NY, 1-2.

also added a type of replay value to the system as the user could bump up the difficulty once game play at a lower difficulty was mastered. Although the development of the Cable-Mate II project carried an intriguing concept, the selling and licensing of the product proved to be a difficult task. Further demonstrations were made to both TelePrompTer and the Manhattan Cable TV Company but no further work on was pursued on the project by 1979.[188] Little did Baer know that the next video game endeavour would also be his last at Sanders.

Sanders Associates entered new video game licensing agreements with the Connecticut Leather Company Industries Incorporated in 1976. Perhaps better known as Coleco, the company was founded with its roots in the leather distribution business. The history of Coleco is a bit of an anomaly as the corporation ventured into above ground pools in the 1950s, turned to the manufacturing of tabletop hockey games by 1968, and eventually turned to the video game industry upon the release of the Coleco *Telstar* in 1976.[189] The *Telstar* was multi-game *Pong* system which was slotted to hit store shelves in time for the Christmas rush. Taking a rather large gamble, Coleco had manufactured tens of thousands of units prior to receiving product approval from the Federal Communications Commission (FCC). As the story unfolds the *Telstar* failed its Radio-Frequency-Interference compliance testing and the company was only granted a couple of days to address the issue. If the conditions were not remedied, it would have to start the testing process over and would not be prepared to launch for the holiday season.[190] It

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[188] FY79 IR+D Activities: TV Games and Related Technology, Ralph H. Baer Papers, Box 6, File: FY '79 IR+D NF IBA, Brian Sutton-Smith Library and Archives of Play at The Strong, Rochester, NY, 5.
[189] Leonard Herman, *Phoenix: The Fall and Rise of Video Games*, 2nd ed. (New Jersey: Rolenta Press, 1997), 19-20.
[190] Herman, "The Baer Essentials," 172.

was at this moment of desperation that Coleco opted to seek the council of Ralph Baer and Sanders Associates.

Upper management at Sanders was more than willing to assist the fledgling video game company so long as they would sign their licensing agreement with Magnavox.[191] Coleco approved of the conditions and by the end of the business week, the *Telstar* received the necessary modifications and was granted product approval by the FCC. A fruitful relationship between Sanders and Coleco emerged out of the panic in which the latter would not be short in memory of the assistance received. In the midst of the development of its second-generation console, the *ColecoVision*, strong relations between the two brought the video game company to entertain new proposals from Sanders regarding product additives.

Business discussions between the two companies concerned Sanders role in the development, fabrication, and design of complementary software for a series of add-on hardware products for use with personal computers and dedicated video game consoles.[192] Some of the software conversions included the delivery of voice and data from low cost audiocassettes and basic interactive videotape support for video games that would allow for optical shooting at complex video game graphic displays using a selective filter for discrimination of the target versus other symbology.[193] Relations between Coleco and Sanders resulted in the signing of eight separate licenses that were

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[191] Herman, "The Baer Essentials," 174.
[192] Final Report – IR+D Code NVYAA, FY'85, 16 July, 1984, Ralph H. Baer Papers, Box 6, File: NZW (FY'85 IR+D), Brian Sutton-Smith Library and Archives of Play at The Strong, Rochester NY, 3.
[193] Memorandum – Funding of Video Games Technology, 2 May, 1983, Ralph H. Baer Papers, Box 6, File: NZW (FY'85 IR+D), Brian Sutton-Smith Library and Archives of Play at The Strong, Rochester NY, 2.

negotiated from 1982-1984 but the reality of the situation was that the entrepreneurial climate of the video game industry had reached its peak at Sanders.

The Telesketch, HEC, and Cable-Mate programs never developed any significant revenue and although the technology was impressive, there were no new avenues to explore. The poor climate was reinforced following a business trip to the Consumer Electronics Show in January 1979 as Baer noted that Magnavox did not even have a stand at the venue.[194] The dampening of the video game industry allowed the engineer to anticipate the need to rework the technology for military programs. Sanders appreciated Baer's contributions and granted him the freedom to work on any projects of his choosing. Sanders role in the video game world was coming to a close and Baer opted to turn his focus towards more militaristic pursuits.

The decision to re-direct the work at Sanders from video game technology to military grade simulators stemmed from two major factors. The first surrounds the shift in entrepreneurial climate within the video game industry by 1977-78.[195] New directions concerning the video game market had been muddied due to the abundance of *Pong* variants that flooded stores. By the mid 1970s, the prices of microchips had reached a new low and vast quantities were available for manufacturing companies to get their hands on. The low production costs combined with the high profit margins of video game

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[194] Memorandum – R. H. Baer to Sanders Distribution: Trip Report, CES-TV Game Status, 18 January, 1979, Ralph H. Baer Papers, Box 6, File: FY'79 IR+D NF IBA, Brian Sutton-Smith Library and Archives of Play at The Strong, Rochester NY, 2.

[195] Introduction and Background. Sanders Associates, Inc. FY-77 Business Plan. Electronic Products Development for Licensing, Ralph H. Baer Papers, Box 6, File: FY '77 IR+D Data, FY '78 NPUBA, Brian Sutton-Smith Library and Archives of Play at The Strong, Rochester, NY, 1-2.

consoles resulted in over 75 separate companies developing *Pong* consoles for home recreation.[196]

The flooding of *Pong* variants into the video game market forced retailers to sell their remaining units at clearance prices by 1977. Product value was so deflated, many questioned as to whether or not the industry would even survive.[197] The console surplus resulted in the first of two video game market crashes and brought a formal end to the first generation of consoles. The market crash caused concern for manufacturing companies and forced them to avoid the risk of venturing out into something new. The only consoles that remained in the market following the crash were the Atari *VCS* and the Magnavox *Odyssey*^{2}. In the fiscal year business plan of 1977, Baer notes that the harsh business climate effected short-term business opportunities and the present product line.[198] New directions are often discouraged, dampening the creativity that inhibited the works and proved to be a great success in the past.[199] It would be far too difficult a task for Sanders to push Baer's recent innovations of the Telesketch, HEC terminal, and Cable-Mate system to prospecting companies. Sanders had tested its hand in the waters of home entertainment but it was time to move forward. Although Sanders had significantly contributed towards the inception of the video game industry, it had to return to its roots as a military contracting company.

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[196] Herman, *Phoenix*, 19.
[197] Ibid., 19.
[198] Introduction and Background. Sanders Associates, Inc. FY-77 Business Plan. Electronic Products Development for Licensing, Ralph H. Baer Papers, Box 6, File: FY '77 IR+D Data, FY '78 NPUBA, Brian Sutton-Smith Library and Archives of Play at The Strong, Rochester, NY, 1.
[199] Introduction and Background. Sanders Associates, Inc. FY-77 Business Plan. Electronic Products Development for Licensing, Ralph H. Baer Papers, Box 6, File: FY '77 IR+D Data, FY '78 NPUBA, Brian Sutton-Smith Library and Archives of Play at The Strong, Rochester, NY, 1.

