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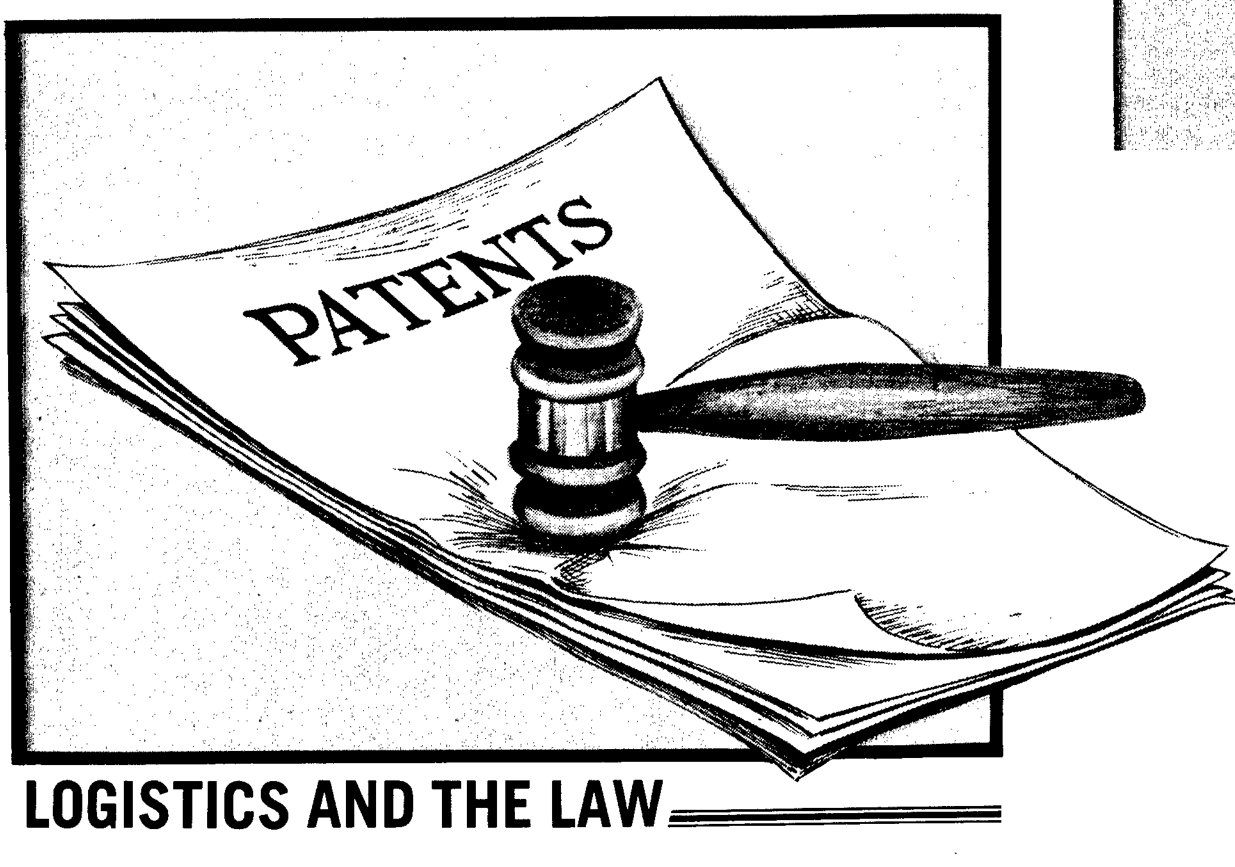

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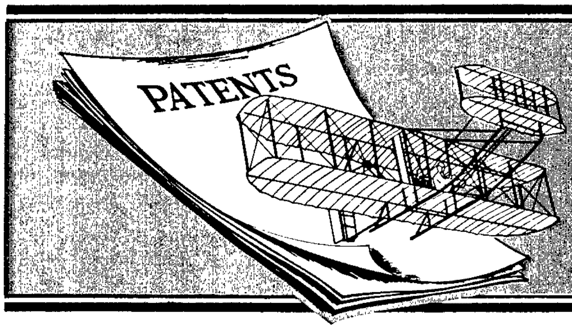

The Wright Patent and Early Army Aviation

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It is much more pleasant to go to Kitty Hawk for experiments than to worry over lawsuits.

Wilbur Wright (25 January 1912)

A man has to have ten years in law school before he has a chance of becoming an aviator.

Charles K. Hamilton (ca. 1911)[1]

The Setting

Today, government contracting practices recognize the importance of acquiring patent rights for inventions which have a significant impact upon national security. Seventy-five years ago, the United States Army (USA) concluded its purchase of a Wright-B military flier and entered the field of heavier-than-air navigation. The September 1909 acquisition of the Army's first airplane was the product of almost two years' negotiation. The Aeronautical Division of the Signal Corps, established on 1 August 1907, prepared specifications and received bids for a military airplane. In September 1908, the Wright Brothers (the only successful bidders to produce a flying machine within the stipulated time period) flew their biplane for Army acceptance and approval. The tragic crash of that aircraft, which killed Lieutenant Thomas E. Selfridge and badly injured Orville Wright, delayed proceedings for a year. With the completion of a new airplane in 1909, the Wrights successfully passed the Army acceptance tests and Army aviation was born. Yet, during those two years, the Army leaders failed to consider what steps, if any, they should have taken in regard to the United States (US) patent rights secured by the Wright brothers in 1906. That oversight may have been one of the major factors leading to American unpreparedness for air war over France in 1917 and 1918.

The US entered World War I shortly after the ill-starred performance of the First Aero Squadron in support of the 1916 Mexican Punitive Expedition. In a nutshell, the loss of every plane in the squadron within the first three months of flying demonstrated the inadequacy of American military airplanes—the Curtiss JN-2s sent to Mexico were unable to gain enough altitude to fly over the Mexican mountain ranges. Aircraft propeller laminates warped in the heat of Mexican noonday sun and the cold desert nights. Logistically, there was inadequate planning for replacement and spare parts; tactically, there was too little appreciation for the limited capabilities of the antiquated "Jennies." By way of contrast, it was in July 1916 that airpower played such a vital role in the battle of the Somme, and the Germans introduced the Fokker F-1, with machine guns firing through the propeller orbit.

Why had European airplane design and construction moved so rapidly ahead of American capabilities? No doubt much credit is due to French, German, and British rearmament efforts and the increased demand for military aircraft of various types. Government orders sustained British and Continental airplane manufacturers, just as lack of US government orders killed the initiative of American aircraft builders. The neglect of American Army aviation was also a product of general defense unpreparedness before the autumn of 1916; the largest proportion of the small defense budget went into construction of Navy dreadnoughts, our "first line of defense."

Litigation over the Wright brothers' patent was certainly not the only cause of American aerial unpreparedness, but it cannot be dismissed as being of no consequence. Indeed, had the US government secured a license from the Wright brothers in conjunction with its purchase of the military flyer in 1909, the history of military aviation might well have been substantially altered.

The Aeronautical Art and the Wright Invention

A rising engineering professionalism was one of the principal reasons for man's solving the problem of manned aerial flight; it followed nearly five centuries of ostensible failure. From 1900 to 1903, several experiments were in progress while the Wrights accomplished their major work, but the Dayton brothers' closer attention to aerodynamic theory and their precise observation of aircraft dynamics and control were responsible for their success. John J. Montgomery of California had tried variable wing surfaces which gave increased lift capacity to his gliders, yet Montgomery like numerous French aircraft designers had not used these wing surfaces to secure lateral control of a flying machine. As aviation historian Tom Crouch observed: ". . . the all important problem of control had been given almost no attention. This approach to the problem of flight was naive. . . ."[2]

As a result of Wilbur and Orville Wright's experiments with gliders, they reduced the camber of the wings (from 1:12 to 1:22) and inserted on the trailing edge a series of control connections that allowed the wings to be warped simultaneously in opposite directions. This control system provided effective three-axis control in roll, pitch, and yaw. Unlike the wings of later Curtiss aircraft, which were provided with moveable ailerons, the wings on the Wright brothers' gliders and their first models of powered airplanes were flexible. While the idea of twisting wings came to them early, it was not until 1902 that the Wrights decided to build the wings with a rigid front edge and a moveable trailing edge (every Wright airplane and glider thereafter was so constructed). To supplement the control function achieved by wing warping, the two brothers developed a vertical tail arrangement which served to balance the forces that worked upon opposite sides of the aircraft while in flight. Thus, they achieved not perfect inherent stability, which they considered unattainable, but rather a control system that would easily restore stability whenever equilibrium was disturbed.[3]

For purposes of patent law, it is important the Wrights' invention be clearly defined. The use of moveable wing surfaces was not unique to them, nor was the use of a vertical tail; their purposes in using these techniques did, however, vary from those of earlier experimenters. What was creative and innovative about their work was the combination of these elements into a control system that worked effectively and permitted the flight of a powered heavier-than-air craft for an extended period of time. The *combination* of these elements, and not the mechanical contrivances themselves, was what formed the most defensible part of the Wright patent when it was issued.

Secrecy and Premature Disclosure

While the Wrights were not unaware of the risks inherent in premature publicity concerning their invention, they nevertheless vacillated between the extremes of total secrecy and naive disclosure. In 1906, they asked Octave Chanute to recommend a remote Florida Island from which they could make flights unobserved; they also declined to fly in exhibitions, fearing that it would expose the nature of their invention. Yet their work had been observed by Augustus Herring as early as 1902, and Herring had attempted to obtain a partnership based upon the details he had purloined. In 1905 Samuel P. Langley's chief engineer, Charles Manly, visited Dayton surreptitiously and presumably carried back some valuable information concerning the Wright control system.[4]

The Aerial Experiment Association (AEA), which Alexander Graham Bell formed in October 1907, played a significant role in early aviation, but its relationship to the Wrights is unclear. Fred Kelly, the official Wright biographer, claims it was only after future association members met with the Wrights that they formed the new experimental group.[5] On the other hand, a Glenn Curtiss biographer asserts that when Lieutenant Thomas Selfridge, Secretary of the AEA, wrote to the Wrights for information in 1908, he ". . . met with a curt refusal."[6] Despite this statement, it is clear that, either through British publication of Wright data or through contact with those who knew the details of their work, the AEA by March 1908 had a very good idea of the aerodynamic principles that were the basis for the Wrights' success.

Actually, there had been at least two disclosures of the Wright control systems before 1908. One was to Augustus Herring in 1904; the other was a disclosure of the glider control systems by Octave Chanute in 1903 (spring) during a speech in France. Later published in a French scientific magazine, the Chanute statement was to haunt the Wrights at various times in their careers. These early disclosures of Wright data and designs make it extremely difficult to prove or disprove the assertion that the AEA, or Glenn Curtiss, used the Wrights' invention in their work after 1907 and thus infringed upon the US patent issued to the Wrights in 1906. However, the weight of the evidence strongly suggests they knew of the Wright brothers' control system early in 1908, and their first successful flight in the June Bug during the summer of 1908 supports this supposition.[7] On the other hand, the AEA assembled some of the finest scientific minds in the US and Canada, and it is plausible that their discoveries were made independently of the Wright patent claims.

Throughout the early years of aviation, the figure of Octave Chanute cast a large shadow over the field. He maintained contact with most groups and individuals experimenting with aerial flight; and, in the case of the Wrights, he was the generous provider of data and other information not readily available to them in Dayton. On the other hand, it was Chanute who provided an introduction for Augustus Herring to the Wrights and gained Herring's admission to the Kitty Hawk encampment in 1902; in 1909 Chanute admitted this "impolicy" to Ernest L. Jones, Editor, *Aeronautics* magazine. Likewise, it was Chanute who, having obtained structural details on Wright gliders in early 1903, relayed this confidential information to French aeronautical circles by means of a speech and an article in the *Revue des Generale Sciences*. Those facts were used in the future development of French aviation, usually without attribution to the Wrights.[8] Indeed, when Wilbur Wright visited France in 1910, it was the generally accepted tradition that he and Orville had been introduced to aviation by Chanute and that they were Chanute's protegees.[9] Wilbur's agitation at this falsehood was doubtless heightened by the knowledge of how much Chanute weakened their patent claims by his 1903 speech. In 1906 they learned he had revealed the camber ratio of their glider wings, as well as the general principles of wing-warping control. Subsequently, in March 1912, the German patent office, during the pendency of American litigation concerning the Wright patents, held that the Wright German patents were null and void because the substance of their control systems was disclosed by Chanute in 1903 and was therefore in the public domain.[10] Thus, Chanute's 1903 speech and article, released against the express prohibition of the Wright brothers, were to complicate their actions for patent infringement against Herring, Curtiss, and others.

The Wrights' American Patent

The basic US patent covering the Wrights' control system was applied for as a consequence of the glider experiments in 1902. Few inventions faced more obstacles in gaining patent recognition. On 23 March 1903, the Wrights filed the initial application which covered only their glider control systems. After the patent examiner rejected their invention as "inoperative" and termed the Wrights' twisted bicycle tire box exhibit as being of "no assistance," the brothers decided professional help was required.[11] At the suggestion of their local attorney, John Kirby, they contacted Henry A. Toulmin of Springfield, Ohio, who in January 1904 undertook the further processing of the patent application.[12] Toulmin's first effort, in a decade of trials and settlements, was to amend the original patent application to have its terms refer to a powered aircraft as well as a glider. By May 1905 the examiner did concede, even though he rejected it again, that the application "disclosed patentable matter." A subsequent attempt in December 1905 resulted in the examiner holding that the application applied to a powered flying aircraft rather than a glider; Toulmin had argued the invention applied to both types of aircraft. Eventually, in March 1906, the new matter was withdrawn, with a careful reservation of rights that might otherwise be precluded by a "file wrapper estoppel." The danger was, when Toulmin withdrew the powered aircraft provisions from the application, it might be held the Wrights had by inference admitted it did not apply to aircraft with motors.[13]

Fortunately, for the Wrights, the doctrine of "file wrapper estoppel" was never invoked against them, presumably because the courts held them to be "pioneers," which entitled their patent to a broad and liberal construction. The patent was ultimately held applicable to powered aircraft, as well as to gliders, and also to cover both wing-warping and an alternative control system based upon hinged rear wing flaps called ailerons.[14] However, even as the effort to obtain an American patent was nearing success, the proceedings in the German patent office had already been jeopardized by the disclosures made by Octave Chanute in 1903. Initially, the Wright brothers seemed concerned about prior disclosure. Writing to Octave Chanute, Wilbur Wright confided, "We had been congratulating ourselves that this had been overlooked by them. We fear it may interfere with our being granted a broad claim on twisting the wings."[15] Thereafter, they ventured the hope that the difference between "distort" and "twist" might work to their benefit, Wilbur ruefully commenting, "I think we will unless the German examiner is unreasonable and stubborn."[16] Apparently, he was both, because he rejected the German application in 1912. The failure of the German application highlights the good fortune the Wrights encountered in the US in the course of their effective prosecution of infringement suits.

The Patent Litigation

Glenn Curtiss and the AEA on one side, and the Wrights on the other, were both aware of the need to litigate the validity of the American patent. During the March 1908 test flight of the AEA Red Wing, Alexander Graham Bell emphasized the need for a complete photographic record, both to aid future designers and to forestall possible patent complications. In July 1908 Orville Wright wrote to Curtiss concerning a newer AEA model, the June Bug, and, after noting the adjustable wing tips, offered to negotiate license terms under the Wright patent numbered 821,393. When Curtiss advised them that he did not expect to use the plane for commercial purposes, the Wrights acquiesced, but the issue resurfaced when the June Bug was used for compensated exhibition flying. Bell's patent attorneys entered the picture shortly after the successful flight of June Bug in July 1908. It was Curtiss's success in prize competition during the summer of 1909 which triggered the first patent action against the Herring-Curtiss Company, formed three months earlier by a merger of the patent interests and resources of Glenn Curtiss and Augustus Herring. *Wright v. Herring-Curtiss* proved crucial to the Wrights' impregnable legal position.[17]

American patent litigation began in late 1909 when the Wrights asked the courts to issue a preliminary injunction against the Curtiss interests. Such an order for injunctive relief would prevent the Curtiss firm from using any aspects of the Wright invention until such time as a final determination would be made in the case. On 3 January 1910 District Judge John R. Hazel, sitting in the US District Court for the Western District of New York, issued the injunction and gave a strong opinion upholding the Wright patent. Four months later the Second Circuit Court of Appeals reversed Judge Hazel's decision and invalidated the injunction on a procedural technicality. However, the substantive basis for Judge Hazel's District Court decision—that the Wright brothers had discovered a method for controlling lateral roll and that in doing so they had made a pioneering contribution to the state-of-the-art—was to be used effectively in subsequent litigation. In essence, the holding that the Wrights were pioneers entitled them to a liberal construction of their patent claims.

A companion case filed in the Southern District of New York against the French exhibition flyer Louis Paulhan also resulted in a preliminary injunction, later rescinded on appeal to the Circuit Court. However, this issue involved not a variant method of altering the airfoil angle of attack, but rather a different mode of obtaining rudder control. District Judge Learned Hand held there were mechanical differences, but he asserted the principle it was not mere mechanics that were determinative of the Wright patent; rather it was the concept of obtaining lateral equilibrium through alterations in the angle of incidence of the airfoils and balancing deflections of the rudder to the left or right. As Judge Hand observed, "the invention is not of a machine, it is not an invention of this means of so turning a rudder, but it is an invention of a combination of which this action of the rudder is a part." Paulhan's counsel argued that the Wrights' invention was a mere improvement over the existing state-of-the-art. As a consequence, Judge Hand devoted considerable attention to that argument in writing his opinion. He specifically concluded that Clarence Ader of France had come close to anticipating the Wright invention, but rejected the idea that Ader was entitled to priority because of the mere suggestion that a rudder might aid in maintaining lateral control. Echoing the rationale of Judge Hazel's opinion, Judge Hand reasoned that it was the use and combination of previously discovered techniques that resulted in the Wrights' pioneer discovery.[18]

Within three years, the broad construction of the Wright patent was again under attack in the case of *Wright Company v. Herring-Curtiss Company*.[19] Once more Judge Hazel decided the case with an opinion that was most encouraging to the Wrights. As before, he felt it necessary to affirm the vital nature of lateral control systems to the achievement of successful human flight. Conceding that Langley, Lilienthal, Chanute, and Maxim had made great progress, the judge pointed out that these experiments ended in failure. Even the published theories of Octave Chanute "were not sufficiently definite to suggest the later improvements by the patentees."[20] From the Henson patent issued in Britain in 1842, to the most recent European patents of Ader in France and Schroder in Germany, the specific combination of wing-warping features and a vertical rudder designed to provide lateral control rather than steering was not present as a unified proposal for controlled aerial flight. The 1868 patent issued to Boulton in Britain indicated the inventor's grasp of the mechanics of air in controlling a flying machine and incorporated some of the features later used by the Wrights; however, as Judge Hazel pointed out, the "assertions and suggestions were altogether too conjectural to teach others how to reduce them to practice, and therefore his patent is not anticipatory."[21]

Since the Curtiss airplanes used a separately controlled vertical rudder (now called a stabilizer), there was considerable argument over the originality of their modification of the Wright vertical rudder which was linked to the wing-warping controls. In this instance, Judge Hazel held the vertical stabilizer was not an essential part of the Wright invention. Quite the contrary, in the Wright airplane the use of flexible wings which permitted the wing angle of attack to be altered (or warped) was the essential part of the machine. "The employment, in a changed form, of the warping feature or its equivalent by another, even though better effects or results are obtained, does not avoid infringement."[22]

Following this decision, Orville Wright correctly observed: "This will give us an absolute monopoly . . . ."[23]

