

Anti-Aircraft Fire Control and the Development of Integrated Systems at Sperry, 1925-1940

David A. Mordell

The dawn of the electrical age brought new types of control systems: data to movement data between distributed computers and effect systems at a distance, these systems employed feedback devices as well as human beings for closed control loops at many levels. By the time the dawn of feedback and stability began to become pertinent for engineers in the USN, a tradition of remote and automatic control engineering had developed that built distributed control systems with coordinated sub-system processes.¹ There was a wealth of technology, control theory and control systems, joined together to produce the large-scale integrated systems typical of World War II and after.

Edwin Anderson Sperry, of 1875-1970, led the company he founded, the Sperry-Helmuth Company, led the engineering and control systems between 1910 and 1940. Sperry and his engineers built distributed data communication systems that laid the foundations of today's command and control systems. Sperry's fire control systems included some three processes or modules. They consisted of distributed networks, data sub-systems, control processes, and outputs that drove machinery.

This article tells the story of Sperry's involvement in anti-aircraft fire control between the world wars and shows how his industrial firm consisted of control systems factors: the common use of control theory in the 1910s, the lack of the closed-loop control progressively more understood, as Sperry engineers gradually replaced human operators with automatic devices, feedback, human interface, and system integration posed challenging problems for the control engineers during the 1920s

and by the end of the decade these problems would become critical as the country struggled to build up its technology to meet the demands of an impending war.

Anti-Aircraft Artillery Fire Control

Before World War I, developments in ship design, guns, and drive drove the need for improved fire control on Navy ships (2). By 1910, smaller ships went at sea in the air, making operations and posture developments in anti-aircraft control the need for weapons and fire control for anti-aircraft artillery. Showing an emphasis out of the day is essentially a problem of "leading" the target, an aircraft developed rapidly in the 1920s. The increased speed and altitude rapidly pushed the task of computing the lead out of the range of human reaction and calculation. Fire control engineers for anti-aircraft guns was a matter of mathematically solving human operators to accomplish a lead beyond their natural capabilities.

During the first world war, mathematicians and control engineers were particularly concerned with engineering control problems. Edwin Sperry, as chairman of the Technical Committee of the Naval Consulting Board, developed two computers for this problem: a gyromotor, a range-finder, and a direction-finder, the director or calculator. Numbers, however, was widely used in the 1920s.³

When the war ended in 1918 the Army continued rapidly its own development in anti-aircraft fire control for the next seven years. In the 1920s, however, the Army began to develop individual components for anti-aircraft equipment including stereoscopic height-finders,

multiplane, and wind location equipment. The Sperry Company was involved in the latter two efforts. About this time Maj. Thomas Wilson, at the Pentagon, opened in Philadelphia, began developing a control computer for fire control data, heavily based on the system of "distance firing" that had developed in naval gunnery. Wilson's device consisted neither fire control calculations, computing data output from existing computers, performing calculations to predict the future location of the target, and predicting direction information to the guns.

Integration and Data Transmission

With the components of an anti-aircraft battery, mounted independently, and together only by telephone, the Problem of the 1920s, that engineers and their personnel of the Sperry Company, resolved. "The answer, however, that the components go to the point of functioning independently within themselves, then the problem of properly transmitting the information from one to the other came to be of prime importance."⁴ The tactical and system considerations often required that different fire control elements be separated by up to several hundred feet. Operators telegraphed their data to an office, often manually entered it into the control computer, read off the results, and telegraphed them to the gun installations. One communication system introduced back a time delay and the opportunity for error. The computer needed higher integration, and such a system required automatic data communication.

Anti Aircraft Fire Control And The Development Of

**United States. President's Aircraft
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Anti Aircraft Fire Control And The Development Of:

ASTIA Subject Headings Defense Documentation Center (U.S.),1959 Naval Anti-Aircraft Guns & Gunnery Norman Friedman,2014-01-21 A winner of the Samuel Eliot Morison Award for Naval Literature gives an excellent overview of the problems involved in shooting at airplanes from ships Coast Defense Journal This book does for naval anti aircraft defense what the author s Naval Firepower did for surface gunnery it makes a highly complex but historically crucial subject accessible to the layman It chronicles the growing aerial threat from its inception in the First World War and the response of each of the major navies down to the end of the Second highlighting in particular the widely underestimated danger from dive bombing Central to this discussion is an analysis of what effective AA fire control required and how well each navy s systems actually worked It also takes in the weapons themselves how they were placed on ships and how this reflected the tactical concepts of naval AA defense Renowned military historian Norman Friedman offers striking insights he argues for example that the Royal Navy so often criticized for lack of air mindedness was actually the most alert to the threat but that its systems were inadequate not because they were too primitive but because they tried to achieve too much The book summarizes the experience of WW2 particularly in theaters where the aerial danger was greatest and a concluding chapter looks at post 1945 developments that drew on wartime lessons All important guns directors and electronics are represented in close up photos and drawings and lengthy appendices detail their technical data It is simply another superb contribution to naval technical history by its leading exponent **Journal of the United States Artillery** ,1922 **Between Human and Machine** David A. Mindell,2003-04-30 Today we associate the relationship between feedback control and computing with Norbert Wiener s 1948 formulation of cybernetics But the theoretical and practical foundations for cybernetics control engineering and digital computing were laid earlier between the two world wars In Between Human and Machine Feedback Control and Computing before Cybernetics David A Mindell shows how the modern sciences of systems emerged from disparate engineering cultures and their convergence during World War II Mindell examines four different arenas of control systems research in the United States between the world wars naval fire control the Sperry Gyroscope Company the Bell Telephone Laboratories and Vannevar Bush s laboratory at MIT Each of these institutional sites had unique technical problems organizational imperatives and working environments and each fostered a distinct engineering culture Each also developed technologies to represent the world in a machine At the beginning of World War II President Roosevelt established the National Defense Research Committee one division of which was devoted to control systems Mindell shows how the NDRC brought together representatives from the four pre war engineering cultures and how its projects synthesized conceptions of control communications and computing By the time Wiener articulated his vision these ideas were already suffusing through engineering They would profoundly influence the digital world As a new way to conceptualize the history of computing this book will be of great interest to historians of science technology and culture as well as computer scientists