The second factor that contributed to Baer's shift from video game technology is quite simple in the fact that Sanders primary business agenda fell within the realm of the defense contracting industry. The initial video game boom had propelled the company through the harsh downsizing experienced in the late 1960s and early 1970s, but their main focus remained on arms development. At the same time, it is important to keep in mind that Cold War policies surrounding nuclear deterrence were changing the way in which conflicts were being fought. The spreading of nuclear proliferation fostered a series of devastating conventional wars and the United States looked for ways to improve combat efficiency and lower training costs.[200] As a product of international tensions and continuous technological development, Baer was placed at a crossroads between military and entertainment. Baer would adopt the video game technology to work for firearms simulations programs. The shift in climate marked the beginning of a fruitful relationship between military and entertainment that was to develop between both video game and military grade simulation technologies in the latter half of the twentieth century. The technology developed within the *Odyssey* would be used to address these changes and solidify Sanders role as a defense contractor.

The video game market collapse, which forced many companies to retreat from the failing industry, in combination with the militaristic need to develop small arms provided the perfect opportunity for Baer to link the two industries. The new objective at Sanders was to extend the techniques and capabilities inherent within video game technology to work within the Interactive Video Training and Education Systems

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[200] Disclosure of Invention, 6 April, 1971, Ralph H. Baer Papers, Box 2, Brian Sutton-Smith Library and Archives of Play at The Strong, Rochester NY, 1.

business.[201] Baer submitted a formal proposal for the establishment of a video production facility on 15 January 1979.[202] The intention behind the facility was to revolutionize the manner in which the military conducted its technical training through firearms simulation. Already well established in both the video game/television and military contracting spheres, both Baer and Sanders Associates would be able to maneuver themselves into a competitive position to contract the operation. As the United States military expanded to include the production of innovative weaponry at the expense of continuous technological advancement, more companies became a part of the military-industrial complex. The development provided the perfect opportunity for the third phase of video game development to commence.

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[201] Baer, "One Inventor's Odyssey," MSS, Ralph Baer Collection, Lemelson Center at the Smithsonian Museum of American History, D.C., 266.
[202] Memorandum – Letter from R. H. Baer to L. Jamison, 15 January, 1979, Ralph H. Baer Papers, Box 6, File: FY'79 IR+D NF IBA, Brian Sutton-Smith Library and Archives of Play at The Strong, Rochester NY.

Chapter 3
The Interactive Video Training and Simulations Business

Once a production agreement was reached between Sanders Associates and Magnavox, Ralph Baer began to realize the connection between home video game console technology and simulations training for the military. The technology found within the *Odyssey* was re-engineered during the second phase of video game development at Sanders in an attempt to produce new commercially available gaming equipment. The development of the Telesketch, the Home Electronics Center (HEC), and Cable-Mate system marked an attempt by Sanders to 'wet their beak' in a hot video game market. The emergence of the first video game market crash dampened the entrepreneurial climate of the industry in 1977. The market crash, combined with Sanders traditional role as a defence contractor, placed Baer at the crossroads between commercial product and militaristic armament. The work conducted at Sanders during the third phase of video game production would act as the catalyst that married the video game industry with the Pentagon in what has come to be known as the military-entertainment complex.[203]

In an opportunistic effort to keep video game related activities afloat at Sanders, the next step for Baer was to adopt video game technology to work for more militaristic endeavours. By pushing the limits of existing video game technology, Baer understood that the outcome would be equally attractive to both the United States military and Sanders Associates.[204] The development of simulations technology would limit the costs of military training for a government that was looking to reduce expenditures while

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[203] Robin Andersen, *A Century of Media, A Century of War* (New York: Peter Lang Publishing Inc., 2006), 244-246.
[204] Disclosure of Invention, 6 April 1971, Ralph H. Baer Papers, Brian Sutton-Smith Library and Archives of Play at The Strong, Rochester NY, 1.

placing Sanders in a competitive position to contract the job. It is through this analysis of the military contracting climate that Ralph Baer would become the visionary that utilized the versatility and practicality of video game technologies to radically alter the training of war.

The decision to further video game development at Sanders surfaced as a type of by-product stemming from the massive development of nuclear arms throughout the course of the Cold War. The deployment of nuclear weapons housed equally destructive outcomes, regardless of the opponent's quantity of arms and a credible threat of nuclear retaliation remained present.[205] The fear of nuclear retaliation led to a new type of struggle, where confrontations concerning guerrilla warfare, revolutionary war, counter-insurgency campaigns, and terrorism have become the norm.[206] The high-costs associated with contemporary warfare encouraged the United States military to pursue cheaper alternatives to training.[207] The softening of the video game as a result of the market crashes combined with Sanders position within the military-industrial complex sparked the Interactive Video Game Training System (IVTS) in the late 1970s. IVTS was a four-year program at Sanders that cemented the relationship between the video game industry and the United States military as they entered a period of increased negotiations in 1979. The IVTS program yielded great results and the adoption of video game simulations technology became seamlessly linked with the military by 1984.

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[205] Fred Kaplan, *The Wizards of Armageddon* (New York: Simon & Schuster, 1983), 26-32.
[206] Gwynne Dyer, *War: The New Edition* (Canada: Vintage Canada Edition, 2005), 292.
[207] Alex Roland, "Was the Nuclear Arms Race Deterministic?" *Technology and Culture* 51 (April 2010): 456.

THE INTERACTIVE VIDEO TRAINING SYSTEM

Responsible for the development of the necessary techniques, hardware, and software of simulations technology, the team at Sanders transformed video game technology into a viable training method for the military. The technology developed for the Magnavox *Odyssey* was utilized to work in correlation with videotape capabilities to produce low-end military simulation and firearms training.[208] The idea of adopting video game technology to work with firearms simulators is derived from notes written on a loose piece of paper dated 6 April 1971. The notes contain Ralph Baer's disclosure of invention for electronic target practice equipment in order to decrease the cost and increase the feasibility of extensive target shooting practice through entirely electronic means, using all makes of arms, through the addition of electronic devices (removable) to the guns and to the target.[209] The electronic target practice equipment intended to alleviate ammunition loss, reduce training longevity, and improve upon performance feedback.

The target practice equipment was originally designed to operate with the light gun that was developed for the *Odyssey*. The system allowed for the user to shoot at stationary or moving targets that included a 'spot-wipe-out-on-coincidence' sequence following a successful hit, the same feature that had been added to TV Game #2.[210] The system utilized specially crafted, superimposed raster scan targets on a black and white

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[208] Scheduled and Planned Activities: FY '83, October 1982, Ralph H. Baer Papers, Box 6, File: FY '83 IR+D, FY '84 IR+D NVYA, Brian Sutton-Smith Library and Archives of Play at The Strong, Rochester, NY, 2.
[209] Disclosure of Invention, 6 April 1971, Ralph H. Baer Papers, Brian Sutton-Smith Library and Archives of Play at The Strong, Rochester NY, 1.
[210] Ralph H. Baer, *Videogames: In the Beginning* (New Jersey: Rolenta Press, 2005), 55.

television screen. The raster scanning technique involves the systematic process of stacking rectangular blocks on top of one another, line-by-line, in order to display image capture on a television set. The raster was outfitted to provide the white 'background' to the black target on the screen. The raster technology also allowed for a variety of target sizes to be replicated in order to simulate target distance.[211] The larger the white raster background, the smaller the target would be, thus representing a further distanced target.