The Impact Upon American Aviation

These successful injunctive suits against Herring-Curtiss Company and Louis Paulhan halted the manufacturing activities of Herring-Curtiss and the experiments of the AEA. Thereafter, Glenn Curtiss and his associates spent extraordinary amounts of time on research and patent litigation to develop a control system that would not infringe upon the Wright patent. This largely unsuccessful effort would persist until the formation of a patent pool between Curtiss, the Wrights, and other inventors, in 1917.[24] A compromise was difficult because of the belligerent attitude of Orville Wright, the surviving brother of the partnership. During the course of the 1913-14 case of *Wright Co. v. Herring-Curtiss Co.*, the defense, in an effort to dispute the "pioneer" status of the Wrights' flyer, refashioned and flew an old Langley aerodrome. Not only had the Smithsonian Institution authorized the reconstruction, but it also paid Curtiss to complete it, and then sent Dr. Albert Zahm to represent the Institution at the test. Zahm testified against the Wright interests in the Herring-Curtiss case, and the Smithsonian earned the enmity of Orville Wright for nearly three decades. The litigation also strained their relations with Octave Chanute, who had advised against filing the first infringement actions in 1909, and who subsequently gave testimony damaging to the Wright interests. Although the break was not complete, Orville Wright, and Wilbur before his death in 1912, were suspicious and hesitant in their friendship for Chanute.[25]

Confusion and hard feelings attended the Wright patent litigation in the US, and the pendency of these suits inhibited further experimentation. Certainly they made it difficult to compete with the Wright Company in the production of a heavier-than-aircraft that had an adequate control system. The experience of Louis Paulhan is indicative of the extent to which American courts protected the Wright position. Notified of the existence of the Wright patents, he reworked the controls of his aircraft to avoid similarities to the wing-warping mechanism of the Wrights. Both of his airplanes crashed as a consequence, but he was still sued by the Wrights for an alleged infringement of their patent. Because of Paulhan's difficulties, European fliers refused to do exhibition flying in the US, and only an agreement between the Aero Club of America and the Wrights secured their promise not to litigate on the basis of contest appearances.[26]

National Preparedness and the Wright Patent

American unpreparedness for the war in the air from 1917 to 1918 may be attributed to many factors, but little attention has been given to the problems presented by the existence of a Wright monopoly in the early years of Army aviation. Although the evidence is slender, there is some reason to believe that lack of competition coupled with wariness about patent litigation inhibited the Army's contracting for improved aircraft. The general decline in the American airplane industry, itself in part due to the preeminence of the Wright patent, added to procurement difficulties. By 1914 European airplane manufacturers approached the USA, asking whether orders could be placed with their firms. Given the litigious character of the Wrights, these inquiries seem to have been left unanswered as the Signal Corps continued its efforts to have the Wrights modernize their military airplane.[27]

> *"The existence of a near monopoly situation in the aircraft industry was rendered critical by the harsh personal feelings that developed between the Wrights on one hand, and the Curtiss-AEA interest on the other."*

Close ties existed between the Signal Corps aviation section and all aeronautical manufacturers. These connections served Army aviation by providing access to public opinion and also by making available technical knowledge of heavier-than-aircraft construction. It was inevitable the Army would become involved in the process of patent application and manufacturers would take an active concern in Army flying appropriations. In November 1910 the Glenn Curtiss Company offered the services of newspaperman E.D. Moore to the Chief Signal Officer, in the hope the general and the former employee of the Associated Press might influence congressional action upon the Signal Corps' aviation appropriation for the coming year. In February 1913 the Wrights asked General Allen's successor to obtain special treatment for one of their patent applications. In this, Scriven was dissuaded by the Patent Office's ruling that only a personal appearance by the Secretary of War would justify priority treatment in examination of the new Wright patent application.[28] Close and continued contact with the civilian aviation community ensured the Army was well informed of the progress of the application for, and litigation of, patent rights in the US. At the same time, the Signal Corps kept close watch over the aircraft patents issued by the Commissioner of Patents, requesting copies of all new patent descriptions for study and filing in departmental records.[29] This monitoring of aviation patents was second nature to the Signal Corps which, for nearly a decade, had been deeply involved in developing and patenting the telegraph, radio, and cable systems that were to mark a turning point in worldwide communications.

The existence of a near monopoly situation in the aircraft industry was rendered critical by the harsh personal feelings that developed between the Wrights on one hand, and the Curtiss-AEA interests on the other. In addition, the secretiveness and naive caution of the Wrights had limited the capital funds of the Wright Company, leaving it unable to provide an adequate supply of airplanes to meet expanding national needs. In July 1917 debates in Congress deplored the degree to which the pendency of the Wright patent litigation inhibited capital investment in airplane production.[30] The willingness of French and British manufacturers to enter the American market is the best evidence that the supply of American built aircraft did not satisfy the requirements of the nation.

Quantity of aircraft manufacture was not the only aspect of aviation progress influenced by the existence of the Wright patent in private hands. Army experience from 1909 through 1913 suggested Wright planes were underpowered in comparison to those of Burgess-Curtiss, which by 1913 operated under a Wright license, but seemingly surpassed the original inventors in aircraft construction and engine development.[31] Wright persistence with the "pusher" style engine despite the safety advantages of the "tractor" type mounting may have been partially responsible for heavy Army aviation fatalities in 1913. Established in position and recognized by US courts as pioneers in the field, the Wrights had little incentive to move forward aggressively in the development of new designs. This is perhaps best illustrated by their correspondence with the Chief Signal Officer in 1913 and 1914. After the Army suggestion they develop hand controls which would be simpler in operation, the Wrights began work on modifying their antiquated system of levers. Using Army descriptions of foreign control systems, they evolved a new control system based upon a wheel and a rim that could control both the wing-warping surfaces and the rudder and stabilizer.[32]

Devoid of substantial outside financial backing before 1914, the Wright Company found itself in a difficult competitive situation, for other American manufacturers could afford to pay royalties on the Wright patents and still turn an adequate profit through production volume. Reorganization of the Wright Company in 1914 and 1915 was completed through the purchase of all outstanding shares by Orville Wright; of the original shareholders, only publisher Robert J. Collier was permitted to retain his interests. Then Orville Wright, with Collier's acquiescence, sold his interests to a syndicate composed of, among others, William Boyce Thompson and Frank Manville.[33] Thereafter, the Wright Company began to participate more actively in the mass production of aircraft, and its business activities were more closely aligned with those of large corporations than the personal ambiance of the Dayton bicycle shop.

The Formation of a Patent Pool

In spite of one informal licensing arrangement that facilitated aircraft manufacture in the US, a "patent jam" developed which had begun to inhibit progress well before American entry into World War I. A "jam" is a situation in which the competing interests of adverse patent holders cause a halt in the development of the art and an inflation in the cost of the invention because of excessively high royalty demands. By 1914 the vast majority of the practical inventions used in heavier-than-air flight were in the hands of the Wrights or the Curtiss interests. Eventually, the government was instrumental in obtaining the formation of a patent pool, known as the Manufacturer's Aircraft Association. Established in October 1917, this Association was controlled by three voting trustees; one of the trustees was appointed jointly by the Wright and Curtiss interests, one was appointed by the small manufacturers, and the third was appointed by the National Advisory Committee on Aeronautics. Revised and redrafted in 1928, the patent pool represented by the Manufacturer's Aircraft Association became a permanent part of American aviation financing.[34]

As a vital part of postwar American aviation, the patent pool represented a major achievement for the War Department and the US government. However, it represented a resolution of the patent litigation that came too late to save the US from unpreparedness in the air from 1917 through November 1918. Consequently, we fought our war in the air with European designed and built aircraft; the major American industrial contribution to Allied aeronautics in World War I was the Liberty engine used in slow observation aircraft.

Notes

[1]Wilbur Wright to M. Hevesy, 25 Jan 1912, Marvin W. MacFarland, ed., *The Papers of Wilbur and Orville Wright*, 2 vols (New York: McGraw-Hill Book Co., 1953), II p. 1035. Quoted in Alden Hatch, *Glenn Curtiss: Pioneer of Naval Aviation* (New York: Julian Messner, 1942), p. 187.

[2]Spearman, Arthur D. *John Joseph Montgomery, 1858-1911: Father of Basic Flying* (Santa Clara: University of Santa Clara, 1967), pp. 20, 40, 43-44, 47, 258, 260; Tom D. Crouch, "Aeronautics in the Pre-Wright Era: Engineers and the Airplane," in Richard P. Hallion, ed., *The Wright Brothers: Heirs of Prometheus* (Washington: Smithsonian Institution Press, 1978), pp. 5, 11-13, 18-19.

[3]MacFarland, ed., *Wright Papers*, I, p. 269 (n.3), p. 469 (n.5), II, p. 1128; Marvin W. MacFarland, "Wilbur and Orville Wright: Seventy-five Years After," in Hallion, ed., *The Wright Brothers*, p. 24; Hatch, Glenn Curtiss, p. 130; Fred C. Kelly, *The Wright Brothers: A Biography Authorized by Orville Wright* (New York: Farrar, Straus & Young, 1950), pp. 49, 69-71, 79, 81-82; Carl Zollman, "Patent Rights in Aircraft," *Marquette Law Review*, II (1927), pp. 216-221, at p. 218; Rodney K. Worrel, "The Wright Brother's Pioneer Patent," *American Bar Association Journal*, LXV (1979), pp. 1512-1518, at pp. 1512-1513.

[4]MacFarland, ed., *Wright Papers* II, pp. 681, 684, 842; Roger E. Bilstein, "Popular Attitudes toward Aviation, 1910-1925: The Airplane, the Wrights and the American Public," in Hallion, ed., *The Wright Brothers*, p. 42.

[5]Studer, Clara. *Sky Storming Yankee: The Life of Glenn Curtiss* (New York: Stackpole Sons, 1937), pp. 87-88, 94, 96, 100-102, 103-104; Hatch, *Glenn Curtiss*, p. 130; Kelly, *Wright Brothers*, pp. 136-137, 146, 242-243, 290-291.

[6]Studer, *Sky Storming Yankee*, 111; an assertion to the contrary is at Kelly, *Wright Brothers*, pp. 290-291.

[7]Ibid., pp. 290-291.

[8]Crouch, "Aeronautics in the Pre-Wright Era," in MacFarland, ed., *The Wright Brothers*, p. 25; Spearman, *John Joseph Montgomery*, p. 118. Wilbur Wright to Octave Chanute, 8 Jan 1904; McFarland, ed., *Wright Papers*, I, pp. 412-413; Octave Chanute to Ernest L. Jones, 26 Aug 1909, ibid., II, p. 913. The basic facts may be studied at MacFarland, ed., *Wright Papers*, I, pp. 335-336, 346, ibid., II, pp. 723-724; see also Kelly, *Wright Brothers*, pp. 166-167; MacFarland, "Wilbur and Orville Wright," in Hallion ed., *The Wright Brothers*, pp. 25-26; Charles H. Gibbs-Smith, "The Wright Brothers: Their Influence," in ibid., p. 32; Orville Wright, *How We Invented the Airplane*, Fred C. Kelly, ed. (New York: David McKay Company, 1950), p. 63.

[9]Orville Wright reported this to Octave Chanute on 29 Jan 1910, adding that they had avoided a public refutation of the statement. MacFarland, ed., *Wright Papers*, II, p. 984.

[10]Wilbur Wright to Octave Chanute, 28 Aug 1906, and Chanute to W. Wright, 31 Aug 1906, MacFarland, ed., *Wright Papers*, II, pp. 723-724. Wright Brothers to Editor, *Scientific American*, 14 Mar 1912, ibid., II, p. 1040; *Aeronautics*, X (1912), p. 100.

[11]This involved a demonstration of the warping technique by twisting the two ends of a long cardboard box in opposite directions; this was claimed to have been the manner in which the Wrights initially discovered the use of wing twisting to secure lateral stability.

[12]Kelly, *Wright Brothers*, p. 112; MacFarland, ed., *Wright Papers*, I, pp. 409, 417; Rodney K. Worrel, "The Wright Brother's Pioneer Patent," *American Bar Association Journal*, LXV (1979), pp. 1512-1518, at pp. 1512, 1514, 1516.

[13]Ibid., pp. 1517-1518.

[14]Ibid., p. 1518.

[15]MacFarland, ed., *Wright Papers*, I, p. 481.

[16]Ibid., I, p. 482.

[17]MacFarland, ed., *Wright Papers*, II, pp. 907, 909, 911; Wright Co. v. Herring Curtiss Co., 177 Fed. 257 at pp. 260-261 (1910); Hatch, *Glenn Curtiss*, pp. 128-130, 144, 176-177, 180, 184-186; Kelly, *Wright Brothers*, pp. 288, 293; Studer, *Sky Storming Yankee*, p. 98.

[18]Wright Co. v. Paulhan, 177 Fed. 261-271 (S.D. N.Y., 1910); John A. Eubank, "Aeronautical Patent Law," *Dickinson Law Review*, LVI (1952), pp. 143-157 at p. 145.

[19]Wright Co. v. Herring-Curtiss Co., 204 Fed. 587-614 (W.D., N.Y. 1913). The case was affirmed on appeal; see per curiam opinion at 211 Fed. 654-655 (2d Cir. 1914). Hatch, *Glenn Curtiss*, p. 232.

[20]204 Fed. 587 at p. 605.

[21]Ibid., p. 603.

[22]Ibid., p. 607.

[23]MacFarland, ed., *Wright Papers*, II, p. 1073.

[24]Ibid., II, p. 1087, note 10.

[25]Ibid., II, pp. 962, 982, 1087-1088; Kelly, *Wright Brothers*, pp. 309-310; Studer, *Sky Storming Yankee*, pp. 324-325, 368.

[26]Studer, *Sky Storming Yankee*, pp. 207, 217.

[27]A French approach is documented in a letter, Counsellor Clause to William Jennings Bryan, 31 July 1914, and Major Edgar Russell to Secretary of War, 20 Aug 1914, RG 111, General Correspondence, 1889-1917, #36009, National Archives, Washington, D.C.; see also Orville Wright to Captain Charles DeF. Chandler, 29 Dec 1911 in MacFarland, ed., *Wright Papers*, II, pp. 1031-1032. A British manufacturer's inquiry came through the attache in London. Major George O. Squier to War College Division, 15 Jan 1913, RG 165, War College Division Correspondence, #7031-6, National Archives, Washington, D.C.

[28]Jerome S. Fanciulli to Brigadier General James Allen, 29 Nov 1910, RG 111, General Correspondence, 1889-1917, #25857-2, National Archives, Washington, D.C.; Brigadier General George P. Scriven to Commissioner of Patents, 14 Feb 1913, Commissioner of Patents to General Scriven, 18 Feb 1913, and General Scriven to Wright Co., 3 Mar 1913, ibid., #32295.

[29]Various patents for flying machines, ibid., #27490; Major Edgar Russell to Commissioner of Patents, 15 Sept 1913, ibid., #33201; Lt Colonel Samuel Reber to Commissioner of Patents, ibid., #34176; see also Becker and Becker to Secretary of War, 12 Apr 1910, ibid., #23889; and Brigadier General Allen to Commissioner of Patents, 1 July 1909, ibid., #21704.

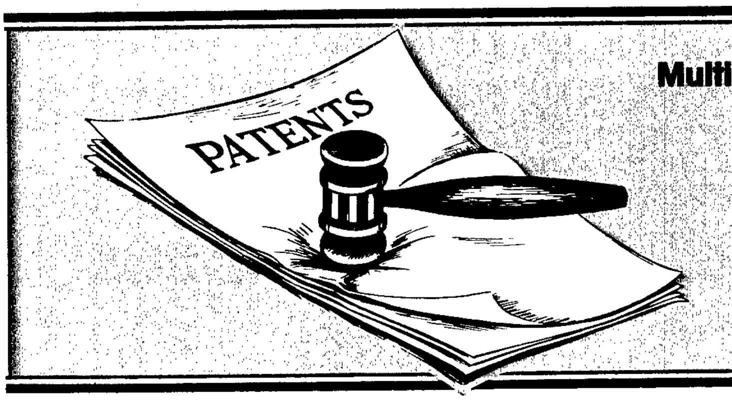
[30]Representative S.D. Fess of Ohio, speaking on H.R. 5326, 4 July 1917; *Congressional Record*, LV, pp. 5123-5124.

[31]Capt Paul W. Beck to Chief Signal Officer, 7 Mar 1911, RG 111, Gen. Corresp. 1889-1917, #25857-20, National Archives, Washington, D.C.; letterhead, Burgess-Curtiss Co., 1913, at ibid., #32984. Despite the Burgess-Curtiss claim of a license, the Wrights asserted in Feb 1914 that any aircraft delivered to the Army after Jan 1913 were infringement upon their patents. Orville Wright to Lt Colonel Reber, 4 Feb 1914, in MacFarland, ed., *Wright Papers*, II, pp. 1075-1076.

[32]Wright Company to Lt Colonel Reber, 11 Feb 1914, RG 111, Gen. Corresp. 1889-1917, #34523, National Archives, Washington, D.C.

[33]Kelly, *Wright Brothers*, pp. 269-271, 282, 285-286.

[34]"Aeronautics: Patents, Monopolies, Aircraft Manufacturers' Cross-Licensing Agreements," *Air Law Review*, VII (1936), pp. 98-115, at pp. 98-99, 104; Eubank, "Aeronautical Patent Law," *Dickinson Law Review*, LVI, p. 149; Kelly, *Wright Brothers*, p. 296; Hatch, *Glenn Curtiss*, pp. 252-253; Studer, *Sky Storming Yankee*, p. 325; MacFarland, ed., *Wright Papers*, II, p. 1098.



Multinational Weapon Development Policy and Patent Law, an Historical Note

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In any future war, it would be preferable for the United States (US) and its allies to apply their entire pool of technical resources to the joint development of improved or new weapons. But how can this cooperation be attained in view of the commercial competition that normally characterizes the relationships between these nations and their respective industries? A study of the efforts to achieve British and American cooperation in the development of nuclear weapons during World War II makes it clear that postwar business considerations must be removed from joint weapon development through an international agreement in which each contributing nation grants to the other participating nations a free privilege to the use of any domestic and foreign patent rights that relate to the joint program.

The failure of Britain and the US to enter royalty-free patent cross-licensing early in World War II blocked cooperation and caused duplicate efforts at a most awkward time.[1] Seldom does an historical example exist that will show in such forceful terms the way in which patent rights can influence military policy.[2]

In 1940 a British group visited Washington, D.C., to engage in a free exchange of defense secrets, including uranium research findings. This initial exchange seemingly influenced British and US efforts to cooperate and appeared to be mutually beneficial to both countries.

However, a series of conflicting events had already started which would eventually obstruct Anglo-American technical cooperation. In 1939, two French scientists had begun work on different aspects of nuclear energy and, before leaving France for Britain in 1940, participated in filing (in a number of countries) part of a group of five basic patent applications.[3] The public record indicated that these applications were assigned to a French government agency. But, in the background was an additional, and legally questionable, agreement between these coinventors and a Belgian mining company, Union Miniere du Haut Katanga.

In 1941, while these two refugee Frenchmen were continuing the work which they had begun in France, the British filed four additional patent applications pertaining to their work. The British saw a need to protect their government's financial investment, especially because of the apparently dominant patent positions held by the French government and the Belgian mining company. At this point, Imperial Chemical Industries (ICI) assumed executive direction of the British nuclear program in "a way that the future interests of the British Empire in this new source of power are safeguarded."[4]

When applied to the realities of international scientific cooperation among wartime allies, the French/ICI situation was a major obstruction to genuine British and American collaboration. On the surface, it appeared the US might be developing major technology that would eventually support a monopolistic ICI exploitation of nuclear power after the war and also provide basic data for unilateral British nuclear weapon production. Consequently, the US rejected British patent cross-licensing proposals when the American efforts surpassed those of the British. It was a repeat of an earlier British action to reject several American patent cross-licensing proposals when the Americans were clearly committed to a lesser effort than the contemporary British one.

During this period, though, commitment to a free exchange and the amount of national investment were not crucial to cooperation at the top levels of the British and American governments. On at least two separate occasions before the end of 1942, President Franklin D. Roosevelt and Prime Minister Winston S. Churchill agreed to a free exchange of nuclear information. However, this movement toward genuine cooperation was abruptly terminated on 27 December 1942 when President Roosevelt learned of an Anglo-Russian agreement which provided for a British and Soviet exchange of new weapons technology. Unquestionably, this agreement could endanger the security of any nuclear weapon technology the US might disclose to the British. The US was not ready to share information with Stalin and the Soviets.