and theorists Between Human and Machine Feedback Control and Computing before Cybernetics **The Budget of the United States Government** United States,1922 **U.S. Navy Bureau of Ordnance in World War II** United States. Navy Department. Bureau of Ordnance,Buford Rowland,1953 *Message of the President of the United States Transmitting the Budget for the Service of the Fiscal Year Ending ...* United States,1922 *Aircraft* United States. President's Aircraft Board,1925 **Technical Abstract Bulletin** Defense Documentation Center (U.S.),1964 *All Hands* ,1946 *British Battleship vs German Battleship* Angus Konstam,2020-12-24 At the outbreak of World War II the four key Capital German ships comprised the Bismarck Tirpitz Scharnhorst and Gneisenau Their primary threats where the Royal Navy s King George Vclass battleships the most modern British battleships in commission during World War II and some of the Navy s most powerful vessels Five ships of this class were built HMS King George V Prince of Wales Duke of York Howe late 1942 and Anson late 1942 The powerful vessels in this class would clash with the pride of the Kriegsmarine in two major engagements first during the Battle of the Denmark Strait and subsequent pursuit of the Bismarck between 24 and 27 May 1941 and again at the Battle of the North Cape on 26 December 1943 Alongside the King George V class the Royal Navy s two ship Nelson class Nelson and Rodney comprised Britain s only other battleships built in the interwar years Both ships served extensively in the Atlantic Mediterranean and Indian oceans during the war but their moment of fame came when Rodney together with King George V chased down and bombarded the doomed Bismarck in May 1941 This superbly detailed addition to the Duel series compares and contrasts the design and development of these opposing capital ships and describes the epic clashes on the high seas that ended with the destruction of the Kriegsmarine s major naval assets **Analog Superpowers** Katherine C. Epstein,2024-10-01 A gripping history that spans law international affairs and top secret technology to unmask the tension between intellectual property rights and national security At the beginning of the twentieth century two British inventors Arthur Pollen and Harold Isherwood became fascinated by a major military question how to aim the big guns of battleships These warships of enormous geopolitical import before the advent of intercontinental missiles or drones had to shoot in poor light and choppy seas at distant moving targets conditions that impeded accurate gunfire Seeing the need to account for a plethora of variables Pollen and Isherwood built an integrated system for gathering data calculating predictions and transmitting the results to the gunners At the heart of their invention was the most advanced analog computer of the day a technological breakthrough that anticipated the famous Norden bombsight of World War II the inertial guidance systems of nuclear missiles and the networked smart systems that dominate combat today Recognizing the value of Pollen and Isherwood s invention the British Royal Navy and the United States Navy pirated it one after the other When the inventors sued both the British and US governments invoked secrecy citing national security concerns Drawing on a wealth of archival evidence Analog Superpowers analyzes these and related legal battles over naval technology exploring how national defense tested the two countries commitment to individual rights and the free market Katherine C Epstein deftly sets out Pollen s and

Isherwood's pioneering achievements the patent questions raised the geopolitical rivalry between Britain and the United States and the legal precedents each country developed to control military tools built by private contractors Epstein's account reveals that long before the US national security state sought to restrict information about atomic energy it was already embroiled in another contest between innovation and secrecy The America portrayed in this sweeping and accessible history isn't yet a global hegemon but a rising superpower ready to acquire foreign technology by fair means or foul much as it accuses China of doing today

War Department Appropriation Bill for 1930 United States. Congress. House. Committee on Appropriations, 1928 **Hearings** United States. Congress. House. Committee on Appropriations, 1933 *War Department Appropriation Bill, 1925, Hearings Before the Subcommittee of ...*, 68-1 on H.R. 7877 United States. Congress. Senate. Appropriations Committee, 1924 **Announcement of Army Extension Courses** United States. Department of the Army, 1953 DA Pam, 1955 **Hearings** United States. Congress. House, 1947 *German Secret Weapons of the Second World War* Ian V. Hogg, 2020-01-24 A comprehensive highly detailed study that displays a stunning wealth of technical knowledge a brisk and understandable narrative HistoryNet The phrase German secret weapons immediately conjures up images of the V 1 and V 2 missiles that bombarded London in 1944 But what of the V 3 and V 4 What of Schmetterling the Rochling shell the Kurt bomb the Hs293 These and many other devices were all part of the German secret armory but are relatively unknown except to a handful of specialists What of the German nuclear bomb And the question of chemical warfare The sheer magnitude of the secret weapon projects of the Third Reich is revealed in this comprehensive study written by one of the world's great experts on weaponry The book explores the various fields in which the Germans concentrated their weapon development and discusses the multiplicity of ideas the difficulties and in several cases how these ideas were subsequently exploited by the victors Although much of the German wartime development was not completed before the war's end it nevertheless provided a foundation for a great deal of the munitions development that has since taken place Comparisons with Allied projects are also drawn This book explodes some of the myths surrounding Hitler's secret weapons to reveal a truth all the stranger for being fact Includes photographs and line drawings **Organization of the Federal Government for Scientific Activities** National Science Foundation (U.S.), 1956

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