The simulation firearms were designed to be equipped with cylindrical optics that would be mounted to the bottom of the barrel. In doing so, the sensor on the rifle and the associated circuitry found within the system itself could spatially calibrate the instantaneous position of the on-screen raster at the moment of trigger release. The position of the firearm in relation to where it was aimed at the time of trigger release marked the location of the 'hit' on screen.[212] Though the *Shooting Gallery* was impressive for its time, the technology would not suffice for IVTS development. The new system looked to incorporate interactive backgrounds and improve upon optical precision techniques in measuring firearms accuracy. This process would be achieved by implementing a collective amalgamation of the existing video game development work at Sanders that occurred from 1966-79.

The IVTS utilized the fundamental hardware and concepts derivative of the *Odyssey* but it also incorporated components from more recent television game projects. The initial concept for IVTS stemmed from the functions and capabilities associated with the HEC. The HEC was the first system that utilized video game technology for

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[211] Disclosure of Invention, 6 April, 1971, Ralph H. Baer Papers, Box 3, Brian Sutton-Smith Library and Archives of Play at The Strong, Rochester New York, 1.
[212] Baer, *Videogames*, 1.

educational purposes but also expanded into the home computer market. The IVTS adopted a similar approach, as the system made use of a modified Apple IIe processor in order to provide more powerful computing capabilities. The current generation of video game consoles simply did not possess adequate computational power to produce high-tech firearms equipment. The computer was modified to synchronize pre-recorded videotapes with the coordinates and various types of targets used for an engaging training exercise.[213] Fortunately, video game capabilities at Sanders had previously established the necessary techniques to complete this very task. The interactive application of 'wall' elements were added to games at Sanders and could be placed overtop of videotape-based backgrounds. The means to do so were a direct result of the Telesketch and Cable-Mate projects that had been concluded by 1979.

The engineers opted to incorporate the capabilities derivative of both the Cable-Mate and Telesketch projects to develop a fully integrated simulator. The Cable-Mate project had initiated the experimentation and eventual adoption of videotape technology for use in a video game to improve upon graphical backgrounds. Scenery would be captured on a generic film that could be incorporated into the background of the video game itself. The game play could then be superimposed on top of the background screen creating one seamless action sequence. The technology was simply outfitted to work in conjunction with the Apple IIe computer as opposed to the Brown Box to simulate precision shooting.

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[213] Baer, *Videogames*, 163.

The Telesketch program provided the ability to produce and control active symbology in the form of a pinball game for the *Odyssey*^{2}. The flipper/ball interaction overlaid the pre-taped video background to create the illusion of one uninterrupted event. The same capabilities could then be replicated in a computer operated simulator to produce "shoot or not to shoot" decision making scenarios that included the incorporation of precision rifles.[214] The amalgamation of existing technologies allowed for the final production of photo-optic firearms simulators. The HEC spurred the realization of utilizing video game technology for educational/training purposes. Demonstrating the ability to allow digitally generated symbology to interact with video presentation deriving from the Telesketch and Cable-Mate projects completed the simulator.[215] The development would come to revolutionize the manner in which the military conducted its technical training. Now that the team possessed the ability to develop interactive backgrounds, the next concern pertained to the improvement of its optics technology.

The first obstacle for the engineers was the need for the improvement and modification of the existing *Shooting Gallery* technology. The raster scan technology used for the *Odyssey* was outdated and unreliable. The IVTS was modified to operate with improved Light Emitting Diode (LED) firing locations by April 1979.[216] The round surface of the shooting target displayed on screen now operated much the same as the inside of a pomegranate half. The seeds of the pomegranate represent the small receiver bulbs used to track the location of the firearm. When the trigger is pulled, the specific

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[214] Baer, *Videogames*, 163.
[215] FY79 IR+D Activities: TV Games and Related Technology, Ralph H. Baer Papers, Box 6, File: FY'79 IR+D NF IBA, Brian Sutton-Smith Library and Archives of Play at The Strong, Rochester NY, 3.
[216] Computer Precision Target Shooting Game, 11 April, 1979, Ralph H. Baer Papers, Box 3, Brian Sutton-Smith Library and Archives of Play at The Strong, Rochester NY, 2-3.

bulb that was spatially aligned with the firearm would illuminate on screen to signal where the hit was registered on the target. The new system was capable of providing a pinpoint accurate representation of firing simulations compared to the generalized hit detection capabilities associated with the raster scan technology found in the *Odyssey's Shooting Gallery*. Once the user completed five shots, the live screen would automatically switch to a display mode to show the hit locations. Additional simulation features included:

a) Preselect the number of shots available (5, 10, 15)

b) Preselect how long the target is available for sighting

c) Explosive sound when the bulls-eye/target is hit

d) Variation on Target pre-selection: target can be illuminated for any length of time desired, for example: sequencing of 10, 5, 4, 3, 2, 1 seconds of length each which can be provided with randomly spaced targets

e) Store up to 5 games consecutive scores and display via LED [217]

The first simulator was developed in conjunction with a fully functional pump action BB gun with built in optics. The firearms system was able to accurately detect 'hits' on the video overlay screen and even provide an overall performance score.[218] Once the system was up-and-running, various demonstrations were given to interested visitors to Sanders, including the Nashua Chief of Police. Unfortunately for Sanders, the Chief could not invest the necessary capital to continue the funding of the operation.[219] The IVTS demonstrations caught the interest of other employees at Sanders however, particularly those in the Defensive Systems Division.

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[217] Computer Precision Target Shooting Game, 11 April, 1979, Ralph H. Baer Papers, Box 3, Brian Sutton-Smith Library and Archives of Play at The Strong, Rochester NY, 2-3.
[218] Baer, *Videogames*, 163-164.
[219] Ibid., 164.

Impressed by the functionality of the firearms simulation, former U.S. Army Field Engineer Al Nunes, whom now worked for Sanders, asked if the technology could be adopted to outfit a Light Anti-Tank Weapon (LAW). The transition was simple enough and a re-hashed version of the precision rifle was produced meeting the weapons specifications of the shoulder-mounted firearm. Baer improved the visual performance of the simulator by creating a videotape that showed Russian tanks moving through terrain that could be engaged and destroyed on screen using the LAW.[220] The final product marked the beginning of the interactive video game industry and Sanders would enter a multi-year program of developing IVTS simulators for the U.S. military.

After far exceeding the desired interests of the military audience at Sanders, the LAW demonstration was taken to the U.S. Army Weapons Show in September 1979.[221] The simulator utilized a life-size replica of a 60mm man-portable unguided rocket system mounted with a photo-optic device. Similar to the LED developments associated with the firearms simulators, a microprocessor encoder provided a spot on the pre-recorded television videotape, which represented the correct point where an individual would be aiming to effectively destroy the target.[222] Participants had to compensate for the speed, direction, and range of the target and the shot would be scored as a hit or miss and a colourful on-screen explosion marked a successful shot. Both the hardware and software supplied by Baer worked flawlessly during the trip and Sanders was rewarded with a bevy of contracts from the military in the following years.