These two problems—military security and postwar commercial rights–were settled, at least with respect to British, American, and Canadian interests by the "Quebec Agreement,"[5] signed by Roosevelt and Churchill on 19 August 1943. A subsequent patent arrangement, adopted in September 1944, implemented this agreement and essentially made each of the participating governments a trustee for the patent rights of the others, subject to a final postwar settlement.

This temporary solution remained in effect until 24 September 1956 when it was supplanted by a "Tripartite Agreement"[6] under which the US, British, and Canadian governments transferred to each other all patents owned within each country. This transfer was subject to an irrevocable, nonexclusive, royalty-free patent cross-license in favor of the transferring government and release from all claims for compensation.

In retrospect, adoption of this royalty-free cross-license early in the war probably would have promoted an exchange of information and would have hastened the development of nuclear weapons for the US. Thus, it would seem royalty-free cross-licensing is the most practical mechanism for resolving the industrial property questions asked in the course of a wartime multinational weapons development program.

Nations, in time of war, have one major objective—national survival. Patent royalties are business considerations that actually interfere with this achievement. Accordingly, participants in future multinational weapons development programs should carefully consider royalty-free cross-licensing as a basis for mutual cooperation, in spite of any disparities which might exist in the relative national contributions to the program in question.

Notes

[1]The different national viewpoints characterizing these early programs provide interesting reading. In this connection, the following books are most instructive: United States—*Atomic Energy for Military Purposes* by Henry DeWolf Smyth, Princeton, Princeton University Press, 1948 (editions published after 1 November 1945 carry statements issued by the British and Canadian Information Services) and *The New World 1939 - 1946* by Richard G. Hewlet and Oscar E. Anderson, Jr., University Park, Pennsylvania, The Pennsylvania State University Press, 1962. British—*Britain and Atomic Energy 1939 - 1945* by Margaret Gowing, London, Macmillan and Company Ltd., 1964. Canada—*Canada's Nuclear Story* by Wilfred Eggleston, Clark, Irwin & Company Ltd., Toronto, 1964. Soviet Union—*Atomic Energy In The Soviet Union* by Arnold Kramish, Stanford, California, Stanford University Press, 1949. Pages 55 and 56 of Kramish summarize the Japanese effort, while materials relating to the French contribution are perhaps best treated in World and Gowing. Germany—*The German Atomic Bomb* by David Irving, New York, Simon and Schuster, 1967. All of the material in this paper has been taken from these sources, except where noted.

[2]With the possible exception of some international industrial property rights difficulties that matured from military aircraft and tank production during World War I and the production of the Bofors 40-mm antiaircraft gun during World War II [*cf.* 87 United States Patent Quarterly (USPQ) 63 and 91 USPQ 285], the diplomatic problems caused by patents and "know-how" in the nuclear technologies seem to be without an earlier precedent.

[3]In spite of the strict security imposed on nuclear weapons development during and after World War II, it is interesting to note in passing that basic concepts in this technology were available throughout this time in a number of published patents as a consequence of the French program. Attention in this respect is invited, illustratively, to Swiss Patent No. 233,011, published 2 October 1944, and Australian Patent No. 114,150 (complete specification open to inspection 2 May 1940). Published patents and patent applications, in view of the foregoing experience, may enjoy some value as a source of technical intelligence information.

[4]Appendix vii to M.A.U.D. Report dated July 1941. Reprinted in Gowing, page 435 et seq., op. cit.

[5]Titled "Articles of Agreement Governing collaboration between the authorities of the USA and the UK in the matter of Tube Alloys" (Tube Alloy was a British-coined code term for military nuclear research). The problems that the basic United States patent applications owned by the French Government caused were eventually resolved through an abandonment of these applications and compensation payment to the French Government.

[6]"Agreement Between the Government of the United States of America, the Government of the United Kingdom of Great Britain and Northern Ireland, and the Government of Canada as to the Disposition of Rights in Atomic Energy Inventions." Reprinted in *CCH Atomic Energy Law Reports*, Paragraph 4852 to Paragraph 4857, pages 10,702 and 10,704.

Item of Interest

Au Revoir

To Our Readers:

I have enjoyed being your editor for the past 42 months, and I thank you for your support and enthusiasm. Perhaps each of you will now help carry the torch of professional enlightenment which began in this Journal when Generals Minter and Poe established it in 1979. Indeed, we are duty bound not only to do our jobs as technicians and specialists but also to hone our professional thinking to a razor's edge. Sometimes there is not much time for that, but your journal does give you an excuse for reflection. To that end, I have tried to make the Journal the professional sharpening strap for you.

With all the metaphors out of the way, please let me introduce your new editor, Lt Colonel David C. Rutenberg. Dave has most recently been prime mover of the logistics curricula at the Air Command and Staff College. He has extensive contacts in the logistics community and is keenly aware of the broad spectrum of logistics issues. Be assured he has already proven his mettle as a writer and comes highly recommended.

In my advice to Dave, I urged him to continue to expand our circulation and our exposure to active, working logisticians. In order to continue to succeed, the dynamics of the Journal must continue; it must be written for, read, and discussed. Our goal is worthy—you must provide the means. Success will indeed be sweet.

Cheers

Ted Kluz

"It is called the Army of the Potomac but it is only McClellan's bodyguard. . . . If McClellan is not using the army, I should like to borrow it for a while."

Abraham Lincoln
Washington DC
9 April 1862

USAF Logistics Policy Insight

Logistics Excellence Program

HQ USAF has approved a two-year test program (Logistics Excellence Program) at Ogden ALC, two MAC C-130 bases (Little Rock and Pope AFBs), and two TAC F-16 bases (Shaw and Hill AFBs). This program will focus on supply and maintenance management. Its purpose is to improve weapon system support by encouraging innovative ideas and providing waivers to policy, regulations, and technical orders which prohibit or inhibit efficient use of resources by field personnel. The Model Installation Program has been successful in employing this concept in the installation management area.

Campaign Wastebuster

An Air Staff Tiger Team recently recommended policy changes to encourage people to retain and reuse serviceable government property which otherwise is discarded or thrown away. For example, the team discovered turn-in procedures were cumbersome and contributed to the disposal of nonrecoverable items as trash. The new policy established simple procedures with multiple locations for property turn-ins as close to the customer as possible. Customer paperwork requirements were drastically reduced and in some cases eliminated. Another problem was associated with the term "expendable/throwaway" on XB3 items, which led to a false perception that these items could not and need not be reclaimed, returned, reused, or repaired. All references to "throwaway" have been deleted. AFR 67-23, *Standard Base Supply Customer's Guide,* was revised to include easily understood definitions of XB3 items and emphasize a common sense approach to their use and disposal. A full-scale publicity effort (Campaign Wastebuster) with new logos will soon advertise all the policy changes.

Support Capability of WRSK/BLSS

During the last year, major policy changes have been implemented which have greatly increased the range, depth, and combat support capability of war readiness spares kit/base-level self-sufficiency spares (WRSK/BLSS):

(1) Changed the Direct Support Objective from five aircraft not mission capable supply (NMCS) per 24PAA at the end of 30 days to four aircraft; i.e., WRSK/BLSS are now built to support a mission capable rate of 84% versus the present 79%.

(2) Changed from using a standard two-day repair cycle time in wartime to using peacetime actual repair times capped at a maximum of six days. This should be more reflective of maintenance throughout capability in a contingency.

(3) Changed the expendable (EOQ) portion of the WRSK from 30 to 60 days. This was done in recognition of increased wartime pipeline times and the time loss inherent in establishing routine resupply lines for bits and pieces.

Peacetime Operating Stock Enhancement Programs

Two peacetime operating stock enhancement programs have been implemented to provide better spares support for strategic bomber units and for tactical aircraft exercise deployments. SIOP Additive Spares Support (SASS) packages were laid in at FB-111, B-52H, and some B-52G units. Consisting of high failure critical items, the purpose of these packages is to maximize strategic bomber generation capability. Weapons Training Detachment Operating Spares (WTDOS) were procured to support tactical training deployments at various ranges in the continental United States (CONUS) and overseas. The goal was to reduce peacetime deployment and usage of war reserve materiel (WRM) spares packages while maximizing sortie generation during the deployment window. Currently, WTDOS packages have been laid in at five locations in USAFE, two in PACAF, and two in TAC.

CEMAS Standard Support System for CE

System testing completed at Tinker AFB shows materiel response time better than any support system used today. The total civil engineering (CE) inventory can now be managed through the ability to automate bills of materiel, document all transactions, and automatically issue residual assets when requirements are submitted. The Civil Engineering Materiel Acquisition System (CEMAS) has greatly increased responsiveness and enables management to deter fraud, waste, and abuse. Interfaces are planned with base supply and the new base contracting automated system (BCAS). Training, documentation, and other program requirements are being supported by an Air Staff/MAJCOM/base working group concept. The Air Force Logistics Management Center (AFLMC/LGS) has provided an innovative stockage/reorder program. The goal of this HQ USAF/LEE/LEY/RDC project is to implement CEMAS as the standard support system for CE, beginning in FY86.

Proposed Investment/Expense Policy Change

Do you need more Base Procured Investment Equipment (BPIE) funds for items that cost more than $3,000 and are locally procured? If so, help may be on the way if Congress approves a proposed Investment/Expense policy change for FY86. The tri-service agreement proposes transferring the source of BPIE funding from the 3080 appropriation to the Operations and Maintenance (O&M) account. This change will eliminate the arbitrary cost guidelines and provide the commander with the flexiblity needed to make the most cost-effective decisions.

Deactivation of Titan II Missile System

As deactivation of the Titan II missile system progresses, the Air Force continues to work for the maximum retention of the launch vehicles' hypergolic propellants. The intent is to store and reuse all the fuel mix on Titan because of its value and to support the President's National Security Decision Directive Number 94, Commercialization of Expendable Launch Vehicles. Assuming some of the Titan II boosters are used for commercial purposes by the private sector, resale of the propellants will help offset previous and future propellant acquisition costs. In conjunction with that policy, the Air Force has two military construction projects to build hypergolic storage at Vandenberg AFB and Cape Canaveral. Both projects are progressing and should permit complete containment of the fuel mix from Titan II.

" Air Base Ground Defense

In 1981, the Air Force became responsible for the ground defense of its bases and expanded the wartime tasking of security police units to include highly mobile combat vehicles, heavier weapons, and specialized training. Currently, the Air Force does not have the capability to accomplish the air base ground defense mission, leaving its air bases in Europe and Korea highly vulnerable to enemy special operations forces armed with close-in and stand-off weapons."

" Strategic and Tactical Airlift

U.S. military strategy and war plans depend on strategic airlift for rapid augmentation of theater forces at the onset of hostilities. Commanders agree that lacking the required airlift, U.S. forces in Europe and Korea cannot sustain combat operations in the execution of war plans. Existing strategic airlift limitations cannot support deployment objectives in Europe due to shortfalls. . . . "

A Report to the Committee on Appropriations, U.S. House of Representatives, Surveys and Investigations Staff, March 1983.

Variability of Demand: Why the Part is Never on the Shelf

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Introduction

Many times a customer wonders why a part is not available when it is most needed. As a conscientious customer of base supply, he exercises good supply discipline, attends all the training classes, and heeds supply's advice. Yet the part used regularly is frequently out of stock. Why can't the system provide the needed support? Because some assumptions of the current standard base supply system (SBSS) inventory leveling models are no longer (if indeed they ever were) valid.

The Air Force Logistics Management Center (AFLMC) is taking a top-to-bottom look at the current Air Force inventory models and challenging each of the assumptions. This article will highlight one method—the current system's estimate of demand variability. We will first explain the current SBSS and its estimate of the variance of demand. Then we will explain the impact of the method and conduct a data analysis to test its applicability to today's demand patterns. Finally, we will show how we can fix the current system and the benefits that accrue from correctly measuring demand variability.

Standard Base Supply System

We limited this article to inventory models for Air Force consumable or economic order quantity (EOQ) items. EOQ items are the relatively low dollar value, fast-moving items that comprise 64% of the transactions at base level and better than $7 billion of Air Force requirements.[1] Stocking EOQ items is big business and these items should be managed both *effectively* and *efficiently*.

The current system computes a demand level for each item that consists of two elements: an operating level and a reorder point. The operating level is the most economical amount of stock needed to perform the day-to-day mission and is also the Wilson EOQ based on a one-year demand forecast. The equation for the operating level for nonlocal purchase items is:[2]

$$\text{Operating Level} = 8.3\ \sqrt{\frac{\text{Daily Demand Rate} \times 365 \quad \times \text{Unit Price}}{\text{Unit Price}}} \qquad (1)$$

The operating level for local purchase items is the same as (1) except that 8.3 is replaced by 16.3 because of the higher local purchase cost to order expense.

The reorder point is the amount of stock necessary to support demand during the replenishment cycle, which is the time transpiring between when an order is placed and when it is received. The reorder point consists of two elements: the order and shipping time quantity (O&STQ) and the safety level quantity (SLQ). The O&STQ is the amount of stock necessary to support demand during an average lead time:[3]

$$\text{O\&STQ} = \text{Daily Demand Rate} \times \text{Average Order and Shipping Time} \qquad (2)$$

The SLQ is an estimate of the standard deviation of demand during the order and shipping time (O&ST). The standard deviation is the square root to the variance. The equation is:[4]

$$\text{SLQ} = \sqrt{3\ (\text{O\&STQ})} \qquad (3)$$

The safety level is multiplied by a C factor, which is used to set the percentage of time a customer order should be filled during the replenishment cycle. The percentages are shown in Table 1.[5]

C FACTOR PERCENTAGES

C Factor	Percentage
1	84
2	97
3	99

Table 1.

Figure 1, which depicts two hypothetical demand distributions, illustrates the concept of the O&STQ and the SLQ.

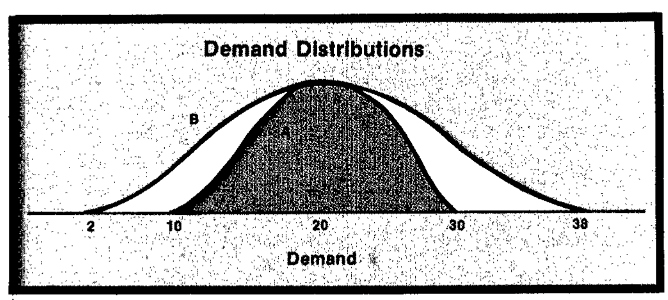

Figure 1.

This figure shows the distribution for the amount of demand over a 30-day O&ST. Thus, for the interior distribution (item A), the smallest number of units ordered in 30 days is 10 and the largest is 30. The most typical and average demand is 20. For the larger distribution (item B), the smallest demand is 2 and the largest is 38. Again, the average demand in 30 days is 20. The current system computes identical reorder points for both items. The O&STQ is the average demand during an O&ST, which in this case is 20. The SLQ can be computed using (3) and is 8 (Figure 2).

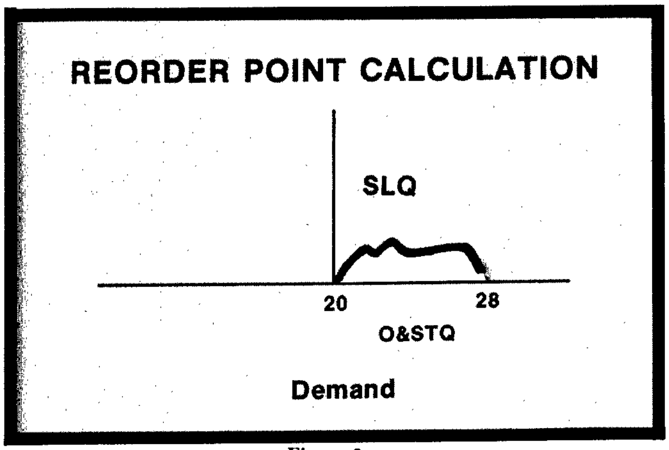

Figure 2.

Figure 3 illustrates the impact of computing the reorder point for item A. Note that 84% of the time demand is less than or equal to 28, thus the current system accurately stocks item A. Figure 4 illustrates the impact for item B. In this case, only 60% of the time demand is less than 28. Thus, up to 40% of the time, a stockout, and perhaps a grounding incident, will occur. The difference between the two demand distributions is the variability of demand. Item B was much more variable than item A; therefore, more stock is necessary to ensure 84% of the time sufficient stock is available to support demand during the replenishment cycle.

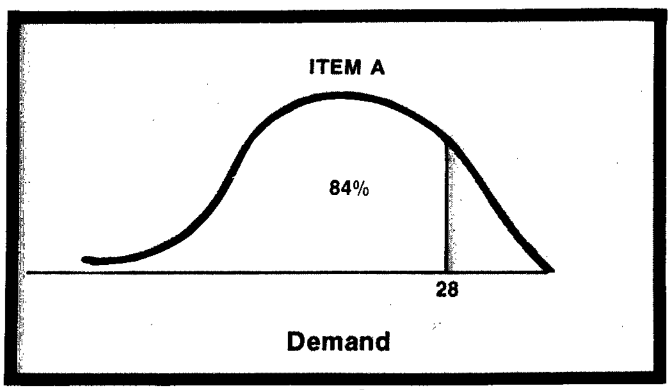

Figure 3.

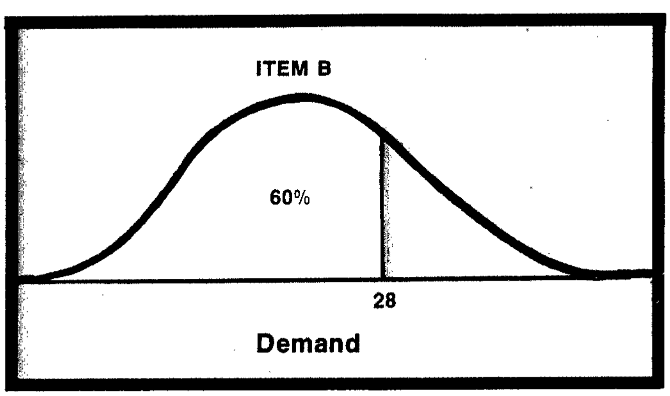

Figure 4.

Data Analysis

The current system assumes that the variance of demand during an O&ST is three times average demand. Thus, the current systems assume a variance-to-mean ratio (VMR) of 3.

We examined the actual average VMR ratio for EOQ items at five AF bases (Table 2). Note the average VMR is significantly higher than 3. To illustrate this further, Figure 5 shows a frequency diagram for the VMR at Little Rock, which is representative of all the bases examined. The figure also shows that the current system provides an accurate estimate for fewer than 57% of the Air Force consumable items. THE CURRENT SYSTEM DOES NOT ACCURATELY MEASURE DEMAND VARIABILITY WHICH RESULTS IN INEFFECTIVE STOCKAGE FOR OVER 40% OF AF CONSUMABLE ITEMS.

VMR

Base	Average VMR
Upper Heyford	14.2
Kunsan	27.6
Little Rock	21.7
Randolph	30.2
England	29.5

Table 2.

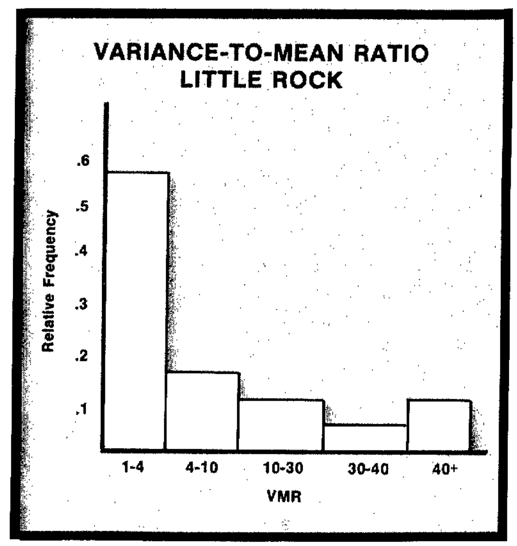

Figure 5.

Recall that in our examples for items A and B, we assumed a *fixed* 30-day O&ST. This time can vary like demand, and failure to measure that variability accurately can also result in stockouts and grounding incidents. The current system does not accurately measure demand variability, and it does not measure O&ST variability at all. Therefore, we need a system that accurately estimates both demand and O&ST variability and uses those estimates to derive an SLQ.

In order to evaluate our methods to derive accurate variability estimates, we examined items with very high VMR. We defined items with high VMR to be items with VMR greater than 100. Items with high VMR may result in a safety level quantity over twice as large as average demand during a lead time (which is the O&STQ). Before significantly increasing the amount of safety stock for these items, we examined their demand pattern. We found 34% (26 out of 75) of the items had VMR greater than 100 and for 38% (10 out of 26) of those items the safety level quantity would be considerably inflated. Table 3 shows the demand pattern for three of those items requiring a significantly large safety level.

As Table 3 also shows, the high VMRs are caused by an unusually high demand occurrence. These demands should be considered outliers, and we should not stock for these occurrences. Therefore, we should either filter out these large demands or place a ceiling on the amount of safety stock to support these items.

Stockage and Operational Performance

We tested six different methods of using demand and O&ST forecasts for computing inventory levels and compared them to the current baseline method. Table 4 describes the six methods evaluated. The methods tested are attempts to improve the current system's forecast of demand and O&ST variability.

DEMAND PATTERNS

Item	Monthly Demand Pattern 1	2	3	4	5	6	7	8	9	10	11	12	VMR
A	0	0	0	0	0	50	0	0	0	0	*326*	0	258
B	0	0	0	22	4	*504*	6	2	4	0	4	2	419
C	10	82	4	28	5	32	*395*	3	0	0	0	0	248

Table 3.

FORECASTING METHODS FOR SIMULATION

Method	Description
Regression for Variance of Demand (RVD)	This method uses the formula: Demand Variance = 3 (Average Demand)$^{1.62}$, which was found via regression.
Regression Variance of Demand and Order and Shipping Time (RVDOST)	This method uses the formula for demand variance as above and also includes the variance of O&ST in the safety level computation.
Variance of Demand (VARD)	This method computes the actual variance of demand based on historical demand data.
Variance of Demand and Order and Shipping Time (VARDO)	This is the same as the above method only it includes O&ST variance.
Variance of Demand with Ceiling (VARDC)	This is the same as the VARD method except that the safety level quantity cannot exceed (C × 2 × O&STQ).
Variance of Demand and Order and Shipping Time with Ceiling (VARDOC)	This is the same as the VARDO method except that the safety level quantity cannot exceed (C × 2 × O&STQ).

Table 4.

Table 5 shows the percent increase (or decrease) from the current system (baseline) for Kunsan Air Force Base. The table also shows the significant increase in fill rates, especially in the unit fill rates. Note that placing a ceiling on the safety level does not significantly lower the effectiveness, but it does significantly reduce cost. The reason is the high safety levels are usually caused by "unusual" demands, and these demands cannot be satisfied even if we increase the safety stock. Table 5 also provides efficiency measures; for example, the mission capability (MICAP) efficiency measure provides the percent decrease in MICAP per percent increase in on-hand inventory. Efficiency measures the amount of bang for the buck!

The results in Table 5 are representative of all bases examined. In virtually every case, the efficiency is higher for methods with a ceiling on the safety level. At one base the efficiency for methods that include O&ST variation is greater than those without O&ST variation. At all the other bases the efficiency is slightly less with the inclusion of O&ST variation. Nonetheless, there is some improvement with O&ST variability without much increase in inventory investment.

SIMULATION RESULTS
(KUNSAN)
PERCENT CHANGE OVER CURRENT SYSTEM

Category	RVD	RVDO	VARD	VARDO	VARDC	VARDOC
Line Item Fill Rate (All Items)	6.7%	8.7%	8.1%	9.4%	7.6%	8.9%
Line Item Fill Rate (Stocked Items)	7.2	9.2	8.6	10.0	8.1	9.5
Unit Fill Rate (All Items)	5.6	8.9	36.9	37.7	35.6	36.3
Unit Fill Rate (Stocked Items)	5.9	9.4	28.8	29.5	27.4	28.2
On-Hand Inventory	10.9	17.9	30.7	33.3	18.0	20.5
MICAP	0	0	−3.0	−3.0	−3.0	−3.0
Efficiency:						
MICAP % / On-Hand Inventory %	0	0	−.098	−.090	−.167	−.146
Unit Fill Rate % (Stocked Items) / On-Hand Inventory %	.541	.525	.938	.886	1.522	1.376

Table 5.

Thus, we recommend the method that accurately computes the variance of demand via:[6]

$$\text{Variance of Demand} = \frac{\Sigma\ \text{Demand}^2 - \frac{[\Sigma\ \text{Demand}]^2}{n}}{n}$$

where

Σ Demand = cumulative recurring demands,

Σ Demand² = the sum of the demands squared, and

n = number of days since date of first demand.

The variance of O&ST should also be included in the safety level via:[7]

$$\text{Safety Level} = C\sqrt{\text{O\&ST (Variance of Demand)} + (\text{DDR})^2 (\text{Variance of O\&ST})}$$

TO 22 ▶

Central America: A Socioeconomic Overview

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The contemporary crises in Central America have focused attention on the most recent manifestations of an ongoing social revolution that has been occurring in Latin America throughout most of the twentieth century. These struggles reflect the aspirations and demands of increasingly articulate middle and working classes against entrenched oligarchies. While many families in these oligarchies trace their ancestry to sixteenth-century Spanish *conquistadores,* they are more precisely a product of the Liberal Revolutions of the late nineteenth century. Central America is in many respects a microcosm of Latin America, and the history of these small city-states reveals general characteristics and trends in Latin America. The resistance of the Central American elites to social change as they tried to promote economic modernization is a prime example.

The conquest of Spanish America was a phase of the Italian and Spanish Renaissance. Beginning in 1524, *conquistadores* from Mexico, Panama, and Santo Domingo planted colonies that were soon unified into the Kingdom of Guatemala. The Europeanization of this region a century prior to the English establishment of Virginia and New England meant that significantly different concepts of society developed in Central America from those in North America. The *conquistadores* brought with them both the mentality of Spanish feudalism and the intention of their monarchs to develop incipient capitalist institutions. Indeed, much of the history of Latin America can be seen as a struggle between these two socioeconomic systems. Subsistence-oriented, feudal-style haciendas, controlling Indian and mestizo serfs, represented the feudal tradition continued by the conquistador-creole class, while agro-export plantations, dependent on European and North American markets, reflected the efforts to promote capitalist economic development.

"The population decline continued until about 1750 before it began to grow slightly through the nineteenth century and then at an alarming pace in the present century."

Existing Indian civilizations, ranging from advanced Mayas in southern Mexico, Guatemala, and Honduras, through less developed, but sedentary, tribes in El Salvador and Nicaragua, to more nomadic and primitive tribes in Costa Rica, suffered greatly. Spanish military conquest and subsequent efforts to enslave the native population decimated their numbers, but far more destructive were the biological consequences of the conquest. Epidemics of smallpox, plague, syphilis, and other European diseases killed millions, perhaps 80% to 90% of the population. The population decline continued until about 1750 before it began to grow slightly through the nineteenth century and then at an alarming pace in the present century. Table 1 reflects these demographic trends.

Except for a few enclaves of capitalist development, the isthmus produced little for export and, for the most part, followed neo-feudal, subsistence economic patterns well into the eighteenth century. Spain's rivals, however, stimulated by the industrial revolution, probed the isthmus with trade. The response of Spain's eighteenth-century Bourbon Reforms was to promote greater commercial agriculture.

ESTIMATES OF CENTRAL AMERICAN POPULATION (1500–2025)

Year	Population
1500	7,500,000
1778	805,339
1810	1,000,000
1824	1,287,491
1855	2,000,000
1915	4,915,133
1930	6,018,880
1945	8,141,493
1955	9,155,000
1965	12,515,000
1975	17,670,000
1985	24,218,000
2000	37,178,000
2025	65,113,000

NOTE: Panama not included in these estimates.

Source: R. L. Woodward, Jr., *Central America, A Nation Divided* (2nd ed., New York: Oxford University Press, 1985).

Table 1.

"Their political parties—Conservative and Liberal—reflected their fundamentally different perceptions of how best to develop the country."

This dual socioeconomic development accelerated after independence from Spain (1821) left the creole landholding and merchant elites free to dominate the five provinces. Their political parties—Conservative and Liberal—reflected their fundamentally different perceptions of how best to develop the country. Conservatives looked toward maintenance of the two-class society that had long characterized the Spanish world. They defended the prerogatives of the landholding elite in their traditionally dominant roles, but also, in *noblesse oblige* fashion, assured the peasants of a degree of protection, especially against exploitation by the Liberal modernizers. They emphasized Hispanic values and institutions, especially the Roman Catholic Church, and rewarded loyal Indian and mestizo peasants with paternalism and respect for communal lands. Their demands on the peasants were real, but limited, and subsistence agriculture was at the heart of their economic philosophy. The Conservatives relied on the Church, local chieftans, and landlords—in feudal style—for social control and to guarantee peace and security. Thus, they defended states' rights against national unity and were xenophobic toward foreigners who threatened the traditional society with Protestantism, democracy, and modernization. Sensitive to the dangers of upsetting native labor and land tenure patterns, they were essentially opposed to granting the nation's land and resources to foreign capitalists who did not share their religion, language, or social and cultural values. They succeeded in breaking apart the Central American federation (1823–40) into the independent but weak republics of Guatemala, El Salvador, Honduras, Nicaragua, and Costa Rica.

Liberals, on the other hand, represented that segment of the elite and tiny upper middle class that wished to modernize Central America through emulation of the economic and political success of western Europe and the United States (US). These "modernizers" rejected Hispanic values and institutions, especially the Church, and espoused classical economic liberalism, opposing monopolies while encouraging private foreign trade, immigration, and investment. They emphasized exports and treated the rural masses and their lands as the principal resources for exploitation. Although republican and democratic in political theory, they became much influenced by positivist materialism later in the century, and were contemptuous, even embarrassed, by the Indian heritage of their countries. Once in power, they resorted to dictatorship to accomplish their economic goals and to defend their gains. Thus, the professionalization of the military, which became their power base, was an important trend in the late nineteenth and twentieth centuries. The absence of stronger middle sectors in the traditional two-class Central American societies and the persistence of elitist attitudes toward the masses meant that in practice this development proceeded very differently than in the industrialized nations. What emerged were elite oligarchies of planters and capitalists who cynically, and without the *noblesse oblige* of their Conservative predecessors, continued to live off the labor of an oppressed rural population which shared little, if any, of the benefits of the expanded export production. On the contrary, the peasants found their subsistence threatened by encroachment on their lands for the production of export commodities.

The struggle culminated, in every Central American state between 1870 and 1895, with the victory of the Liberals, who launched bold programs of modernization, with emphasis on infrastructure and agro-exports. A few prominent families dominated this economic growth and the political power accrued with it. The rural masses gained little from the modernization and, in most cases, actually suffered a decline in their standard of living, especially as the eradication of epidemic diseases resulted in rapid population growth among these peoples without corresponding increases in real wages.

> *"A close relationship developed between the Central American Liberals and the US in business, government, and academia. . . ."*

But the increase in exports and accompanying modernization of the cities and development of transportation and other industries related to the international trade contributed to the growth of small, but significant, middle classes in the cities.

A close relationship developed between the Central American Liberals and the US in business, government, and academia, as Central Americans sought to imitate the North American development model. It was a model that brought considerable modernization, but failed to achieve the prosperity and general welfare its promoters expected. Rather, new levels of poverty and misery have come to be associated with the development process. Instead of "developing nations," these states have become dependent poor relations of an industrialized core of North Atlantic mother countries. Although coffee was a more important export for most, the banana industry, developed with US capital, shipping, and technology, came to typify the relationship, as the giant United Fruit Company in the early twentieth century controlled Central American rail, steamship, and radio communications as well as banana production.

The elites began to send their children to school in the US, rather than to Europe. They often returned with spouses who brought North American values directly into the social structure of the isthmus, blending more modern attitudes with traditional Hispanic values. These elites were part of an international capitalist upper class and had less and less in common with the working masses of their own countries. The Liberals imitated US political forms, if not realities, and the terminology of North American democracy filled the Liberal rhetoric. They rewrote the Central American constitutions to conform more closely to the US Constitution of 1789, although in practice Central American chief executives retained more authority than their US counterparts. US embassies became inordinately large for such tiny countries, and basic economic and political decisions for these states were often made within US embassy walls. Military missions provided significant assistance toward the maintenance of the Liberal dictatorships through the training of national internal security forces.

The oligarchies jealously guarded their economic and political power, refusing to share it with the emerging middle classes. Denied access to power through constitutional means, for elections were almost always rigged in favor of the oligarchies or their military surrogates, new political factions representing the middle and working classes turned to revolution to bring about reform.

Serious challenges to the oligarchies began during the 1920s as more modern political parties began to emerge, supported especially among the university communities and urban labor, as well as by progressive elements within the military. More recently, the Church has supported the challenge to the oligarchies. While the details vary from state to state, these parties ranged from moderate Christian Democratic or Social Democratic to Marxist-Leninist, but the neo-Liberal dictatorships branded all opposition as "communist." Only Costa Rica successfully made the transition from elite rule to social democracy. The old Liberal Parties gradually succumbed to these more modern pressures in Guatemala, El Salvador, and Honduras, but the military and elite establishments jealously retained power, increasingly by force against the popular will. The military became the power base and, in time, a political force on its own behalf.

In broad historic terms, much of Central America is still involved in replacing the vestiges of Spanish feudalism with capitalism. The failure to mitigate some of the harsher economic and social consequences of this shift has encouraged the rise of Marxist and other modern anticapitalist forces. Recent research has revealed that in terms of the amount of corn that a day's wages could buy, rural Central American real wages dropped steadily from the 1850s through the mid-twentieth century. By the 1970s malnutrition was widespread. El Salvador compared with Bangladesh as among the most poorly nourished and land-poor countries in the world. While it is true that this was done in collaboration with native elites, foreign capitalists have been active, if sometimes naive, partners in brutally keeping wages low, suppressing labor unions, and resisting participation in government by the working masses. This paradoxical trend of greater economic development being accompanied by greater poverty accelerated rapidly after World War II, with the Alliance for Progress, the Common Market, and industrialization. Unlike North America or western Europe, in Central America capitalism developed relatively unchecked by the pressure of organized labor or social justice movements such as Populism, Progressivism, or the New Deal in the US.

More modern parties emerged first in Costa Rica, where the elitist Liberals and Conservatives were never so firmly entrenched as in the other states. Costa Rica became the model social democracy in twentieth-century Latin America.

In Guatemala a middle-class oriented revolution ended 73 years of Liberal domination in 1944. Philosopher-President Juan José Arévalo launched a sweeping social revolution the following year, incorporating many features of the Mexican Revolution, and encouraging the labor unions in the political and economic life of the country. His successor, Jacobo Arbenz, carried the revolution further to the left, inaugurating a major land reform program that challenged the United Fruit Company's hegemony and led to the 1954 US-supported overthrow of the Revolution by Guatemalan neo-Liberals. Guatemala has been under right-wing control ever since.

In El Salvador, students, workers, and progressive military officers also overthrew the Liberals in 1944 and formed the basis of more effective middle-class participation in politics. In El Salvador, however, the compact coffee oligarchy—the so-called "14 families"—kept control and through the military were able to prevent their state from pursuing the reformist route of either Costa Rica or Guatemala. The Salvadoran elite had reacted savagely to "save the country from communism" in a 1932 peasant uprising, when the army massacred an estimated 10,000 to 30,000 peasants. Yet labor and student organization advanced and, with Catholic liberation theology organizations (Christian Base Communities), became important in mobilizing popular opposition to the oligarchy. After José Napoleón Duarte's Christian Democratic Party apparently won the election of 1972 but was denied office, the country was plunged into a civil war which continues to the present day. The 1979 coup brought more progressive forces to the government, including Duarte in 1980. His election to the presidency in 1984 promised continued moderate efforts to challenge the old order, but his government faced violent opposition from both the Right and the Left which will have to be stopped if he is to succeed.

> *"While certain segments of the middle class have embraced neoliberalism, others, along with working class representatives, have risen to challenge it. . . ."*

Meanwhile, in Nicaragua the last Liberal Party dictatorship was overthrown in a massive popular uprising in 1979. The Sandinista Front for National Liberation led this struggle and seized power following the fall of the Somoza dynasty. Dedicated to a thoroughgoing Marxist-oriented revolution, the Sandinistas aligned themselves with Cuba and the Soviet Union in an effort to prevent the sort of intervention which had cut short the Guatemalan and Chilean socialist experiments, while at the same time allowing private interests to remain and participate in the development of their social democratic state. In Nicaragua, the challenge to classical liberalism caused polarization beyond that state and made Central America a focus of East-West confrontation.

Contemporary Central America reflects the persistence of nineteenth-century Liberalism, conservative by today's definitions, among Central American elites, along with the inevitable rise of more modern, middle-class elements against it. While certain segments of the middle class have embraced neoliberalism, others, along with working class representatives, have risen to challenge it, with the inevitable clashes of working class versus capitalist interests becoming important in Central American politics. The principal failure of liberalism and capitalism in Central America has been its neglect to reward labor with adequate wages, so the prosperity could become more general and expand in a healthy manner. Especially in agriculture, but also in the capital intensive new industries promoted by the Common Market, labor has not received a fair share of the gains, and this has retarded development of a stronger consumer-based economy. This continued repression of labor has deprived most Central Americans of better standards of living and a more participatory role in their governments.

Editor's Note: This is the second in our series of articles designed to broaden logisticians' understanding of the international scene. The first, on Islam, drew much more positive commentary than we had ever expected. We hope you enjoyed this one as well.

"Nobody dislikes war more than warriors, but we value the causes of peace so highly that we will not duck a war in an effort to get a lasting peace."

Gen Daniel "Chappie" James
1977

Over the Horizon: More Push or More Pull?

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Introduction

We are rapidly approaching a crossroads in requirements policy, and I believe it is now time to consider and evaluate some necessary conceptual changes. More and more, key senior logisticians rely on data and computer simulation models to accurately project the logistics needs of wartime units. The logical extension of a reliance on this new-found technology will lead to a wartime supply system solely designed to push stocks to bases in anticipation of actual need. That may not be the best alternative.

The predicted efficiency and overall effectiveness of such automated systems have understandably led to increased interest and greater emphasis toward the development of further forecasting networks. However, there are some difficult issues that must be faced prior to the full-scale development of these systems, by necessity highly centralized and automated. In this paper, I will explore past and present supply systems and the current direction of wartime supply processes. I will also discuss the resource requirements of wartime supply systems and evaluate these systems against the real wartime environment. In the process, we will find that a centralized, highly automated system may not actually provide the best real support to wartime units.

Where Are We?

The support philosophy for wartime requirements arises from an evaluation of the performance of two types of approaches. The first approach is called the "pull" system. Under this concept, resources in wartime are forwarded to using bases only when demanded. The wartime base, in other words, pulls assets to sustain operations. The second approach is the "push" system. Using this system, resources are supplied in wartime *in anticipation* of the level of need. The depot activities push crucial stocks which they estimate will be needed at some future date. The application of these concepts can also take the form of special hybrid systems that occur when some resources are pulled while others are pushed. The emphasis between the two approaches can be determined by Air Force senior logisticians. Some assets may actually be pushed initially until a certain time at which point the pull system takes over.

Historically, Air Force and its predecessor, the Air Corps, have employed both techniques. Early in World War II, a pull system was used. When, as expected, the pull system fell behind demand, a push system was quickly improvised to provide enough resources to sustain and support the increasingly larger forces of the allies. Korea presented similar problems, and the Air Force devised similar solutions. At the end of the conflict, the push system was still in effect.

With the increasing intensity of hostilities in Vietnam, the Air Force initiated Project BITTERWINE (a push system) to provide the massive amounts of supplies required to support rapidly growing United States (US) commitments. After that initial build-up, the Air Force reverted to a pull system which was then relatively successful through the conclusion of the conflict. In a postwar examination of Vietnam logistics support, we concluded that the pull system was, by far, the most effective method of supporting air forces.