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[220] Baer, *Videogames*, 164.
[221] Ibid., 165.
[222] Final Report: IR+D Task 82-NIL, FY'82, 20 November, 1981, Ralph H. Baer Papers, Box 6, File: FY'82 IVTS/VIPER Demo, Brian Sutton-Smith Library and Archives of Play at The Strong, Rochester NY, 3.

The fundamental concept behind shooting targets on the Magnavox *Odyssey* was successfully modified to fit the needs of weapons training exercises. The LAW program successfully meshed the technological advancements of the first two phases of video game development for the military. It was an event that laid the foundation for the establishment of a trans-sectored relationship known as the military-entertainment complex. As the commercial videogame market continued to rebound from the first market crash and Baer's LAW simulator continued to impress staff officers at the Pentagon, the U.S. military expanded and began to commission game developers to provide modified training versions of their games. Ed Rotberg, a key member of Atari's coin-op division, became the driving force behind the hit arcade game *Battlezone* (1980) and its transition into a state of the art combat simulator.

COMBAT SIMULATORS: ALIGNING VIDEO GAME PRODUCTION COMPANIES WITH THE MILITARY

The first person tank simulation game *Battlezone* utilized modern vector graphics and was the first arcade game to market itself in true three-dimensional space.[223] The graphics were so advanced, a group of consultants from the United States Army approached Atari with the intention of adopting the technology as a training simulator for the new Infantry Fighting Vehicle (IFV) in December 1980.[224] The military was under the impression that if traditional combat simulators could be made into a game than trainees might be more inclined to use it. Exposure to the system would not only allow users to learn the basic operations of the machinery more efficiently but it would double as an educational program to distinguish between friendly and enemy vehicle

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[223] Craig Grannell, "The Making of ... Battlezone," *Retro Gamer: The Ultimate Guide to Classic Videogaming* 4 (59): 178.
[224] Roger Stahl, *Militainment, Inc.* (New York: Routledge, 2010), 96.

silhouettes.[225] The Army requested a fully functional prototype to be prepared for the U.S. Army Training and Doctrine Command (TRADOC) conference to be held in March 1981.

Atari accepted the Army's request and appointed Rotberg as the lead programmer for the completion of the military training simulator. Though he opposed the idea of working on a military grade project, Rotberg was convinced by management to commence with the necessary alterations that had to be made to the game. The military simulator was outfitted with a modified controller that modeled the functionality of those found in the IFV. The controller was so realistic in its function that the fantasy shells that were used in *Battlezone* had to be modified to accommodate the control scheme. The generic missile that appeared in the arcade game was replaced with the four separate weapons mounted on the IFV that included a machine gun turret, incendiary shells, armour piercing rounds and wire guided missiles that were individually modeled to replicate accurate trajectories.[226]

The militarized version of the game would also incorporate new models of enemy tanks and helicopters with detailed specifications provided by the consulting group.[227] The combat simulator only represented the first of many modifications to commercial games. The Pentagon would become a frequent customer to video game production companies by the 1990s. But for the time being, the main driving force in simulation technology stemmed from the works of Baer and Sanders Associates. Although the video

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[225] James Hague, "Ed Rotberg: Battlezone, Blasteroids, S.T.U.N. Runner," *Halcyon Days*, http://www.dadgum.com/halcyon/BOOK/MISC/CONTENTS.HTM [accessed August 21, 2012].
[226] Hague, "Ed Rotberg: Battlezone, Blasteroids, S.T.U.N. Runner."
[227] Roger Stahl, *Militainment, Inc.* (New York: Routledge, 2010), 96.

game industry rebounded from the loss of its first generation consoles and now dabbled in early simulations work, the industry was dealt another blow in 1983-84.

The makeup of the video game market throughout the 1970s consisted of *Pong*-variant titles that drove the industry to a point of repetitive exhaustion.[228] The build up of clone consoles made it appear as if a series of simple modifications to the same fundamental game was all the industry could produce. The saving grace for the video game industry in North America was the release of *Space Invaders* produced by Taito and manufactured by Nintendo in 1978. The arcade game was brought to North America after a licensing agreement was crafted between production companies Midway and Taito. The arcade game became an instant classic and demonstrated the artistic capabilities associated with the industry. *Space Invaders* was the first target game to feature both animated characters and include the concept of the HIGH SCORE![229] The Japanese title reinvigorated the video game industry and old perspectives concerning the limitations of video game capabilities were put to rest. New and improved systems and production companies emerged resulting in the beginnings of what is often referred as the golden age of video games.

Bolstered by the introduction of the home console and a strong lineup of converted popular arcade games, the popularity of video games continued to grow throughout the late 1970s and early 1980s. The success of the industry continued to climb, so much so, that Warner promised $25 million to Universal Pictures for the rights to produce a game based on Steven Speilberg's blockbuster film *E.T. The Extra-*

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[228] "Crash and Burn," *Retro: Micro Games Action*, 2010, 125.
[229] Leonard Herman, *Phoenix: The Fall and Rise of Video Games*, 2nd ed. (New Jersey: Rolenta Press, 1997), 33-34.

Terrestrial.[230] Once negotiations were completed between Atari and Universal, game designer Howard Scott Warshaw only had a few weeks to complete the game for the holiday rush. Despite the limited production time, companies enjoyed the high market demand for their games and believed they could do no wrong. It appeared as though any game releases would continue to sell at staggering rates. This ethos and the rapid expansion of the industry also marked the beginning of its second collapse. While the first video game market crash emerged as a result of creative repetition, the primary cause for the second video game market crash surrounded quality control and employee mismanagement.[231] The oversaturation of low quality games caused the general public to lose interest in the industry.

The release of *E.T.* for the Atari *VCS* was heavily symbolic of what was wrong with the industry by the early 1980s. Although the game was among the first to be licensed from a film franchise, it is often regarded as the worst video games ever made. Legend has it that the harsh criticisms led Atari to collect the remaining game cartridges and bury them in landfill located in Alamogordo, New Mexico.[232] In an interesting side note, the city recently granted permission for a company to find the buried cartridges to coincide with the game's thirtieth anniversary.[233] The larger issue surrounding the *E.T.* release concerned the treatment of employees and the general time frame allotted to

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[230] "Atari Gets 'E.T.' Rights," *New York Times*, August 19, 1982, http://www.nytimes.com/1982/08/19/business/atari-gets-et-rights.html [accessed April 3, 2013].
[231] Roberto Dillon, *The Golden Age of Video Games: The Birth of a Multi-Billion Dollar Industry* (Florida: CRC Press, 2011), 70.
[232] Zoe Kleinman, "ET Game Excavation Confirmed by Studio," *British Broadcasting Corporation*, June 4, 2013, http://www.bbc.co.uk/news/technology-22766511 [accessed June 6, 2013].
[233] Ibid.

complete projects.[234] The upper management at many production companies treated the staff as if they were replaceable drones.[235] Programmers were heavily criticized and were often informed that they were no more an important part of the production process than those putting the cartridges in the box on the assembly line.[236] The hurried programming of games resulted in the production of poor quality titles. *E.T.* was not alone in this habit and rushed production tendencies triggered a snowball effect in which people stopped playing and purchasing video games altogether.[237] The second market collapse had a devastating impact on the North American video game industry that would not be remedied until the emergence of the *Nintendo Entertainment System* (*NES*) in 1985.

At the time of the second video game market crash the United States Department of Defense (DoD) was searching for a transportable, low cost, interactive training medium for use in institutional and field training environments.[238] Baer had pioneered the necessary technology in the form of home television games back in 1966 that placed Sanders in a very competitive position in the emerging simulations market. Sanders held the rights to simulations technologies that included the Interactive Television Gaming System, the Interactive Video Playback System, the Television Precision Target Shooting Apparatus and Method, the Electro-Optical Sensor for Colour Television Games and Training Systems, and even the specific apparatus for the synchronization of a source of

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[234] "Atari Parts are Dumped," *New York Times*, September 28, 1983, http://www.nytimes.com/1983/09/28/business/atari-parts-are-dumped.html [accessed April 3, 2013].
[235] "Activisionaries: The Founding Members Speak Out," *Retro: Micro Games Action*, 2010, 66.
[236] Ibid., 66-67.
[237] Dillon, *The Golden Age of Video Games*, 70.
[238] Final Report: IR+D Task 82-NIL, FY'82, 20 November, 1981, Ralph H. Baer Papers, Box 6, File: FY'82 IVTS/VIPER Demo, Brian Sutton-Smith Library and Archives of Play at The Strong, Rochester NY, 2.

video controlled computer to another video source.[239] Of course, all of this was derivative of the video game technology developed at Sanders throughout the 1970s.

The objective for Baer at Sanders in 1982 was to develop both the required hardware and software for a specific IVTS demonstration based on the VIPER 70mm anti-tank weapon. What differentiated the VIPER program from the LAW demonstration was that the team looked to incorporate the associated techniques of special effects into one smooth demonstration system.[240] The initiation of this integration would dramatically alter the simulation industry for years to come. The adoption of specialized techniques developed within the entertainment industry would further prove the validity of IVTS for low-end weapons simulation by increasing the audio-visual realism of the scenario. As such, the VIPER demonstrated the increasingly complex capabilities of the technology by incorporating: video motion picture presentation with computer generated effects overlay, synthetic voice commands and comments, computer controlled video playback, special electronic sound effects, large screen realism (72 inches), wireless weapon linked to the microprocessor, and integrated software that automates learning and scoring process.[241]

The VIPER system also permitted the constant monitoring of the gunner's aim point to display habitual errors. A wide variety of scenario discrepancies such as weather conditions, terrain, and the time of day were included to prepare the combatant for any type of potential hazards. Perhaps the most impressive factor was the simulators ability to

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[239] For more information or to analyze copies of the official patents, see; Ralph H. Baer Papers, Box 6, File: Sullivan '87, Brian Sutton-Smith Library and Archives of Play at The Strong, Rochester NY.
[240] Final Report: IR+D Task 82-NIL, FY'82, 20 November, 1981, Box 6, Brian Sutton-Smith Library and Archives of Play at The Strong, 6.
[241] Final Report: IR+D Task 82-NIL, FY'82, 20 November, 1981, Box 6, Brian Sutton-Smith Library and Archives of Play at The Strong, 6.

provide optical alignment on the target coordinates as close as ± 1% both horizontally and vertically.[242] This was a drastic improvement in accuracy readings from previous years programs. The system also alleviated common concerns associated with traditional training. The costs associated with conventional training can be very expensive in both manpower and the amounts of ammunition needed.

Not unlike modern firearms/training simulators, the system was capable of scoring and debriefing the trainee at the end of the session without intervention from an instructor.[243] The adoption of firearms simulators also alleviated the need to hire experienced instructors who are often in high demand and short in supply. In many military locations, no expert is available to conduct training but the adoption of high-tech firearms simulators rectifies the problem. At the same time, training personnel are not available for regular duty while molding new recruits. The system encompassed impressive accuracies and tendencies which a traditional instructor may not be able to address as efficiently. The system was demonstrated at the annual Association of the United States Army (AUSA) expo in Washington D.C. in October 1981. The inherent benefits of the system alleviated numerous training concerns and only bolstered the effectiveness of firearms simulations making it a staple in the industry by 1984.[244]

The primitive Raster Scan Video Display technology developed within the *Odyssey* transitioned into a competitive industry of interactive simulations technology by

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[242] VIPER: Interactive Video Training System, Ralph H. Baer Papers, Box 6, File: FY'82 IVTS/VIPER Demo, Brian Sutton-Smith Library and Archives of Play at The Strong, Rochester NY, 4.
[243] VIPER: Interactive Video Training System, Ralph H. Baer Papers, Box 6, File: FY'82 IVTS/VIPER Demo, Brian Sutton-Smith Library and Archives of Play at The Strong, Rochester NY, 2.
[244] Final Report – IR+D Task Code: NVYAB FY'84, Interactive Video Disc-Based Training System, 13 July, 1984, Ralph H. Baer Papers, Box 6, File: FY'83 IR+D, FY'84 IR+D NVYA, Brian Sutton-Smith Library and Archives of Play at The Strong, Rochester NY, 3-4.

the mid-1980s. One of the leading competitors when compared to the Sanders product was the Multipurpose Arcade Combat Simulator (MACS) for use with the M16 assault rifle, M203 grenade launcher, and the M72A2 light anti-tank weapon developed by Litton Industries.[245] The U.S. Army Research Institute for the Behavioral and Social Sciences conducted an investigation to evaluate the MACS software in comparison to traditional combat training. The findings determined that firearms simulations provided the trainees with a firm set of marksmanship skills that resulted in a closer centre of mass on targets.[246] The institute recommended additional implementation of simulators to bridge the gap between what is financially practical and what is necessary to produce combat ready soldiers.[247] Simulators had been approved as a viable source of low-cost training while maintaining high standards of instruction. State of the art simulations technology emerged out of a natural progression of additions and modifications to the *Shooting Gallery* device for the Brown Box during the third phase of video game projects at Sanders.

The transition from a commercial product in the form of a video game console to that of a high-tech stand-alone firearms simulator was an eighteen-year process that bore great fruit for Sanders Associates. The video games projects progressed through a series of developmental stages that highlighted the intrinsic capabilities associated with video game technology. The second phase programs demonstrated the flexibility and feasibility of video game technology. This is a feature that continues to attract a variety of

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[245] Mary N. Perkins, R. Dale Selby, John M. Broom, and Alan S. Osborne, "Preliminary Evaluation of the Multipurpose Arcade Combat Simulator (MACS) for the M16, M203, and M72A2," *Report Prepared for the U.S. Army Research Institute for Behavioral and Social Sciences*, Fort Benning: Georgia, June 1985.
[246] Ibid., 1-3
[247] Ibid., 1-3

commercial fields to the industry to date. Despite the moderate success of the Magnavox *Odyssey* in a lucrative video game market, Baer encouraged further video game production at Sanders. The decision resulted in a six-year program that marked the second phase of video game development from 1974-79.