Today, military planners are looking much harder at using highly centralized and automated wartime supply networks. A centralized push system offers some attractive opportunities for headquarters personnel to oversee the system and respond to support glitches. A highly efficient push system could, ideally, provide needed supplies to the wartime unit just prior to the time of actual need. Indeed, there are several prominent "logisticians" who actively advocate the use of an automated "push" network as the solution to the vagaries of wartime supply.

Since we have, and can use, the fairly recent example of Vietnam, the question we should ask is: Why are we again turning toward a push system? The advent of several significant computer models which purport to describe the logistics process, coupled with more elaborate and complete logistics data bases, has encouraged this development. If we know what each unit has, what the failure rates are, and what the operational demands are, then we can surely and simply project the demands of a wartime unit.

While there are some obvious efficiencies associated with a push system, the real virtue of any such approach lies in its success in meeting resource demands and whether or not it adds to mission effectiveness. In the remainder of this paper, these two measures of success (efficiency and effectiveness) will be developed.

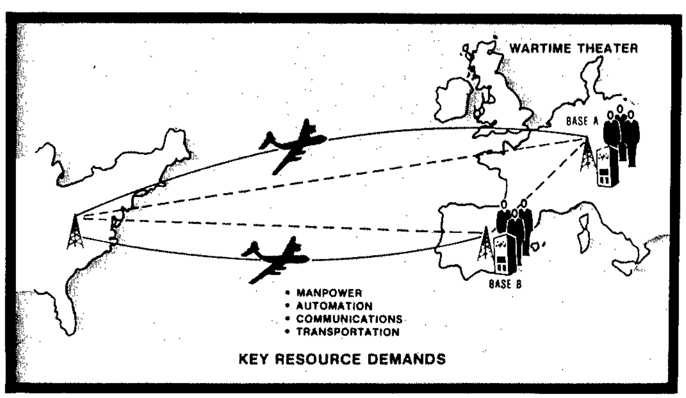

Figure 1.

Resource Demands

Each of the two types of distribution techniques (push and pull) presents certain structural demands in addition to espoused strengths. Some discussion of these demands will then provide a means of evaluating the relative worth of each technique.

The resources required to run any requirements system fall into four major categories (Figure 1). (NOTE: These resource requirements originate regardless of the potential benefits of any system. No requirements system is "free"; there are costs associated with each technique. In the two cases discussed, both require a certain level of commitment in all four areas.)

(1) **MANPOWER:** Both the push and the pull systems demand manpower at the point of receipt of stocks (the wartime base). The push system demands a number of people to handle the rapid influx of resources. The push system, by its very nature, will provide more stocks than are immediately necessary and maldistribute some stocks. People, therefore, are necessary to process the useful stocks and manage the excesses and maldistributed stocks.

The pull system makes similar manpower demands. In this instance, people are essential to manage the necessary leveling process. The pull system can operate effectively only with careful management of stock levels at the using wartime base. Because the base receives only what is demanded, there are fewer excesses and less demand on warehousing and receiving personnel.

(2) **AUTOMATION:** Bases in wartime will require much data processing resources regardless of the system employed. The uses for that data, however, will be somewhat different. The push system presents the wartime air base with two immediate automation demands. The first demand results from the need for automated means of tracking assets and maintaining some sort of visibility over them. Otherwise, base-level accounts could be faced with nonoperational aircraft. The second automation demand results when there is a demand for some assets not currently forecast under the push system. The fighting base must have some means for accumulating information on those assets for which there is no anticipated wartime demand.

The pull system requires automation in much the same manner as the push system. Automation is essential to track assets and to collect demand information. From this data collection effort, however, the pull system identifies quantifiable stock levels required to sustain wartime activities. These levels are forwarded to the wholesale activity for replenishment. The pull system, then, collects the same type of information, but it performs the function of level determination.

(3) **COMMUNICATIONS:** The absolute requirement for near-perfect communications in the war zone has long been emphasized. Usually forgotten, however, is the fact the push system requires the same sophistication in communications as does the pull system. Unanticipated requirements must be "communicated" to the wholesale level for action. Thus, push is in reality no "safer" than pull. In addition, consumption information must move to the wholesale item and system managers to update their projected wartime shipment requirements.

The pull system will probably make a larger demand, overall, on communications nets due to the sheer VOLUME of transactions. The same sophistication of communications is necessary. However, because all demands are satisfied through the communication of specific needs with the wholesale item and system managers, more communications are necessary under the push system.

(4) **TRANSPORTATION:** In this category, the push system will probably make greater demands than the pull system. The push system projects anticipated demands and ships accordingly. One of the most often observed weaknesses of the push system is its propensity to maldistribute stocks. That is, wartime demand may not live up to the best of push system expectations. As a result, to compensate for shortage, the transportation system must ship into a theater more stocks than necessary and then commit additional resources to redistribute them.

The pull system, conversely, draws assets into the theater to respond to specific and identified needs. The transportation network is called upon to ship resources only to those wartime bases that have legitimate demands for the resources.

SUMMARY: Whichever system is ultimately accepted, the resource demands are very similar. There are no real cost savings associated with one over the other. It is the wartime environment that ultimately makes one better suited to support and sustain wartime activities.

Wartime Effectiveness

Clausewitz pointed out that everything in war is simple. However, even the simplest thing is extremely difficult. In evaluating or adopting any resupply technique, Clausewitz's words must be remembered. Any system must be capable of adapting successfully to the inherently messy and erratic conditions caused by the frictions of war. Particular concerns to any wartime supply approach are the erratic demand patterns, questionable distribution capabilities, and uncertain communications links. Each pattern can materially affect the ability of a requirements system to respond to wartime needs.

(1) **ERRATIC DEMAND PATTERNS:** Erratic demand patterns threaten to pose a significant problem to any push requirements system. We do not really have a good grasp of what wartime demand will involve. For instance, will demand escalate according to increased flying activity? The answer is probably yes and no. Some requests will increase, while other systems will demand less. The problem facing logisticians is that we really do not know which systems will respond and in which direction. War increases this complexity by adding other variables. How, for instance, do you deal with battle damaged aircraft? We most probably will have some aircraft damaged in combat. In addition, the air base itself may be subject to attack. Finally, other related issues, such as the compromise of maintenance capabilities, further complicate the picture of requirements support. The wartime supply system, however, must be capable of responding to any unexpected changes in demand.

The two methods of resupplying wartime units respond differently to this problem. The pull system reacts to the situation as it changes. Levels are set and demands are placed to support identifiable needs. The push system may very well guess wrong. In such cases, the wartime unit must record demands in much the same manner as under the pull system. For assets which are in short supply, the push system may send these critical parts to units that do not need them. This, in turn, places added demands on the distribution network.

(2) **QUESTIONABLE DISTRIBUTION CAPABILITIES:** The distribution system in any future conflict may prove erratic or, at best, irregular. Port capacity is a continual

headache for logistics planners. Many areas where potential conflicts may occur have limited—even primitive—port facilities. The distribution infrastructure of the host nation may be little better. Highways and railroads are limited in many areas of the world. The issue for logistics planners, then, is how to process limited quantities of resources that meet basic military needs without exceeding port and infrastructure capacity. Clearly, the wartime supply system will exert itself heavily on distribution, and we must look carefully at the realities of "throughput," or how we get something to where it is needed.

Again, the two systems react differently against this wartime reality. The push system, in its attempt to support forces accurately and adequately, may overwhelm limited port facilities. In addition, the need to redistribute assets within the theater may place significant burdens on the distribution system. The pull system limits redistribution within the theater and is less likely to overwhelm limited distribution channels. Basically, the pull system demands fewer assets than a push system because we only react to actual demand rather than attempt to anticipate all potential needs.

(3) **UNCERTAIN COMMUNICATIONS LINKS:** Communications is increasingly recognized as a limitation to military operations in foreign lands. For many areas, the communications links will be uncertain. For other contingencies, communications may be disrupted for prolonged periods of time. A wartime resupply system falls somewhere on the lower end of priorities to the communications links. Operations command and control systems will probably consume a great deal of communications resources. A resupply network must recognize there will be limited access to communicate logistical requirements. Both push and pull resupply concepts demand some communications. A strong, central push system, however, demands a great deal more information to function properly. Ideally, such a system should know what has failed and when. The central push managers could then project future demands and requirements. A pull system would require less in the communications arena and provide some added flexibility. This system would not need to report all demands. Rather, the wartime unit would locally accumulate demands and request stocks sufficient to support local levels. This information could be transmitted and accepted into the logistics system in a number of ways. Orders could be handwritten or transmitted over the available communications networks. A push system provides less flexibility in this area.

Conclusion

We have, as a nation, operated under a fundamentally erroneous logistics principle for a long time. "Fustest with the mostest" applies well when talking of armed conflict. Certainly, he who has a preponderance of strength is in a better position to impose his will on his enemy. However, logistically, the principle must be revised to state "the needed amount at the place and time required."

This article has not been designed to advocate one system over another, but to place the discussions about resupply techniques in a proper context. Both push and pull demand much the same resources. There is no particular monetary savings associated with one system over the other. However, the wartime environment will always favor the more efficient and effective system, for that system will promise the best probability for success. At present, the pull system offers the best payoff; the push system offers some substantial benefits but at a cost in flexibility. Much more analytical work on the push technique is essential before any permanent movement toward this form of support system is taken.

We live in a world of limits. It is nice to think of providing ample stocks well in advance of need. However, a number of factors may preclude doing that. A wartime resupply system must recognize the realities of war as well as the costs of employing any effective system.

Item of Interest

Stockage Policy Videotape

The Air Force Logistics Management Center (AFLMC) developed a videotape to explain the recently implemented Air Force stockage policy changes to the standard base supply system (SBSS), which include revising the safety level, increasing the quantity to order, extending the excess retention period, and establishing an operating level for field level reparable items. These changes will increase the level of stock for consumables and field reparable items, thereby increasing the fill rate by 10% to 14%. More importantly, they will increase the Air Force's mission capability and will result in an increase of 2.5 million aircraft mission capable hours. The videotape also explains to base level supply managers the theory behind the changes and how they will affect them. Lieutenant General Leo Marquez, Deputy Chief of Staff, Logistics and Engineering (HQ USAF/LE), and Brigadier General Richard L. Stoner, Director of Maintenance and Supply (HQ USAF/LEY), introduce the tape. (Copies of the videotape can be obtained through the Base Audio Visual Office by ordering under the number SAVPIN #602068.)

"Winning is overemphasized. The only time it is really important is in surgery and war."

Dr. Laurence J. Peter in
Peter's Quotations

CAREER AND PERSONNEL INFORMATION

Civilian Career Management

Logistics Civilian Career Enhancement Program (LCCEP)

One of the primary goals of the LCCEP is to encourage logisticians to attain their fullest career potential. To this end, LCCEP Program Administrators devote much of their time to provide valuable information to the members. This article, in conjunction with our Summer 1984 article in the *AFJL*, will help in planning an individual's career. The statistical data (cumulative through end of FY84) will help gauge an individual's competitive status in the LCCEP and assess potential career growth.

Tables 1 and 2 show the population in each current or targeted grade, series, and geographical location.

LCCEP MEMBERS BY COMMAND/GRADE

COMMAND	OTHER	GS-11	GS-12	GS-13	GS-14	GS-15	TOTAL
AFR	31	47	58	31	6	1	174
ATC	22	35	39	9	2	0	107
AFCC	4	27	61	16	4	3	115
HAF	2	0	3	22	28	3	58
MAC	36	51	69	8	8	0	172
SAC	16	52	26	5	3	2	104
TAC	22	79	49	10	1	0	161
AFSC	24	229	393	151	34	9	840
AFLC							
Hill	89	439	485	156	42	19	1,230
Kelly	66	479	452	155	59	17	1,228
McClellan	133	516	474	133	47	27	1,330
AGMC	1	96	103	28	11	4	243
Norton	0	7	21	22	7	0	57
Robins	96	586	595	183	58	24	1,542
Tinker	91	566	663	187	59	23	1,589
HQ AFLC	29	82	632	340	102	38	1,223
Other AFLC	5	89	211	66	12	6	389
Other CMDS	49	97	156	74	22	4	402
TOTAL	716	3,477	4,490	1,596	505	180	10,964

Table 1.

Tables 3, 4, and 5 reveal a definite correlation between the amount of education, multifunctional, multioccupational series (OCSRs) experience, and higher grades. From GS-12 up, the statistics favor those who have multifunctional, multi-OCSRs experience and a college education. For example, these tables show almost 66% of the GS-13 LCCEP members have a bachelor's degree or higher, almost 74% have experience in more than one occupational job series, and 60% have multifunctional experience. These percentages continue to increase for GS-14s/GS-15s.

During FY84, there were 248 LCCEP selections. Two hundred and twenty-one were promotions and 27 lateral reassignments. Table 6 details the promotions and reassignments by grade and location.

LCCEP MEMBERS BY OCSRs/GRADE

OCSRs	OTHER	GS-11	GS-12	GS-13	GS-14	GS-15	TOTAL
301	9	164	280	116	57	28	654
334	1	30	122	24	7	2	186
343	4	85	84	24	2	0	199
345	1	102	220	90	40	6	459
346	14	260	1,087	341	109	50	1,861
801	0	3	58	102	22	7	192
830	0	14	116	23	0	0	153
855	0	9	301	113	24	4	451
856	4	77	20	0	0	0	101
861	0	2	131	42	10	0	185
895	2	149	63	13	0	0	227
896	1	13	133	54	6	0	207
1101	5	290	180	69	36	9	589
1102	10	27	40	14	8	3	102
1152	2	78	54	15	0	0	149
1601	5	10	18	43	18	14	108
1670	7	642	244	56	6	0	955
1910	10	407	238	68	22	1	746
2001	5	61	55	19	8	0	148
2003	1	113	207	66	20	6	413
2010	7	435	273	92	26	5	838
2101	58	32	22	5	8	1	126
2130	53	70	98	26	5	1	253
2131	112	4	0	0	0	0	116
Other	361	420	436	177	67	45	1,506
TOTAL	672	3,497	4,480	1,592	501	182	10,924

Table 2.

MULTIFUNCTIONAL EXPERIENCE

	GS-11	GS-12	GS-13	GS-14	GS-15
Multifunctional Experience	48.6%	55.4%	60.1%	69.2%	71.0%
No Multifunctional Experience	51.4%	44.6%	39.9%	30.8%	29.0%

Table 3.

MULTI-OCSRs EXPERIENCE

	GS-11	GS-12	GS-13	GS-14	GS-15
Multi-OCSRs Experience	71.7%	68.0%	73.8%	82.3%	92.0%
No Multi-OCSRs Experience	28.3%	32.0%	26.2%	17.7%	8.0%

Table 4.

EDUCATION					
	GS-11	*GS-12*	*GS-13*	*GS-14*	*GS-15*
No College Degree	75.0%	51.9%	34.1%	24.5%	19.6%
BA/BS or Greater	25.0%	48.1%	65.9%	75.5%	80.4%

Table 5.

FY84 LCCEP SELECTIONS BY GRADE/LOCATION

VACANCY	*GS-12*		*GS-13*		*GS-14*		*GS-15*		
LOCATION	*P*	*R*	*P*	*R*	*P*	*R*	*P*	*R*	*TOTAL*
AAC		1							1
USAFE		1		1					2
ATC		1							1
HAF			1		4				5
MAC	3	2							5
MPC/OCPO	2	1	2	1					6
SAC	2								2
AFSC	7	1	8	1	5		2		24
TAC	3								3
Other AF	2	3							5
HQ AFLC	6	4	24	1	12		3		50
Other AFLC	7	1	9	1	3				21
OC-ALC	12	1	8		7		1		29
OO-ALC	3	2	2		8		2		17
SA-ALC	15	2	5		8		4		34
SM-ALC	5		2	2	10		3		22
WR-ALC	2		8		8		3		21
TOTALS	69	20	69	7	65	0	18	0	248

Table 6.

Source: Richard E. Mendiola, OCPO/MPKCL.

Military Career Management

Officer Special Experience Identifier (SEI)

For the past six months, the Logistics Career Management Section (PALACE LOG), Headquarters Air Force Manpower and Personnel Center (AFMPC), has made a major effort to update the logistics officer special experience identifier (SEI) data base. PALACE LOG is concentrating on two different aspects: awarding SEIs in a "batch" process to logistics officers who qualify for common SEIs and reviewing each logistics officer's record during the assignment process to ensure the correct SEIs are recorded. To date, over 3,000 SEIs have been awarded to logistics officers.

SEIs are defined in AFR 36-1, *Officer Classification*, Attachment 29. An SEI is a three-character alphanumeric code set consisting of an "activity code" (first character) and an "experience set" (second two characters). The activity code identifies activities that can be performed in a variety of career fields. In logistics, the most common activity codes are: "A" - acquisition of systems; "L" - logistics; and "M" - maintenance. The "experience set" identifies a particular system, level of experience in a particular activity, or the type of experience within a general activity. Presently, there are 380 "experience sets" established in the Air Force; however, there are about 85 "experience sets" which apply to logistics officers. It is the combination of the "activity code" and the "experience set" that forms an officer SEI code. Eight separate SEIs can be recorded.

SEIs are awarded or deleted by AFMPC career management teams after a review and evaluation of the officer's record or by an officer requesting, through his CBPO, award or deletion of an SEI. This request is forwarded to the AFMPC career management team (in the case of logistics officers - PALACE LOG) where it is reviewed and either approved or disapproved.

The following list represents some of the more common SEI "experience sets" awarded to logistics officers:

GENERAL LOGISTICS
(004X, 009X)
(40XX, 60XX, 64XX, 65XX, 66XX)

C3 - Joint/component staff augmentee

EE - Single integrated operational plan (SIOP) experience

KI - Quality assurance

UB - Inspector

U2 - Air Staff Training (ASTRA) officer

Y7 - Acquisition logistics

EJ - Joint Operations Planning System/ Operation Plan (JOPS/OPlan) writer/developer

EN-ES - BLUE FLAG/COPE THUNDER

LA - Air Force Career Broadening Program

U1 - MAJCOM level readiness

YA - Security assistance

OD-OG - Exchange officer

MAINTENANCE/MUNITIONS
(40XX)

AE-AN,A5,BH-BI,BK-BL,BS-BT,BX,B1,B3-B4,CD, CU,CY,CZ - Major aircraft weapon systems

ET - Weapons safety (explosive/ nuclear

LC - Explosive ordnance disposal (EOD) experience

U9 - Maintenance mishap investigator

EW - Nuclear weapons safety

LE - Maintenance control

Y8 - Production

CONTRACTING/MANUFACTURING
(65XX)

KA - Manufacturing planning

KD - Contracting officer

KG - Contracting overseas

KK - Deputy Program Manager for Logistics (DPML) experience

KS - Contract administration

KC - Pricing analyst

KF - Base contracting

KJ - Program management responsibility transfer (PMRT) experience

KR - Contract term

YP - Air Force Plant Representative Office (AFPRO) experience

TRANSPORTATION
(60XX)

LW - Mobility planning

U6 - Service on joint or combined staff

SUPPLY
(64XX)

YM - Integrated logistics

LI - Fuels experience

SEIs are awarded to officers based on some specific type duty in which they gain experience or receive training which corresponds to an established SEI—officers get an SEI while *in* a position/job. On the other hand, some positions require officers to have some specific experience/training in order to accomplish the job. In some cases, these positions/jobs can be identified by SEIs which act as an additional classification tool and help identify specific requirements (experience/training) for certain assignments.

In the assignment process, SEIs aid AFMPC career managers in matching the right officer to the right job. The significance of the three-digit code is the capability to retrieve information from the data system. All the information on experience/training is available in officer records; however, extracting and reviewing the data are extremely time consuming.

Historically, SEIs have not been used for logistics officers due to an insufficient data base; thus, PALACE LOG's effort to update the data base for use as a management tool. We are trying to capture or save, via a three-digit code, valuable experience/training which logistics officers receive in the process of doing their jobs. This data is then available for statistical analysis and, at some point, we can search the rolls for the "right" officer to fill a logistics position demanding an array of varied experience/training. To date, in PALACE LOG, not a single logistics officer has received an assignment on the sole basis of having a particular SEI, but we have been able to place officers in demanding jobs which capitalize on their qualifications/skills and experience/training.

PALACE LOG cannot update an SEI or maintain a reliable data base without the help of the senior logistics leaders (commanders/supervisors) and individual logistics officers. In the long run, the SEI program is another management tool via the classification system. Senior leaders can be a great help by using the PALACE MODE Job Description (AF Form 2051) to identify SEIs for which officers qualify when performing specific jobs covered in the job description. They can also help by emphasizing the value of SEIs during career counseling and by monitoring records and requesting award/deletion of SEIs through the local CBPOs. In this way, the SEI data base will provide a valuable management tool for both the resource managers at AFMPC and the logistics community as a whole.

Source: Lt Col Edwin C. Humphreys III, HQ AFMPC/MPCROS1, AUTOVON 487-3556.

▶ *FROM 13*

Summary

This recommendation was implemented worldwide this fiscal year. Implementation will result in an average 14% increase in the worldwide fill rates for consumable items and a reduction of over 20,000 grounding incidents a year. It is an example of using scientific management principles to improve the Air Force's capability to fly, fight, and win.

Notes

[1] USAF Monthly Supply Management Report (M32), microfiche from the Data Systems Design Office, Gunter AFS, AL, Jan-Mar 1984.

[2] *USAF Supply Manual* (AFM 67-1, Volume II, Part Two), Air Force Printing Office, pp. 11-1 through 11-15.

[3] Ibid.

[4] Ibid.

[5] Ibid.

[6] Peterson, Rein and Edward A. Silver. *Decision Systems for Inventory Management and Production Planning*, John Wiley & Sons, New York, 1979, p. 244.

[7] Ibid.

"Modern warfare is vast, complicated and impersonal; most of it is fought at a distance. A complicated series of weapons are being used in a complicated way; inevitably the inter-relations and effects of these weapons will be complicated and imperfectly understood. They army of today is moreover a huge society and, as with any great society, there is inevitably uncertainty at the top as to what plans and orders really imply when they are carried out at the bottom. As long as there are these uncertainties the army cannot achieve its objects effectively and economically. These then are the reasons for Operational Research. Enough has been done to show that the means of Operation Research can sometimes go further to clearing up these uncertainties than practical experience or casual observation, not because the means are in any way different or even new, but simply because they involve studying many aspects of an incident rather than only one and so reasoning out new and more fundamental lessons. And lastly, enough has been done to show that the results of Operational Research can be valuable and can affect the battle."

From: "Readings on Early Military Operational Research," Royal Military College of Science, Shrivenham, Mar 84

IRM Budgeting for the Air Force: An Approach for the Military Organization

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Introduction

Information Resource Management (IRM) is a relatively new discipline; it is an idea, however, whose time has come. Since the field is so new, little practical work has been done on the subject; and, while many learned treatises have emerged, the body of knowledge has not really solidified yet. What little has shown up has been directed primarily toward private industry and civilian federal agencies. The military, however, has a different set of problems with IRM: the sheer size of the operation, the environment in which it operates, and the diverse functions it performs. Several writers have claimed the organization for IRM will differ for each agency that seeks to implement it. Consequently, the special considerations for the military will cause it to differ from most other agencies, and it will differ even further among the Army, Navy, and Air Force, as well as within their respective elements.

I do not propose to reveal how to organize for IRM in this paper. I do, however, wish to propose some considerations for military IRM and suggest approaches in the planning and budgeting aspects of the problem. IRM is a fine idea, but budgeting for the process must be more than just an exercise in cost accounting. The Office of Management and Budget (OMB) has been directed to add a budget line-item for IRM, and in turn we must examine our information budgets.

A Quick Overview

What Is It?

Several definitions have evolved, but IRM refers to the fact that information costs money—it costs money to gather, use, hold, and dispose of information. In the past, the thrust has always been to control the amount of and access to the information, but little else. However, now that the possibilities for information gathering have increased tremendously, we must understand the marketplace's new and adequate tools which handle it. As technology continues to grow (it doubles about every 18 months), more needs are satisfied and, at the same time, fertile minds develop yet additional applications. The result has been a parallel "information explosion."

The implications of these developments are enormous. When we contemplate how much this is costing our operation, it does not take long to see what information is doing to the financial bottom line. This is one phase of IRM. Another phase is getting the information from source to user *intact* and *usable*. This can be as simple as using a pencil and paper, or as complex as using communication networks and computer architecture, involving everything from wires to fiber optics, to satellites in space. Consequently, the form, storage, and transmission requirements for all information must be closely examined and carefully managed.

The net result of this activity, then, is that information resources must be viewed as a single problem. In the past, we in the Air Force have managed the technology as one issue and have looked at our information needs as a side effect of that issue. Indeed, we even split up the technology management into one group for computers, another for communications, and still another for office automation. The IRM concept forces us to look at the problem as a whole. In fact, today, when one machine runs many different processes simultaneously, and with it many different functions, technology becomes the side issue; the total picture of obtaining, transmitting, storing, and disposing of information becomes *the* way in which to look at what we are doing.

Implications for Budgeting

IRM: it is law. We have little choice in the question of implementation. As IRM matures, we will have to change some of our ways of doing business in developing budgets and requirements, and defending these programs before Congress and the American public. IRM demands that we look at information as a resource and that it be managed the same way as personnel, energy, and real estate.

Obviously, we must recognize information is not "free" and the cost of that piece of information sitting on our desk is comprised of man-hours of effort, storage space, processing time, and communication, and will yet cost money to pass on, use, and, eventually, to destroy.

How We Use and Value Information

Under the conditions of true IRM, information exhibits the characteristics of the classic capital asset. As such, the cash flow involved in acquiring, using, and disposing of this information can be measured and applied.

Describing the Asset

There are basically five kinds of information a military organization has and uses:

(1) **Administrative** - accounting, order passing, and record-keeping functions.

(2) **Command and Control** - real time management knowledge which is passed up and down the chain. This can be further broken down into:

Tactical - control of forces on the battlefield and information passing between field-fighting units.

Strategic - large scale movement of troops and equipment, basing in the combat area, and combat logistics.

(3) **Intelligence** - enemy operations, movements, resources, intentions, plans, etc.

(4) **Technical Research** - test results, measurements, and specifications.

(5) **Archival** - records required by law or procedure to be kept for a year or more. This information is static and is used

for historical record and/or for establishing trends and analyzing progress.

Valuing the Asset

The use that a given body of information receives is a key factor in its appraisal; in fact, most complaints involve this issue. Once information is collected, transmitted, stored, and processed, is anyone using it? For what? And, of course, the ultimate question: Was it worth all the cost to get it here? In the theatre of combat, this is a vital concern, because costs are measured not only in dollars but in human life and, perhaps, in national survival itself! Has the field commander been deluged with so much information that there is no time to use it to any advantage? Has he enough information so he can operate properly without losing all his resources and, consequently, the battle? The same points apply to our work places.

If we are to turn information into an asset rather than a pure expense, we must find a way to place a value on a body of information. By looking at traditional ways of assigning a dollar cost for capital goods, we can see how they apply to information.

First, we must "purchase" the asset (acquire the asset). In the administrative area, for instance, this can be broken down into tangible goods, materials, labor, and overhead. The pay clerk behind glass windows and high counters spends time with the civilian or military member gathering pay data. The personnel clerk spends time reviewing the information the member has just supplied. Also, that person has had to take time from his job to fill in the form, come by the office, and talk to the clerk. This, then, is some of what it costs to buy any information.

Next, we must "deliver" the asset (transmit it). To get the information from one place to another and from one transmission medium to another costs money. The paper form is handed from one person to another, from one office to another, and from active use to passive storage; removed from storage; sent over the phone or through a radio; written elsewhere; rewritten; or spoken by one human being to another. We must, therefore, be able to analyze the "flow" of the information by sending it via the most direct or least expensive mode, depending on its urgency.

What we have just done is set a cost to a block of information in the way one would traditionally determine the value of any asset—purchase price and delivery cost. Having a new asset, we should now be able to prepare a capital budget.

Now that we have transmitted, we have to store. The information may be stored along the way or stored only at the users' location. It may be used immediately and destroyed (never stored at all) or stored, used, stored again, and used again, perhaps in different locations. We may put it into a file cabinet, on computer tape or disk, or in a desk. Any way we do it, storage involves space, and the cost of that space applies to the cost of our information. We must consider the cost of the storage facility and the security requirements when figuring the cost of the storage space.

Now that we have acquired the information, sent it where it needs to go, and provided storage for it, some of the information will have to be processed before we can use it and, perhaps, processed again when we are finished. When we talk about processing data, we talk about three basic operations:

(1) **Media change** - putting data acquired and stored on electromagnetic media onto paper, from paper to fiche, back again, etc.

(2) **Format change** - Within electromagnetic media, changing the data from one tape record format to another, from punch card to disk, from American Standard Code for Information Interchange (ASCII) to Extended Binary Coded Decimal Interchange Code (EBCDIC), etc.

(3) **Data reorganization** - sorting into any number of chronologies and going from rough draft to final, from outline to narrative. Using this concept, we must consider, again, people and equipment (paper, typewriter and printer ribbons) costs, computer time, software to drive the computers, and instructions to drive the people.

When we are no longer using this information with no further need for storage, it is now time for disposal. Surprisingly enough, this costs money also. It may be as simple as a person forgetting it or as complex as removing a security classification, searching for all locations in which it is stored, or accounting for its destruction and using specially designed equipment to destroy it. Again, we measure people costs, equipment costs, and, perhaps, even the expense of commercial trash collection.

And now, to add insult to injury, overhead must be allocated to the cost of information. There are lawyers and policy makers who develop, explain, or clarify the regulations concerning information, accesses, etc. There are those who write, evaluate, and execute budgets, plans, and procurement. There are those who design systems and equipment, and there are many people and processes on the side that contribute to the processes enumerated. All this costs money. Let us not forget, of course, depreciation and/or amortization of hardware and leaseholds that must be applied.

What is it that is being advocated? Does this mean that the personnel department has to come under the information resource division because people are an information resource? No! What is implied, though, is that the COSTS involved should be allocated against the processes which contribute to them.

What is a "Block" of Information?

Before we can perform our management magic on information, we must first define the unit we are about to manage. To illustrate, let us suppose we need to keep the names, addresses, phone numbers, and dates of rank of everyone in the Pentagon. In designating the information we need, we have just defined our block of information. This block has a definite composition, and, therefore, can be tracked. It can also be modified. Perhaps some day we will want to add "date of birth" to the information or even "wife's maiden name." The block of data is still the same. We merely add to it as one would add a room onto a house or put better tires on an automobile. Note that name, address, and birth dates are data fields as well as information. Other information as needed can be derived from these data. For instance, from our data, we can derive a count of people living in Fairfax, Virginia, a count of how many captains we have, and even which ones are coming up for promotion this year. These are only some of the articles of information we can glean from our data and are property of this "block of information" we have described using items of data.

Determining the Investment

To cost out our investment in a block of information, we must consider two characteristics:

(1) How dynamic are the data contained?

(2) How long is the life cycle?

Let us return to our example. The data are quite dynamic, since the turnover of people in the Pentagon is frequent. So what do we use for an acquisition cost? First, we can estimate the cost of building the data base from scratch until the first maintenance action is needed. "Maintenance" in this case means adding, changing, or deleting any information in the data base. Doing it this way, and assuming we are going to keep this information on a computer, we add the cost of developing the software to handle the job, the cost of the file clerks rummaging through paper files to find the data, and the cost of personal interviews with people to collect the data. Also, add to this the cost of data entry and the cost of materials. We are not sending it anywhere but into in-house storage so there is not a transmission cost. Consequently, we now have the cost of our asset.

But what of the life cycle? The data will not stay stable, but may have to be changed daily. This too costs money in the same way as the initial building of the data base. Since we are capitalizing the costs of our information base, the cost of constant maintenance must be taken into account. Therefore, this method of valuation may be inadequate. However, since maintenance is inevitable, like any machine or building, the amount of maintenance can be estimated and projected into a monthly figure. This leaves us with a relatively easy question: How long are we going to keep this data around? If maintenance is so hot and heavy that the data base turns over completely in five years, that is what we will use. Remember that whatever happens to that block of data past the end of its life cycle will end up as pure expense.

Time Value and Life Cycle

Now that we have an asset and an investment value applied, we need to recognize that, as such, the information has a life, just as any mechanical, tangible asset, and we can build a capital budget for it. We know how much it costs to acquire the information and get it to its current state, but it will likely lose value over time. Consequently, acquisition costs can and should be depreciated or amortized. In order to do that, we have to come up with some kind of estimate as to the time value (life cycle) of a given block of information. Some information can be considered "consumable," since it is used instantly and never needed again. Intelligence will expire as the world will continue to turn, although there will be some historical value to some of the information. This needs to be determined when arriving at a life cycle.

Certainly, a mode of depreciation or amortization of the value of information needs to be applied and, in so doing, we will be able to see, in numerical, quantifiable terms, when and if it becomes uneconomical to retain or continue to collect certain kinds of information. The usual measures of asset productivity, such as return on investment (ROI) or payback, can be applied, and we can proceed to justify our programs based on value added savings and/or cost avoidance. This raises the question of "at what point does information become 'nice to know' "? In some cases, such as intelligence, we may never know. Careful analysis can, however, help us place some kind of time value on the data. Again, each organization will be different according to how it assesses individual needs.

IRM and the Planning, Programming and Budgeting System (PPBS)

IRM will by necessity change the method in which the programming and budgeting process will operate. There are problems, however, which must be resolved before a true IRM concept can be implemented. There are also forces external to the Air Force which must be dealt with as well.

Until now, budgets and plans have been primarily based on technology and hardware. It is comfortable and tangible, and it has a definite price defined by the vendors. We can see it, track it, pass its serial number around, and handle it. Under IRM, it is no longer that easy.

External

The rules and regulations we must function under were written back in the days when the computer was the giant box in the basement. The computer room was a mysterious place with its special power supplies; fancy environmental control equipment; the whirring, clicking relays; teletypes; and blinking lights. The world has since changed and changed radically. The regulations and laws have not. Indeed, the Paperwork Reduction Act only touches the periphery of the problem. In order to implement IRM, the Federal Procurement Regulations have to be reviewed and modified, and government accounting procedures have to be reviewed for change. The A-11 report is an interesting example. If we are working on an IRM orientation, the report is meaningless. Even now, its use is dubious at best. It requires reporting automated data processing (ADP) expenses separate from communications, a concept that is already in trouble. On the ADP side, that old cabinet in the corner that use to be the central processing unit (CPU) now may have as many as 30 CPUs in it. The CPU now fits on a space smaller than the eraser on a pencil. Do we really want to count CPUs? If so, then, do we count the cabinet or the actual CPU itself? A CPU count which, only seven years ago, would have been 2,000 may now be closer to 100,000. Some of these rules and procedures are a matter of policy and, therefore, can be changed with the stroke of a pen. That part is easy. It is the legislation that takes time to modify.

Internal

With the implementation of IRM, real changes are needed in the MAJCOM and Air Staff panel and board structures. For this discussion, we will assume that there are no legislative barriers in the way, only those of policy.

Reflecting the old "hardware" orientation of our process, two panels are now in place to review ADP and communications under an "information systems" concept, but these panels review only 25% of ADP requirements! In addition, the Support Panel passes judgement on the base operating support and logistics computer systems, the Mobility Panel on the airlift systems, and the Research, Development, Test and Evaluation (RDT&E) Panel on those computers involved with research and development. Under IRM, this is an intolerable situation.

Future Events

The need for IRM was technology driven. Overall, the information explosion is not so much a new phenomenon but a reflection of real world information needs. Technology is only the handmaiden to the process. Indeed, the tiny computer driving our wrist watches only ten short years ago would have taken up a console the size of a four-drawer filing cabinet. This fall, a machine with the same computing power and greater speed than the old Burroughs 3500 will appear in a cabinet the

TO 32 ▶

Transportation of Hazardous Materials (Titan II Deactivation)

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In order to deter nuclear aggression against our nation and its allies, the United States (US) maintains a "triad" of strategic forces: land-based intercontinental ballistics missiles, manned bombers, and fleet ballistics missile submarines. In recent years, a steady buildup of Soviet nuclear forces has upset the strategic balance to such an extent that US forces must now be strengthened to redress that imbalance. To that end, our President announced a multifaceted strategic force improvement program.

This program includes a plan to modernize the intercontinental ballistic missile (ICBM) leg of the triad by retiring older, less cost-effective Titan II missiles and deploying systems that are more advanced. The savings associated with the Titan II retirement will partially offset the cost of developing and fielding the newer systems.

A Titan II deactivation plan was developed in response to a Deputy Secretary of Defense Program Decision Memorandum, 20 October 1981, which directed Titan II missiles be retired as soon as possible. The plan describes the methods for managing the Titan II deactivation and alternatives for accomplishing a safe and orderly deactivation program. HQ USAF designated the Director of Programs, Strategic Air Command Headquarters, Offutt AFB, Nebraska, as the Air Force program manager with primary responsibility for the Titan II deactivation.

Deactivation of the Titan II system includes missile sites located around the missile wings at McConnell AFB, near Wichita, Kansas, and Little Rock AFB, near Little Rock, Arkansas. The deactivation plan is to proceed sequentially from one installation to the next. Deactivation of the 18 missiles at Davis-Monthan AFB, Arizona, began in October 1982 and is now complete. McConnell AFB missile deactivation began in July 1984 with Little Rock AFB to follow. The Titan II deactivation plan is scheduled to be completed by the end of 1987, barring unforeseen delays.

Propellants used in the Titan II missile are nitrogen tetroxide (N_2O_4) (oxidizer) and a 50/50 mixture of hydrazine and unsymmetrical dimethylhydrazine (UDMH-mix) (fuel), also known as Aerozine-50. In the early 1960s, nitrogen tetroxide (N_2O_4), a Class A poison, and oxidizer and unsymmetrical dimethylhydrazine blended 50/50 with anhydrous hydrazine (UDMH-mix), a poisonous flammable liquid, were selected as the most effective storable fuels for use in our missile and space programs. The oxidizer and fuel are mixed to provide propulsion to missiles and rockets. At that time, the only mode of transportation for bulk N_2O_4 and UDMH-mix shipments authorized by the Interstate Commerce Commission (ICC) was railroad tank cars. Because of the missile sites' remote location and lack of rail trackage, the need for motor transport capability became apparent.

A close working relationship between Motor Carriers, HQ Military Traffic Command, and Directorate of Energy Management Transportation personnel resulted in locating commercial carrier-owned tank trailers suitable to transport fuel-mix and in the design and construction of acceptable trailers for transporting bulk N_2O_4 over-the-road.

At that time, the Air Force and Military Traffic Management Command petitioned the ICC for an exemption to transport N_2O_4 in specially designed novel NON-DOT specification cargo tanks. Since initially allowing the exemption, subsequent renewals have been granted based on the safety record compiled by commercial carriers involved in over-the-road shipments.

Exemptions are granted by the Department of Transportation (DOT) and are just that—exemptions from specific regulations contained in Title 49 (Transportation Code of Federal Regulations). In petitioning for an exemption, the applicant must ensure safety control measures in the proposals will achieve a level of safety at least equal to that specified in the regulation, will be consistent with the public interest, and will adequately protect against the risks to life and property, which are inherent in the transportation of hazardous material in commerce.

Exemptions for N_2O_4 shipments are granted for a two-year period, at the end of which time they must be renewed. Petitions for renewal must contain a historical record of previous shipments and any incidents of product loss, and are processed under the same rigid controls as the original petition.

The Titan II missile deactivation requires the transfer of the liquid propellants into the holding trailers. Two distinct types of holding tank trailers provide a storage capacity for the missile propellants when offloaded. One is designated for the Aerozine-50 (fuel) and the other for the N_2O_4 (oxidizer). Missile wing maintenance personnel will begin propellant offloading with the transfer of the fuel mix from the missile to its designated holding trailer. Then, they will take samples of the fuel mix and forward them to a designated laboratory for immediate analysis. Subsequently, the missile's fuel system is pressure drained and purged of the fuel mix. Propellant offloading continues with the transfer of oxidizer from the missile to the designated oxidizer holding trailer. Sampling of the oxidizer and pressure draining and purging of the missile's oxidizer system are then accomplished.