The adoption and implementation of technology derivative of the Telesketch project (1976-78), the development of the HEC terminal (1977-79), and the Cable-Mate program (1972-79) expanded the fundamental technology affiliated with the *Odyssey*. The projects aimed at improving Sanders position in the commercial video game market. Though the projects failed to yield any significant income, the experiences brought the military contracting company into close proximity with the film industry. The interaction provided the necessary videotape technology to develop both the LAW and IVTS systems during the third phase of video game development (1979-1984). Relations with Warner also marked the first point of contact and interests between cinema, video games, and military that led to the adoption of Atari's *Battlezone* as a combat simulator. The development was one that would radically alter the industrial makeup of the United States.

When American President Dwight D. Eisenhower first called attention to the phenomenon known as the military-industrial complex attempts were made to keep relations between defense contractors and commercial firms separate.[248] A physical distinction could be recognized between commercial and militaristic industrial practices. As military interests continued to move closer towards the technological capabilities

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[248] Tim Lenoir and Henry Lowood, "Theatres of War: The Military-Entertainment Complex," in *Collection, Laboratory, Theatre*, ed. Jan Lazardig, Helmar Schramm, and Ludger Schwarte (Berlin: Walter de Gruyter Publishers, 2003), 21.

found within the entertainment industry, commercial/militaristic distinctions began to blur. It is within this structure that the military-entertainment complex began to emerge.

The end of the Cold War was met with the collapse of the Soviet Union, marking a period of great change for the DoD. Now that the immediate threat had dissolved and tensions had thawed, the U.S. government called for a drastic reduction in spending on the part of the DoD. Section 2220 of the Armed Services Acquisitions bill highlights significant modifications to performance-based management of military programs. The amendment indicates that "the Secretary of Defense shall approve or define the cost, performance, and schedule goals for major defense acquisition programs of the Department of Defense and for each phase of the acquisition cycle of such programs."[249] If programs were "significantly behind schedule, over budget, or not in compliance with performance or capability requirements" suitable actions including termination could be taken.[250] The DoD was experiencing a dramatic restructuring of policies and budget that had been in place since the Second World War.

With a type of shortened leash regarding military funding, a stronger emphasis was placed on running "a fiscally efficient military built on the practices of sound business, and the making of military procurement practices interface seamlessly with commercial industrial manufacturing processes."[251] Video game production companies were to be utilized as a type of test market for the United States military in order to reduce the costs of planning and practicing war. The research and development of shared

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[249] *Federal Streamlining Acquisition Act of 1994*, S. 1587, 103rd Cong., Enrolled Bill.
[250] *Federal Streamlining Acquisition Act of 1994*, S. 1587, 103rd Cong., Enrolled Bill.
[251] Tim Lenoir, "All But War is Simulation: The Military Entertainment Complex," *Configurations* 8 (2000): 314.

computer based digital technologies, Hollywood, and the video game industry became partners in the economics of war, weaponry, military training, and recruitment.[252] The dramatic shift in clientele for video game production companies is derivative of the third phase of video game production at Sanders Associates. The success of the IVTS demonstrated both the functional and versatile capabilities associated with video game technology.

The impact of the Magnavox *Odyssey* moves far beyond the inception and the success of video games in the commercial electronics entertainment industry. Ralph Baer used a combination of existing video game technologies to develop firearms simulations and initiated the relationship between the video game industry and the Pentagon. The symbiotic relationship that now exists between the military and the entertainment industry emerged as a product of Baer's position in the military contracting realm that continues to impact contemporary society. Baer was placed at a crossroads between wartime industrial practices and technological innovation deriving from the invention of the computer that facilitated the establishment of the military-entertainment complex.

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[252] Robin Andersen, "Bush's Fantasy Budget and the Military/Entertainment Complex," *Pacific Free Press*, February 14, 2007, www.pacificfreepress.com/news/1/939-bushs-fantasy-budget-and-the-militaryentertainment-complex.html [accessed March 20, 2012].

Conclusion:
Where is the Industry Heading?

Video games were originally perceived to be nothing more than a passing fad in the mid-1970s.[253] The immediate success of the video *Pong* market encouraged companies to churn out clone consoles for a quick profit as opposed to investing in new game designs. Despite poor marketing strategies and a plethora of blockbuster flops that caused two market crashes, the video game industry is closing in on its fiftieth anniversary furthering its validity as an entertainment medium. Although there is a striking difference between early versions of video games when compared to more contemporary ones, the fundamental principle of the industry continues to focus on interactivity. The modern incorporation of detailed narrative, life-like graphics, and highly communicative exchanges continue to enhance the gaming experience. Innovative developments have placed video games at the beginning of a creative explosion and there is no real end to where the medium can go.[254] It is evident that the video game industry has avoided the all-to-familiar shortcomings of its childhood toy brethren and has emerged as a commercial juggernaut. The interactive advancements found within the video game industry have also doubled in their function for the military contracting realm stemming from increased computer technology.

The sweeping changes associated with the development of digital computing and communications technology spurred the appointment of the digital revolution in the latter half of the twentieth century. As computers became more powerful and commonly used

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[253] Stuart Hunt, "In the Chair with David Crane," *Retro Gamer: The Ultimate Guide to Classic Videogaming*, July 2011, 54-61.
[254] Greg Palmer, *The Video Game Revolution*, VHS (Seattle: KCTS Television Channel 9, 2004).

as commercial devices, the future world depicted by philosopher Marshall McLuhan in the 1960s has emerged to form the contemporary experience. McLuhan explains how the contracting of our world in the digital state has altered our traditional patterns of organization, representing the fundamental principle of the global village.[255] Now that human societies live in such close proximity to one another, due to our electronic involvements, one of the changes that is occurring surrounds a shift in educational developments in the sense of digital literacy. An inter-relation or blending of knowledge in which certain subjects used to remain separate from one another is now beginning to occur as a result of continuous technological innovation.[256] The digital influence is changing the very fabric of contemporary society but it has also carried over into the military theatre.

The type of compound learning depicted by McLuhan has witnessed a shift in traditional education/training to that of the digital realm. One of the most intriguing developments stems from the pioneering strides taken within the entertainment industry itself. The increasing sophistication of video game technology continues to impact military simulations and training in numerous facets. While the concepts of work and games are often perceived in an antagonistic relationship, the two have become successfully integrated due to an emergence of spillover technologies.[257] These multi-functional tools allow technological knowledge to be used by producers rather than the inventor to increase their productivity, hence generating additional benefits referred to as

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[255] Marshall McLuhan, *Understanding Media: The Extensions of Man*, 1st MIT Press ed. (Cambridge: MIT Press, 1994), 35.
[256] Ibid., 35
[257] Robert W. Crandall and James G. Sidak, "Video Games: Serious Business for America's Economy," *Entertainment Software Association Report*, 2006, 2.

spillovers.[258] Combat simulators are one of the leading examples of spillover technology that derived from early video game technology.