The Directorate of Energy Management, Transportation Office, San Antonio Air Logistics Center (SA-ALC/SFRM, Kelly AFB, Texas) manages and directs the transportation program for liquid propellant downloaded from the deactivated Titan II missiles. Since the early 1960s, the Directorate of Energy Management has had extensive experience in transporting Titan II propellants. The trailers used to transport fuel mix and oxidizer from the missile sites are commercially owned, common carrier tank trailer equipment, under exclusive use contract to Directorate of Energy Management, SA-ALC/SF. SA-ALC/SFRM is responsible for ensuring an effective overall transportation plan and managing the movement of downloaded propellants from Titan II bases to final destinations.

Propellants transferred to each holding trailer are subsequently loaded onto commercial tank trailers for transport from the missile site. Six commercial tank trailers are required to accommodate the oxidizer download from each missile, and an additional three trailers are required to accommodate the associated fuel mix. These commercial carriers are brought onto each site at a rate of three per day.

Transporting propellants is accomplished in strict accordance with all applicable provisions of the Hazardous Materials Transportation Act, detailed in Title 49, Transportation Code of Federal Regulations, and Department of Transportation Exemption 3121, the authority for bulk highway shipment of nitrogen tetroxide. Shipments are made under terms of a Government Bill of Lading. Carriers are responsible for safe origin to destination delivery. All governing regulations for commercial transportation of hazardous materials for Department of Defense (DOD) shipments are followed, including issuance of special instructions to drivers, and vehicle inspections prior to loading.

To provide assurance of the soundness and safety of the 8 fuel trailers and 11 oxidizer trailers, owned and operated by five different motor carriers, SA-ALC/SFRM initiates and requires numerous inspections and tests. The criteria which apply to fuel trailers differ from those of the oxidizer trailers since the fuel and oxidizer trailers are distinctly different. The following is a list of the inspections and tests:

- Radiographic x-ray, ultrasonic wave tests, and magnetic particle tests.
- Pneumatic or hydrostatic tank tests.
- Monthly inspections at carriers' terminals for contract compliance.
- Pre-trip inspection.
- Pre-loading inspection.
- Inspection before and after product offloading.

Radiographic x-ray, ultrasonic wave testing, and magnetic particle testing are accomplished on the oxidizer trailers. These tests are made on the tank and undercarriage to uncover any structural deficiencies and provide the means of assuring all concerned parties that equipment is safe for use. Both fuel and oxidizer trailers meet or exceed all DOT requirements and have been in continuous service since built without failure. The carriers perform continuous checks and maintenance procedures to their trailers in compliance with contract provisions.

The pneumatic tank test is required each 30 months on oxidizer trailers. The hydrostatic tank test is required each five years on fuel trailers. Tests are made at 1½ times designed tank working pressure in compliance with DOT regulations.

Defense Contract Administration Services, Quality Assurance Representative (DCAS-QAR) conducts monthly inspections of trailers and carrier records at carriers' terminals in accordance with all hazardous materials regulations. Items of inspection include verification of a positive interior nitrogen tank pressure (to prevent entry of outside air or contamination) and check of static grounding cable, tires, fire blanket and face mask, driver's kit, overall trailer appearance, and trailer log of events.

Pre-trip inspections are conducted at carrier terminals, just prior to drivers' departure to point of loading. DCAS-QAR completes these inspections to assure the equipment's suitability for over-the-road usage and that drivers are trained on the hazards of the product to be transported. Inspections assure drivers are informed about the characteristics of the material transported and are fully instructed in the measures and procedures to be followed to protect the public in the event of accident or emergency.

Pre-loading inspection takes place at product loading activity upon arrival of trailers for loading. This inspection is nearly identical to the pre-trip inspection, but allows the shipping activity to verify that drivers' tractor and trailer are qualified for shipment. Trailer weighing is accomplished before and after product loading. Both oxidizer and fuel shipments require mechanical inspection of tractor and trailer, using DD Form 626 (Motor Vehicle Inspection (Transporting Hazardous Material)) and SA-ALC/SFRM Inspection Checklists.

Inspection before and after product unloading is conducted at the product receiving activities to assure no product leakage has occurred en route and the trailer is satisfactory for unloading. Each trailer is weighed in and out to assure as completely as possible product unloading.

Air Force personnel load the commercial tank trailers from the holding trailer and notify drivers to take the loaded trailer back to the holding area where the Transportation Officer will complete the SA-ALC/SFRM inspection. Drivers are then provided shipping papers and accompanied to the certified scale to determine official loaded weight. If product weight is satisfactory, the driver will be released for through movement to the prescribed destination. The host base Transportation Officer will then assure that a prompt telephone report of any shipment is provided to the SA-ALC/SFRM Transportation Office and to the consignee after each trailer release.

Over-the-road transportation of all propellants is accomplished in strict accordance with all applicable provisions of Title 49, Transportation Code of Federal Regulations, and Department of Transportation Exemption 3121. One of these provisions requires two drivers be assigned to each vehicle and shipments be transported from origin to destination without layover en route, except for necessary rest stops of short duration. The vehicle must be attended at all times by a driver.

In addition, each vehicle driver is furnished written instructions, showing the route to be taken from point of origin to destination. The route must be planned insofar as possible to avoid congested thoroughfares, places where crowds assemble, streetcar tracks, tunnels, viaducts, and dangerous crossings. These instructions designate the places where stops are to be made for fuel and meals.

Loaded trailers may arrive at their product destinations at any hour and will be provided a safe holding area, pending acceptance for offloading. After trailer unloading, the transportation vehicle will be weighed to assure complete product offloading. Transport equipment will then be released to return to its home terminal.

A major reason for the fine safety record in transporting these materials is the requirement that missile propellant truck drivers receive formal classroom training. The training includes familiarization with the transport equipment used, and the product transported, and specific attention to the route of movement. Using specific carriers, trained personnel, and specially designed tank trailers, shipments have been made for over 20 years without a single major accident, incident, or product loss.

Crawford Slip Method (CSM)

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Abstract

People often learn their newly assigned tasks (school or work) in a haphazard method (group education, on-the-job training, etc.). The Crawford slip method is a productivity improvement technology which can be applied to simple or complex tasks. It is a system of using slips of papers to record and coordinate "brainstorming" sessions of a particular designated group. This method has proven to be successful in both government and private industry. Recently, a University of Southern California (USC) Productivity Network, which will be interdisciplinary and geographically dispersed, was created to teach others how to use the system.

Present Methods

Our nation pays a high price for the haphazard ways in which people learn specific tasks:

(1) **Group education (GE):** Group education, whether in high school or university, or in an employer's in-house training program, can fall far short of application to specific job situations. Instruction that is general enough to apply to all students or employees may not be actually APPLIED to any of them. GE by nature is INCOMPLETE.

(2) **On-the-job training (OJT):** On-the-job training is supposed to finish what GE cannot. Supposedly, the new employee will be oriented, coached, checked, and assisted in new duties. However, many times this is a mere wishful dream or cop-out. Too often OJT ranges from the haphazard to the nonexistent. It may amount to, "Here's your bench/desk/office. You are in charge."

(3) **Trial and error (TE):** Trial and error is often the learner's only hope. The polite term is "learning by experience." Workshop evidence documents this as a typical result. Students start near zero and flounder and fumble with little help from anybody. Is it any wonder that quality and productivity and international competitiveness suffer? Turnover may even stop much of the trial and error learning.

Crawford Slip Method

The Crawford slip method is a productivity improvement technology. It can apply to the simplest routine tasks or the involved needs of the ultra-complex professions. It is analogous to the medical profession as a way to diagnose and treat ailments or "ill health" in a job activity or system by:

(1) **Problem diagnosis.** Each session begins with a diagnostic workshop of people who have some know-how or awareness about the chosen activity or problem. The instructor (who has received training in this method) gets their independent, anonymous, and looseleaf inputs, one sentence per slip of paper, about the precisely defined target questions. These inputs vary, but he typically asks for the troubles, deficiencies, obstacles, or imperfections. Each person usually writes one or so of these per minute but slows down after about ten. The instructor then may ask for about ten slips on any remedies for the previous problems. The two targets together yield a fair penetration into the specifics by each person. But the combined input and penetration are infinitely richer. One workshop may yield a few thousand slips, depending on size of audience, writing time, and number of targets.

(2) **In-depth remedial analysis.** Classifying the diagnostic slips may yield 20, 40, or more categories of SUBPROBLEMS. People can usually penetrate as deeply into each subproblem as into the main one. More workshops, more people, and higher levels of experts as slip writers can add enormously to the know-how composite. They should move to the next higher number when they slow down on the first. Once all these bits of know-how are organized and printed, much on-the-job learning (OJL) can be done by reading.

(3) **Standard operating procedures (SOPs).** The composite just described is likely to be on the level of general advice about PROBLEMS. It will probably fall short of specific directions for specific tasks. It is good content for group education and for initial OJL orientation. But like GE, it is INCOMPLETE. To complete the OJL process, individuals will need standard operating procedures, technical orders, or checklists of step-by-step directions for some of the most troublesome tasks and interactions.

Standard Operating Procedures

Someone who really knows how to do a task can usually write on slips the ten or dozen steps for doing it in a few minutes. Another who also knows the task can usually improve that draft by a mutual aid critique. Still others may add additional refinements. When several have conferred, agreed, and SIGNED such a draft, the group should have a good consensus for adoption as a standard procedure. It is important to get such critiques and signatures from co-workers, interfacers, and managers with a broader perspective and higher authority.

This process gains momentum fast if done under very precise editorial control. Without such control, the prospects for success are not so good. There is no royal road to procedure writing; typically, it is done in a swamp. That is one reason why so little of it gets done, and resulting procedures are of such poor quality. Details of our SOP approach to OJL are:

(1) **Task lists.** General advice about problems and policies is not precise enough to guide specific tasks or interactions. About 20% of the tasks generate about 80% of the errors or trouble. Each person in a workshop can write slips on what tasks seem to be in that 20%. These are the ones that need stabilization first.

The first tasks written down are usually less than 50% actual tasks; over 50% are just general problems. Some quality control instruction based on first efforts can soon raise the success rate greatly. Editorial touchup before the actual procedure drafts are written can greatly improve them and the drafts based on them. The independent task suggestions from a group aid greatly in setting priorities for actual procedure writing.

(2) **First drafts of procedures.** The first draft should be written by someone who knows the task well, acting alone. He should write each step on a separate slip and then lay these slips, like shingles, in the best sequence for readers. Thus, he gets the effect of a list on a page, with freedom to rearrange the items with little extra writing. Next, he should put the underlined task title slip on top of the cluster of step slips after telescoping them together. His signature on that title slip documents his responsibility for it. A workshop group can record a vast amount of task know-how in a few hours.

(3) **Mutual aid critiques.** A one-author draft may have deficiencies or errors. Some steps may be overlooked or taken for granted. Some may be hard to understand as worded. Some sequences may be questionable. Mutual aid critiques make touch-ups and refinements possible. It is best to work in pairs for this. Each participant should try to improve each other's drafts in the light of his unique perspectives. But he should not change anything without the other's consent. Either person might be wrong. Next, the participants should talk it over, work out differences, agree, and SIGN on the task title slip. Several such mutual aid critiques and signatures produce a draft that can be officially adopted as a standard. The improvers should include people from both sides of interfaces or interactions.

(4) **Official adoption of procedures.** It helps if the "approvers" are in the workshop and serve as improvers. These managers' perspectives add a valuable dimension to the critiques. Their involvement helps them to become more realistic about some of the decisions they must make as generalists.

(5) **OJL by self-instruction.** With well-considered procedures on paper, a learner may ascertain much simply by reading. Editorial reviewers should make sure the steps are written in simple learners' language so self-instruction is easier.

(6) **Supervisory instruction (REAL OJT) based on adoption procedures.** With an officially agreed on and adopted checklist, a supervisor has some reliable and organized content for genuine one-to-one TRAINING (OJT) for those being supervised. The absence of such standards and content explains why OJT is so often haphazard or nonexistent.

(7) **Supervisory control and enforcement.** People do not always DO what they KNOW HOW to do. They may forget, or take shortcuts. Supervisory control and enforcement of standards must supplement the writing and learning of them. Standard procedures are like the vehicle traffic code in many ways. It is hard to enforce a standard of performance if it has never been written, agreed on, and adopted. The procedures aid the control as much as the instruction.

Know-How Networking

On 21 December 1984 the "USC PRODUCTIVITY NETWORK" was officially created as a new institutional resource for on-the-job learning of many kinds. It resembles a research center, publishing house, and computer system, all combined. Its goal is to assemble, organize, print, computerize, and apply such job know-how as described in this article. Following are some of its main features:

(1) **Workshops to collect know-how on slips.** The data base for network outputs can come from workshops run in Dallas or Indonesia, or wherever someone knows how to run one. Targeting notes may be prepared by leaders there, or by experts at USC. Targeting notes and slips can be transported by postal systems or the more rapid electronic technologies. USC classes are now being taught to international students on campus and in many nations around the world. Students in those classes can work with the network nucleus at USC. There is no limit to the range of productivity problems that might be attacked by such a network.

(2) **Network nucleus at USC.** USC now has a network director and typical support personnel. The focus will be on productive performance of useful activities, ranging from the simplest to the ultra-complex. The nucleus of professionals will serve local client organizations or those in other states or continents. They will seek to develop "MULTIPLIERS" of the Crawford slip method within the clients' systems. A network specialist will work as a teammate to someone within each client organization. Those two can jointly plan and run diagnostic and procedure writing workshops or other analyses. They may seek to build within each client's system a network similar to the one at USC. They might draw on the USC data bank and contribute to it. Models developed in one client's system can become resources for others. The USC nucleus will coordinate all activities.

(3) **Market survey of clients' needs.** As planners of a new institutional venture, the network needs to do a market survey to know who needs its help. Each reader of this article is a potential contributor to that survey. What troubles, problems, obstacles, or shortcomings in individual systems need such diagnostic and remedial help as we have described? What types of personnel need to learn better ways? Whose know-how could yield the learning content for retraining those people? How might clients assemble those know-how people for a slip writing workshop? How would they motivate them to attend and write? How might someone from USC help clients develop workable answers to such questions?

(4) **Computerized networking.** Electronic transmission is faster than shipping hard copy. Computers open up vast new publication possibilities. Much of the know-how that needs to be transferred might better go out through computer systems. The network's intensively exploring ways to do that. It sees the workshops as yielding valuable bodies of organized job know-how, perhaps first in printed manuals, then with computerized distribution.

(5) **Network progress and potential.** Following are case examples which show the prospects for the proposed network:

(a) Dr John W. Demidovich at the Air Force Institute of Technology (AFIT) began collaborating with Crawford in 1979. He is in great demand as a lecturer on management and productivity problems, both military and civilian. He often includes a slip workshop with his lectures, seminars, or classes. Thousands of slips may come from one of his audiences. Many thousands of these are now in the Crawford data bank in Los Angeles.

(b) Demidovich and Crawford led 90 officers from all bases in the Tactical Air Command (TAC) in a week-long workshop at command headquarters in 1980. They wrote procedures for about 200 contracting tasks by the method described in this article.

(c) Dr Robert M. Krone began collaborating in 1981. He teaches the Crawford slip method in his graduate classes in systems management at USC and around the world. His slips, collected worldwide, are now part of the team's data base. He is working intensively on computerized distribution of know-how from USC workshops.

(d) Krone and Crawford led week-long workshop activities for the Air Force Logistics Management Center (AFLMC) at Gunter Air Force Station in April 1984. About 40 experts in base contracting learned how to merge their combined know-how for better ways to buy goods and services for 130 Air Force bases. Those people are potential leaders of slip writing workshops at their respective base locations around the world.

(e) Krone and Crawford in May of 1984 repeated at Tyndall Air Force Base the same conference leadership format they used at Gunter in April. This time the problem was how to OPERATE those 130 bases. About 60 civil engineer experts now know how to collect slips on an urgent Air Force problem that may arise. Those 60, plus the 40 from the Gunter conference, greatly extend the geographical reach of the proposed network. Maintenance and further development of this networking capability is a major challenge. However, the capability may dissipate rapidly through disuse or rapid personnel turnover.

(f) Robert L. Zambenini uses the Crawford slip method in his nationwide consulting for major companies in the private sector. He teaches and uses it in his systems management classes for USC.

(g) Colonel Leo K. Thorsness, Director of Civic Affairs for Litton Industries, has run Crawford slip method workshops to help organize and operate such groups as the Vietnam Veterans Leadership Program (VVLP) and the Aerospace Alliance, plus other similar socioeconomic programs.

(h) Dr Gilbert B. Siegel, author of many books and articles on management, will direct and administer the new USC Productivity Network.

(i) Crawford, Thorsness, and Siegel were co-instructors in a USC course on "Authorship for Productivity." That trio will prepare USC professors, staff, and similar professionals to be the nucleus of the proposed network. They were learning the method while they worked on their own productivity projects and collaborated in planning the network.

CAUTION. The Crawford slip method is not as foolproof as an electric toaster. It is a high-technology PROFESSIONAL SYSTEM. There is more to learn about it than meets the eye. One does not attempt brain surgery after reading a medical journal. An instructor should not waste 50 people's production time in a workshop until he knows what he is doing. Even with thousands of good slips, he would not have a sound remedial program.

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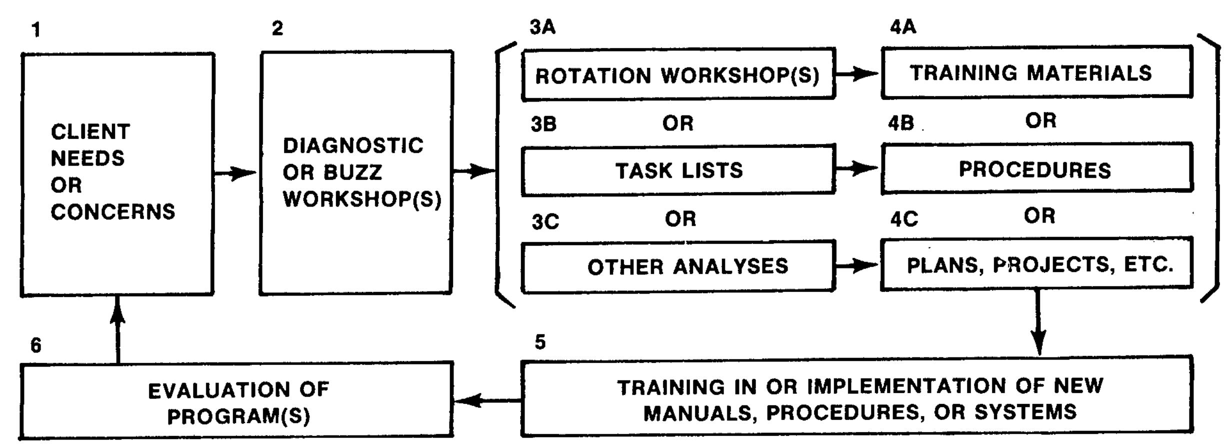

CRAWFORD SLIP METHOD SEQUENCE

Microcircuits

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They are the guts of every piece of military hardware out there. A few years ago, they were installed in noncritical backup systems, but now they are the heart and brains of military weapon systems. When they fail, the mission fails, the airplane stops flying, and we have a life-threatening situation. Their quality and reliability is paramount to the Department of Defense mission and is more important now than ever before.

Darrell Hill

Darrell Hill is an electronics engineer at the Defense Electronics Supply Center (DESC) in Dayton, Ohio. As Chief, Microelectronics Branch, Qualifications Division, Directorate of Engineering Standardization, Hill heads a group of engineers and technicians whose job is to ensure that the requirements in the military specifications and standards for microcircuits are met and that they receive the prestigious JAN (Joint Army-Navy) designation.