The lineage of computer simulations and war games has a rich background history. In order to develop a better understanding of the relationship between training and simulation, a theory of gradual evolution proves to be a trustworthy guide. The process of developing contemporary simulations technology was by no means simple as many intermediate stages occurred, starting with board games.[259] Playing games is one of the oldest and most widespread forms of education. One of the ways that games and simulation were combined was in war games as they offered an opportunity to simulate reality.[260] A war game can be defined as a model of military reality set up by a judicious process of selection and aggregation, yielding the results of the interactions of opponents with conflicting objectives and the results are developed under more or less definite rules enforced by a control or umpire group.[261] The games became exercises in physical skill and intellectual strategy within the borders of a single simulated environment. Lieutenant Georg Leopold von Reisswitz's publication of *Kriegsspiel* in 1824 radically revolutionized the conventional board game and inspired a new way to both participate and think about war.

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[258] Giovanni Peri, "Technology Spillovers," in *The Princeton Encyclopedia of the World Economy*, ed. Kenneth A. Reinert, Rajan S. Ramkishen, Amy Joycelyn Glass, and Lewis S. Davis, 2 vols. (Princeton: Princeton University Press, 2009), 2.
[259] E. B. Tylor, "The History of Games," in *The Study of Games*, ed. Elliott M. Avedon and Brian Sutton-Smith (New York: Krieger Publishing Company, 1979), 76.
[260] James S. Coleman, "Learning Through Games," in *The Study of Games*, ed. Elliott M. Avedon and Brian Sutton-Smith (New York: Krieger Publishing Company, 1979), 324.
[261] E. W. Paxson, "War Gaming," in *The Study of Games*, ed. Elliott M. Avedon and Brian Sutton-Smith (New York: Krieger Publishing Company, 1979), 278.

Although the modes of simulation have changed from that of the board game to the digital, the fundamental principle of war games remains consistent. The Department of Defense (DoD) defines war games 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."[262] It is apparent that the fundamental objective of war games has remained consistent despite a dramatic shift in technological capability following the emergence of the computer. There are two ways in which computers are used in war games. They can be programmed to simulate the whole operation, acting as both control and players to depict results, but they can also be adopted to perform part of the operation leaving decisions to be made by human players.[263] This is a dramatic shift from early computer simulators that were stand-alone systems designed for specific task training purposes and were severely limited in functional capabilities. As computational techniques continued to evolve and progressive simulations developments in the form of firearms simulators continued at Sanders Associates, war games would undertake a radical overhaul.

Major Jack Thorpe was a program manager in flight training research and development programs at the Advanced Research Projects Agency (ARPA) in 1983. ARPA was working on a distributed networking project known as Arpanet, the precursor to the global Internet. The insights gained while working on the Arpanet project encouraged Thorpe to expand on the methods necessary to teach group skills in combat

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[262] Joint Chiefs of Staff, *Department of Defense Dictionary of Military and Associated Terms*, ed. Barry Leonard (Washington D.C.: Government Printing Office, 2010), 503.
[263] Andrew Wilson, *The Bomb and the Computer* (London: Barrie and Rockliff – The Cresset Press, 1968), 85-86.

scenarios.[264] The concept came to a head with the idea that simulators should be used to supplement traditional aircraft training as opposed to merely reinforcing them. Pilots should have the ability to complete simulation programs that involve more complex air combat skills that typically cannot be practiced in times of peace.[265] In order to devise such as system, Thorpe proposed a twenty-five year development program for the construction of battle engagement simulation technology.[266] It was this arrangement that led to the development of the SIMulator NETwork (SIMNET) for collective training and cost alleviation for the DoD. The Cold War was in its final stages and the opportunity to train soldiers for a decrease in cost rested in adopting video game technology for the program.

The Interactive Video Game Training System (IVTS) devised by Ralph H. Baer looked to hone the skills of the individual in the form of firearms training. Baer introduced firearms simulators to the United States military that resulted in the practice of contracting video game companies to produce combat vehicle ports from increasingly complex video game software. The fundamental principle behind SIMNET looked to remain true to the strides made by video game developers but also wanted to improve upon their methods. SIMNET placed emphasis on the collective effort as opposed to the individual participant in an isolated simulator. This was to be done by improving upon group communications for the deployment of various formations and tactics. The digital

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[264] Fred Hapgood, "SIMNET: William Gibson Didn't Invent Cyberspace, Air Force Captain Jack Thorpe Did," *Wired* 5.04 (April, 1997).
[265] Tim Lenoir, "All But War is Simulation: The Military Entertainment Complex," *Configurations* 8 (2000): 308.
[266] Jack Thorpe, "Future Views: Aircrew Training, 1980-2000," discussed in Dennis A. Vincenzi, John A. Wise, Mustapha Mouloua, and Peter A. Hancock, *Human Factors in Simulation and Training* (Florida: CRC Press, 2009), 22.

network consisted of both local and long haul nets of interactive simulators for maneuvering armored vehicle combat elements, combat support elements, and close air support, and all the necessary command and control, administrative, and logistics elements.[267] SIMNET was the first of its kind and provided a complete representation of full-scale engagements.

Similar to the scoring methods devised for the LAW and VIPER IVTS simulators, SIMNET recorded precise statistics on combat events including firings, movements, hits and outcomes, and actions during the simulation that were under the complete control of the individual users. Each system was developed as a self-contained stand alone unit with its own graphics, sound systems, host microprocessor, terrain database, cockpit with training justified controls, and network plug-in capability.[268] The system was utilized to rehearse a variety of strategies, operations, and tactics and was fully operational by January 1990. The SIMNET system incorporated a variety of elements from the IVTS simulators developed in the late 1970s and 1980s. While Baer had no direct involvement in the SIMNET project, his works certainly influenced the development of the system by making simulations technology a viable pursuit for the military. The IVTS systems that were derivative of video game projects at Sanders successfully immersed the DoD with a fruitful simulations community that continues to thrive in the form of the military-entertainment complex to date.

The military-entertainment complex emerged out of the reciprocal relationship between the Pentagon and the entertainment industry. The formal recognition of the co-

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[267] Lenoir, "All But War is Simulation," 311.
[268] Ibid., 311.

habitation between the two structures was exercised by the Computer Science and Telecommunications Board as they determined, "though the two communities differ widely in their structures, incentives, and motivations, opportunities may exist for the entertainment industry and the defense modeling and simulation community to work together to advance the state of the art in M+S technology."[269] The relationship described by the committee has blossomed into a massive industry in which video game technology lays at the heart of the operation. The innovative technology provides low-cost training capabilities deriving form the work conducted by Ralph Baer. The projects conducted at Sanders emerged out of commercial television engineering and the militaristic needs associated with the Cold War. The development occurred at four separate transitional stages, beginning with the invention of the computer.

The scientific nature of the Second World War combined with a heavy concentration of industrial manufacturing processes fostered a new economic system within the United States. The military-industrial complex brought the military, commercial industry, and university laboratories to a collective apex stemming from the invention of the computer. Initially developed to calculate ballistics trajectories, the Electronic Numerical Integrator and Calculator (ENIAC) was adopted to complete complex calculations for the development of the atomic bomb. Not only did the weapon bring a formal conclusion to the War in the Pacific but it highlighted the significance of computer technology both socially and militaristically. This development radically

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[269] Committee on Modeling and Simulation: Opportunities for Collaboration Between the Defense and Entertainment Research Communities, Computer Science and Telecommunications Board, and National Research Council, *Modeling and Simulation: Linking Entertainment and Defense* (Washington, DC: National Academies Press, 1997), 13.

altered human-computer relations that witnessed the birth of both hacker culture and the invention of primitive computer games.

A series of human-computer interactions provided the social and technical foundation for the establishment of the video game industry. The collective works of Alexander Douglas, William Higinbotham, Steve Russell, and Nolan Bushnell marked the first stage of video game development (1952-72) and sparked a revolution in video entertainment. The inherent capabilities associated with video game technology would intersect with the works of Ralph H. Baer at Sanders Associates. After graduating with a degree in television engineering, Baer utilized his experiences at television manufacturing companies and military contracting companies to develop his initial concept of TV Games on 1 September 1966. The final product resulted from eight successive stages of TV Games progression, marking the first phase of video game development at Sanders from 1966-72. The Brown Box prototype eventually entered the market as the Magnavox *Odyssey*.

The success of the *Odyssey* was limited by a poorly crafted advertisement campaign adopted by Magnavox that witnessed the removal of the product from store shelves in 1975. In an attempt to extend the techniques and capabilities associated with video game technology, the Telesketch, Home Entertainment Center, and Cable-Mate programs (1974-79) were initiated with the intention of capitalizing on a fruitful industry. Although the projects yielded no significant contracts for Sanders directly, it brought the company into close proximity with entertainment giants such as Coleco and Warner. The commercial conglomerates assisted in establishing the first link in a chain connecting entertainment and cinema with the military contracting industry. The second phase

developments also doubled for the creation of simulations programs at Sanders. The experiences gained as an instructor at the Salisbury Plain during the Second World War made Baer a self-proclaimed expert on small arms. The engineer would utilize this knowledge in combination with the technology developed at Sanders to introduce the Pentagon to firearms simulators.

The third and final phase of video game development at Sanders (1979-84) witnessed the transition from commercial video game technology to more militaristic pursuits deriving from the first video game market crash of 1977. The crash dampened the creative entrepreneurial climate of the industry and hastened new directions of video game technology at Sanders. The shift encouraged Sanders to transition the technology towards its primary market in the form of the LAW and VIPER IVTS systems. The stage was set for the initiation of improved simulations programs and the recent technological innovations developed by Baer allowed for it. The success of IVTS programs also bore witness to the rise of a new trend. The contracting of video game production companies became common practice in the late stages of the twentieth century as interests between commercial game and militaristic training continued to overlap.

Recent developments in the video game industry have allowed the medium to expand and demonstrate its creative capabilities for training solutions. Video game simulations have been modified to teach individuals how to work in teams as they provide a platform for engaging solutions, provide and promote avenues to think in systems to avoid potentially catastrophic situations, and a process of learning through

repetition and simulation occurs throughout the virtual experience.[270] The simulation community focuses on new forms of training and allows players to learn through a series of team-based skills in Immersive Virtual Environments (IVE).

The implementation of IVE's have allowed the technology to simulate relevant scenarios for government and military training, provide personal performance assessment, and have even entered the realm of behavioural research.[271] Studies have shown that these methods have produced better learning rates in the transfer of training skills.[272] Improved results in collaborative tasks including general efficiency, productivity, and leadership had made it apparent that the shared learning environment depicted by McLuhan has become a reality. Multi-tiered training through digital platforms have become the norm in military training and have become capable of replicating intensive combat experiences.

The accuracy of McLuhan's predictions can be exemplified in the unification of video game technology with advanced simulations programs. Cooperation between the two parties can take many forms, including collaborative research and development projects, sharing research results, or coordinating ongoing research programs to avoid unnecessary duplication of effort.[273] While the technology has far exceeded expectations when compared to the primitive simulators of the 1980s, plenty of technological concerns remain at the turn of the twenty-first century. In order to shed some light on such issues,

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[270] David Edery and Ethan Mollick, *Changing the Game: How Video Games Are Changing the Future of Business* (New Jersey: FT Press, 2008), 103.
[271] Susan Persky and Jim Blascovich, "Consequences of Playing Violent Video Games in Immersive Virtual Environments," in *Avatars at Work and Play: Collaboration and Interaction in Shared Virtual Environments*, ed. Ralph Schroeder and Ann-Sofie Axelsson (Netherlands: Springer, 2006), 167.
[272] Ibid., 168.
[273] Committee on Modeling and Simulation, *Modeling and Simulation*, 1.

Dr. Peter Gizewski produced a brief presentation concerning the future security environment of the Canadian Armed Forces in the wake of the digital world. The security analyst from the Defence Research and Development Canada (DRDC) located at the Royal Military College highlighted potential threats concerning the continuous development of science and technology and its impact on globalization. The fundamental issues discussed throughout the presentation assessed the pros and cons concerning an increased access to information and communications technology in the digital age. While the developments have allowed for many innovative possibilities for the military, Gizewski warns that they should also be taken with a grain of salt.

While modern military technology primarily remains in the developed world, it is gradually beginning to cascade beyond its reach. Commercial industries continue to push the entertainment realm and its technological capabilities into new areas of competition. This global dynamic, in combination with additional elements such as cyberspace, have granted easier access to military technology.[274] The information explosion has allowed non-state actors such as non-governmental organizations, multi-national corporations, terrorist groups, organized crime, and armed irregulars to become well equipped and act as a potential threat to Western security.[275] Gizewski continues by explaining how technological capabilities will arouse rapid and unpredictable events in future conflicts, issuing a wide variety of economic, political, and militaristic concerns. The future security environment depends on the government's ability to handle the intensity and the interactions associated with these trends. This is pivotal to Western security, as our

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[274] Peter Gizewski, "The Future Security Environment" (presentation, PACI Auditorium, Thunder Bay, ON, November 3, 2012).
[275] Ibid.

current level of global interconnectedness has ensured that events occurring in one region will assuredly impact others.[276] The future environment Gizewski describes has been a long time in the making and the contemporary business landscape continues to fuel the expansion of a military-entertainment structure that planted its roots in video game technology.

The pioneering works of Ralph H. Baer in the field of video games rewarded the engineer with the national Medal of Technology in 2006 and an induction to the National Inventor's Hall of Fame in 2010.[277] Already boasting an impressive resume, the engineering successes enjoyed by Baer extend much deeper than personal accolades. The significance of Baer's contributions in the long lineage of combat simulators often goes ignored. The training programs developed at Sanders revolutionized military training and demonstrated the numerous capabilities associated with video game technology.

In a world that is becoming increasingly dependent on the digital economy and as warfare continues to shift towards electronic systems, the creative industries will continue to play a heavy role in military operations. The preparation and training for future conflicts will house synergies in three-dimensional replications of realistic scenarios bolstering highly communicative and interactive simulations. It is apparent that the entertainment industry and the developers behind some of the most successful console franchises will further the role of video game technology within the confines of the military structure that founded it.

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[276] Peter Gizewski, "The Future Security Environment" (presentation, PACI Auditorium, Thunder Bay, ON, November 3, 2012).
[277] David Brooks, "N.H. Brain Behind GPS in Hall of Fame," *The Telegraphy*, http://www.nashuatelegraph.com/news/697050-196/n.h.-brain-behind-gps-in-hall-of.html [accessed March 10, 2012].

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