The general specification for military microcircuits is MIL-M-38510, *General Specifications for Microcircuits* (revised in October 1983). It establishes the general requirements for monolithic, multichip, and hybrid microcircuits, and the quality and reliability assurance standards which must be met in the acquisition of microcircuits.

Used in conjunction with MIL-M-38510 is MIL-STD-883, *Test Methods and Procedures for Microelectronics* (revised in August 1983), which outlines the test methods and procedures for microelectronics. This military standard establishes uniform methods and procedures for testing microelectronic devices, including basic environmental tests to determine resistance to deleterious effects of natural elements and conditions surrounding military and space operations, and physical and electrical tests. It also specifies suitable conditions obtainable in the laboratory and at the device level which give test results equivalent to the actual service conditions existing in the field.

The Rome Air Development Center, Griffiss Air Force Base, New York, is the military services' preparing activity for the specifications and standards mentioned, and DESC is the agent which actually prepares and publishes the documents. Although the military services have the final word on what the specifications and standards are to be, preparation is a joint venture between them, DESC, the device manufacturers, and their ultimate prime contractor or users.

Manufacturers who wish to produce JAN microcircuits must be listed on a Qualified Products List (QPL) maintained by DESC's Engineering Directorate. Currently, 18 manufacturers, who are qualified to produce 501 different device types, are on this list. To be included on this list, manufacturers must undergo an initial certification audit by DESC engineers to confirm that the manufacturer's fabrication line, assembly, and test operations meet the stringent requirements of the military specifications and standards. DESC conducts reaudits every two years and will perform required additional audits as necessary. Other audits and inspections are also conducted by the Defense Contract Administration Services (DCAS) offices.

If microcircuits are the heart of military systems, testing is the heart of microcircuit quality. As Hill further states:

> You don't test in quality; you have to build it in. That's what certification is all about. But the tests outlined in MIL-STD-883 are designed to assure you have quality and reliability in the devices. You need that assurance before you can put the microcircuits in military hardware. The cost of replacing failed parts and the cost, perhaps in human life, of mission failure are too great. We can't take that risk.
>
> JAN microcircuits cost anywhere from a few dollars to a few hundred dollars, but if they fail they can ground a multimillion dollar airplane, or cause a problem in the space shuttle. Because of the rigorous testing they undergo, JAN microcircuits should have a failure rate of less than one tenth of a percent, and they should last in the neighborhood of 20 to 30 years—as long as their parent systems. There is no higher reliability or quality device available to industry; you cannot buy anything better than a JAN microcircuit.
>
> The rigorous tests detailed in MIL-STD-883 are the result of the combined effort of component experts from the military and industry. They are based on a lot of data and studies, and are designed to detect specific problems that could result in failure of the device. If it's going to fail, we want it to fail in the plant, not in the field.

Two standard levels of device screening are specified, one for Class S devices, which are used in space applications, and the other for Class B devices, which include all other applications. Each microcircuit produced is subjected to a series of screens.

The inspection lot which passes these screens is then subjected to Quality Conformance Inspection (QCI) or sample testing on a lot-by-lot basis for both Class S and Class B devices, according to Method 5005, MIL-STD-883, to assure that the device and lot quality conforms with the requirements of the applicable procurement document.

"If the testing isn't done and done right, we don't have assurance that we have good quality and a reliable device. If a critical test is left out, we could have some problems," said Hill. "Plus we may not be getting the quality of device we paid for. JAN parts cost roughly twice as much as commercial parts, largely because of the stringent testing requirements. When that testing isn't done, we're not getting our money's worth."

When DESC learns that testing is not being done or that some other deviation from the specifications and standards has occurred, its engineers assess the problem to determine its seriousness, identify corrective actions, and determine if it is an isolated instance or if the whole manufacturing system is out of control. If the latter is the case, it is likely that DESC, with the consent of the preparing activity, will remove the manufacturer from the QPL until the problem is rectified and the manufacturer again is in compliance with the specification. Removal from the list means that manufacturers cannot take orders for or ship the affected JAN parts, but they may be permitted to manufacture for inventory. However, DESC can decertify the manufacturers' production line, in which case they cannot build JAN parts.

Removing a manufacturer from the QPL is not an action that DESC takes lightly. It usually has severe economic impact on the manufacturer and causes supply problems in the military logistics system. When a manufacturer is removed from the list, DESC usually requires the manufacturer to issue a Government, Industry Data Exchange Program (GIDEP) alert describing the problem that resulted in the removal. The alert is a mechanism to give the users guidance on what to do with the parts. Often the manufacturer will replace all returned parts with properly tested, reliable ones.

Even so, the user is faced with many problems. First, all the national stock numbers (NSNs) of device types affected in a QPL removal must be identified. A few dozen device types may generate hundreds or even thousands of NSNs, and identifying them is a big job. Then, if warranted, original equipment manufacturers and the military services remove the devices from inventory, circuit boards, or current systems. The military services may even have to remove the devices from the hardware unit assigned, in the field. Then, the displaced parts must be shipped to the manufacturer and the replacement parts received and installed. All this activity costs money, affects production schedules, and impacts military readiness.

Often, the difficult question is: What do we do with parts of unassured quality? Depending on the nature of the problem with the device and its application, the military service program office may grant waivers to original equipment manufacturers to use devices even if the manufacturer has been removed from the QPL. Such a decision is most likely when the manufacturer is the sole source for the device. Without such a waiver, however, DCAS will not accept for delivery to the government from original equipment manufacturers (OEMs) systems containing such noncompliant devices.

Since 1980, five microcircuit manufacturers have been removed from the QPL. An additional firm had its production of JAN devices frozen. All the manufacturers were subsequently reinstated to the QPL. The length of time firms remained off the QPL ranged from two weeks to more than eight months.

When JAN microcircuits which were not subjected to proper testing were returned to the manufacturer and tested in accordance with the specifications and standards, they experienced a much higher failure rate than the .1% expected from JAN parts. Some of the failure rates were in the 10% to 15% range. These results show, according to Darrell Hill, that manufacturers who claim commercial parts are "just as good" as JAN parts are incorrect.

> A manufacturer will say he can supply you with anything you want to buy, that he can supply high quality parts without someone looking over his shoulder. But if manufacturers producing JAN parts sometimes fail to meet the required standards, how often is it happening with commercial parts when nobody's watching the manufacturer?
>
> Even if that were not the case, the proliferation of parts which are virtually "off the shelf," but are produced to an OEM drawing rather than to a standardized specification, drives up the price of the parts and creates many serious problems for the military logistics system, which must buy and manage these parts to support military systems for years and in some cases decades.
>
> I think there are companies out there who are doing a very good job. Others have experienced problems because they have grown very large without making the progress in quality assurance that they have in other areas. Large companies employ lots of people who need to be trained and supervised. Microcircuits are sophisticated devices, and the producer has to be equally sophisticated in quality assurance areas to produce them. Then there is the pressure to meet production schedules, and shortening or omitting tests may be a tempting way to meet tight schedules. A manufacturer could save money by not performing tests he's getting paid to perform.
>
> But I think the fact that manufacturers have been removed from the QPL, and later reinstated after problems have been rectified, shows the JAN system is working well. The system is detecting problems and correcting them. It's doing what it's supposed to do: assure that the military services are getting the high quality, high reliability electronic parts that have become so important to our nation's defense.

▶ FROM 25

size of a medium-sized console television set. Memory cycle speeds are already measured in picoseconds, a development only one year old. For the first time in modern history, we have more technology than we can use. We also require more and more information in today's world to make more sophisticated decisions about more sophisticated problems. And just around the corner, if the Japanese have their way, true artificial intelligence will become a reality—a thinking, reasoning machine! Even now, with today's technology, those in the know are no longer talking about data bases and data base management systems. Instead, the concept of metaknowledge, information about information with logical operations, is taking hold. Now, the industry is beginning to talk about knowledge bases and knowledge-based information systems.

What is obvious, however, is the work that yet needs to be done. Whatever approaches we take toward valuing information and preparing to budget effectively for information resources, we must keep our options open. Flexibility is a key word and, with good information systems in place, we should be able to manage information efficiently and effectively.

References

1. *Information Resources Management*. Washington, D.C., U.S. Government Printing Office, 1977.
2. "Information Management in Public Organizations: Defining a New Resource Management Function," *The Bureaucrat*, Vol 7, Winter 78, pp. 4-10.
3. *Information Management in Public Administration*, Horton and Marchand, Information Resources Press, Arlington, VA, 1982.

"For too long, the reliability and maintainability of our weapon systems have been secondary considerations in the acquisition process. It is time to change this practice and make reliability and maintainability primary considerations.

Reliable weapon systems reduce life-cycle costs, require fewer spares and less manpower, and result in higher sortie rates. Similarly, maintainable weapons require fewer people and lower skill levels, and reduce maintenance times. Equally important, good reliability and maintainability improve the mobility of our forces—fewer people and less support equipment to deploy. They reduce dependence on airlift and prepositioning, while increasing our ability to generate sorties.

We must emphasize reliability and maintainability throughout the acquisition process—from requirements definition, through concept development, design, production, and acceptance. Everyone must insure reliability and maintainability requirements are met through every step of the process. Reliability and maintainability must be coequal with cost, schedule, and performance as we bring a system into the Air Force inventory.

Our efforts, however, should not be confined to new or future programs. Many current systems will be with us into the next century. We need to make modifications which provide proven increases in reliability and address specific problems of maintainability."

Quoted from 17 Sep 84 ACTION MEMORANDUM, signed by General Charles Gabriel, Chief of Staff, and Verne Orr, Secretary of the AF.

Consolidated Index Volume IV—Volume VIII Winter 1980—Fall 1984

Part II
AUTHOR INDEX OF ARTICLES

(cont from Fall 84 issue)

Most Significant Article Award

The Editorial Advisory Board has selected "Future World Systems—The Calamity of Logistics" by Stanley A. Tremaine and Paul J. Palcic as the most significant article in the Winter issue of the *Air Force Journal of Logistics*.

Most Significant Article Award for 1984

The Editorial Advisory Board has selected "Reliability and Maintainability in the Air Force" by Major Gordon M. Hodgson, USAF, as the most significant article published in the *Air Force Journal of Logistics* during 1984.

CURRENT RESEARCH

Air University Logistics Research in the PME Classes of 1983-84

The logistics related research papers and projects completed by the students of Air War College and Air Command and Staff College during the 1983-84 academic year are:

Air War College

"Multi-Phase Acquisition of Support Equipment: An Alternative Approach"—Colonel Don G. Bush. **(Winner - Society of Logistics Engineers (SOLE) Logistics Award)**

"Increasing Competitive Procurement of Engine Spare Parts: Let's Be Careful"—Colonel Stephen P. Condon. **(Runner-Up - Society of Logistics Engineers (SOLE) Logistics Award)**

"Strategies for the Use of Product Performance Agreements to Enhance Supportability"—Colonel Lewis E. Curtis.

"Factors and Constraints to Take into Account During the Conception of Modern Weapon Systems"—Lt Colonel Jean-Jacques Flock, French Air Force.

"DLA Support for Weapons Systems of Military Services"—Donald T. Gardier.

"Deployed Depot Support for Sustained Operations"—Lt Colonel William C. Shaw, Jr.

"Combat Oriented Supply and the ANG"—Lt Colonel David C. Stephenson.

"The Relationships of Industrial Capacity, Mobilization and Defense Policy"—Colonel Frank E. Thieme, Jr.

Air Command and Staff College

"Nuclear Hardness Logistics Challenge"—Majors Terry L. Brum and Robert D. Hays. **(Winner - Society of Logistics Engineers (SOLE) Logistics Award)**

"Increased Contracting Professionalism - Standards for Contracting Officers"—Major Robert J. Ivaniszek.

"Understanding Logistics - A Prerequisite for Mission Effectiveness"—Major Walter J. Kozak.

"TNT and the Clean Water Act - Case Study of a Dilemma"—Major Mark E. Meranda.

"Objectives of an Aircraft Quality Assurance Program"—Major Richard N. Moore.

"A Comparison of Soviet and U.S. Military Transportation Systems"—Major Charles P. Russell.

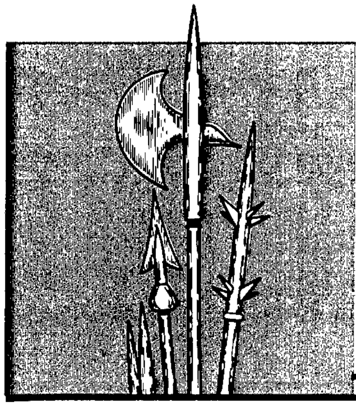
"A Critical Evaluation of the Use of Cost per Flying Hour Factors to Adjust the USAF POM Requirements for Replenishment Spares"—Major J. M. Wallace.

Loan copies are available through the Air University Library, Interlibrary Loan Service (AUL/LDEX), Maxwell AFB, Alabama 36112-5564. Additional information on the ACSC studies can be obtained through ACSC/EDCC, Maxwell AFB, Alabama 36112-5542 (AUTOVON 875-2867; Commercial 205-293-2867).

Item of Interest

Winner of NAPM Doctoral Dissertation Grant

Lieutenant Colonel Gary L. Delaney, Instructor in Contracting Management, Air Force Institute of Technology (AFIT), has been named winner of a doctoral dissertation grant awarded annually by the National Association of Purchasing Management (NAPM). The purposes of the grant are to encourage research in the purchasing/contracting field and to help develop academicians who are interested and qualified to teach in the contracting area. Colonel Delaney attended the University of Texas at Austin under AFIT sponsorship and is now completing his Ph.D. dissertation, "Determinants of Efficiency in Public Sector Purchasing: A Study of the Contracting Process in United States Air Force Weapon Systems Program Offices." He is presently Program Manager, Contracting and Manufacturing Management Option, School of Systems and Logistics, AFIT. In this position he teaches, researches, writes, and develops curricula in the contracting and manufacturing major within the Master of Science in Logistics Management degree program. He is also available to do consulting work with Air Force/DOD organizations interested in contracting productivity assessment/enhancement, and other contracting topics.



Project Warrior

Project Warrior is a concept fomulated to create an environment where our people can learn from the warfighting lessons of the past and use that knowledge to better prepare for the future.

Logistics Warrior

Logistics Warrior is the contribution of your journal to help create that environment. Your suggestions are solicited.

LOGISTICS WARRIORS: A New Strategy

"So long as a reasonable degree of nuclear parity exists between the United States and the Soviet Union, one must conclude that an overt Soviet invasion of Western Europe is the most remote peril facing this country today. Far more probable will be peripheral encounters, perhaps involving the two superpowers directly, in which vital interests of the United States may be seriously imperiled.

In such circumstances it may become necessary, from time to time, for Washington to invoke the ultimate sanction in international affairs: armed force. The odds are extremely high that any crisis scene will lie at a considerable distance from this nation's shores. Moreover, history teaches that when armed intervention is required, speed of reaction is a critical factor. The more rapid the response to a crisis, the smaller the amount of force usually needed to put things right. If to these fundamentals, one adds the physical limitations suffered by airlift and the political constraints exemplified by overflight and landing rights, it becomes evident that only across the vast reaches of international waters can men and equipment be moved without significant restriction.

Unfettered access to global littorals, achieved by means of surface ocean transport, however, sacrifices the element of speed possessed by aircraft. The only feasible method of overcoming this comparative deficiency of maritime forces is forward deployment and prepositioning. This principle has underlain the presence of the Sixth Fleet in the Mediterranean and the Seventh Fleet in the Western Pacific since their inception. Forward deployment, however, raises the difficult issue of bases.

During the Second World War, the United States Navy amply demonstrated its ability to operate at sea for extended periods of time without direct recourse to bases. Nevertheless, as the combat zone moved further from American territory, it became necessary to establish forward facilities from which mobile logistics groups could operate. Without those advance bases, the support mission would have been infinitely more difficult and the task of defeating the Japanese far more arduous and time consuming. Many of these logistics imperatives still obtain.

The practice of prepositioning heavy combat equipment and supplies is today well established in NATO Europe. Where U.S. leased bases are available in the Western Pacific, that practice has been followed to a lesser extent. Unfortunately, the progressive loss of access to foreign territory where such commodities were stored in the past has seriously eroded the capability of the U.S. Fleet to perform forward-deployment tasks on a sustained basis. The situation is currently most evident in the Indian Ocean where the only assured facility available—it is far too modest to boast the title "base"—is the tiny atoll of Diego Garcia. Although the United States has managed to acquire pledges of territorial usage for logistics purposes from Oman, Somalia and Kenya, the political uncertainties attending access in time of crisis cannot be ignored.

The difficulties involved in maintaining significant naval strength—ships, aircraft and amphibious forces—on station in some regions of the world notwithstanding, it is impossible to avoid the conclusion that for an insular nation, as the United States indisputably is despite its continental size, maritime forces offer the most appropriate means of protecting its interests."

From: *U.S. Strategy at the Crossroads: Two Views* by Jeffery Record and Robert J. Hanks.

LOGISTICS WARRIORS: High-Low Mixes

"In another important response to the problems of reliability, cost, and numbers in advancing military technology, defense experts have argued the relative merits of what is called 'high mix' versus 'low mix' investment. Simply put, proponents of a high mix, of continued investment in the most advanced technologies, point to the increasing sophistication of America's adversaries, to the possibility of falling into obsolescence, to uncertainties about likely future uses of American forces. They argue that only the most advanced technology will be (1) adequate to deal with the most worrisome enemies, and (2) flexible enough to make American forces effective in the variety of political-military contexts the nation might face. Advocates of the 'low mix' contend that the costs of advanced technologies make it impossible to buy necessary numbers of weapons and to maintain them properly; that numbers matter; that in places such as Europe, where Soviet military power is greatest, the United States has no choice but to deploy more and cheaper planes and tanks even if they are individually less capable. There are also, as one might expect, advocates of a middle course, a 'high-low mix.' It should be possible, they suggest, to analyze expected uses of weapons to determine which of them require the ultimate in technological sophistication and, in contrast, which might be adequate even though less than the best.

'High mix' and 'low mix' are, of course, relative terms. Nearly all weapons are very expensive indeed. But some cost enough more than others to make a difference in basic choices about force size and composition. Consider a high-mix versus low-mix issue that has been at the heart of naval force planning for the last decade: whether to build a small number of very large nuclear aircraft carriers, such as the *Nimitz,* carrying about one hundred warplanes each; or a larger number of smaller aircraft carriers, possibly conventionally powered, carrying forty to sixty aircraft each. The larger ones cost more than $2 billion apiece, and with the cost of their aircraft and associated equipment, more than $4 billion each. The low-mix carrier's costs have been a matter of dispute, but usually they are estimated at between $1.2 and $1.6 billion, plus planes, for a total cost of about $3 billion, or slightly more.

From issue to issue, each position—high mix, low mix, and high-low mix—has merit. But political uncertainties and analytic difficulties have prevented overall consensus within the military on high-low mix issues. From year to year, budget to budget, and administration to administration, the direction pursued in military modernization varies. Yet in general, with a few notable exceptions, the military leadership of recent years has tended to favor high-mix systems; nonuniformed military experts in the Congressional Budget Office, in the Office of Management and the Budget, and on congressional staffs more often favor low mix or high-low mix compromises. Decisions on major weapons and systems thereafter reflect the prevailing bureaucratic and political balances, and not their military merits, a fact that also contributes to long-term inconsistency in the character of American military forces."

From: *Defense or Delusion?: America's Military in the 1980s* by Thomas H. Etzold.

LOGISTICS WARRIORS: Liddell Hart on Sherman

"This was the first war between modern democracies, and Sherman saw very clearly that the resisting power of a democracy depends even more on the strength of the people's will than on the strength of its armies. His strategy was ably fitted to fulfill the primary aim of his grand strategy. His unchecked march through the heart of the South, destroying its resources, was the most effective way to create and spread a sense of helplessness that would undermine the will to continue the war.

The havoc that Sherman's march produced in the opponent's back areas left a legacy of bitterness in later years that has recoiled on Sherman's historical reputation. But it is questionable whether that bitterness or the improverishment of the South would have been prolonged, or grave, if the peace settlement had not been dominated by the vindictiveness of the Northern extremists who gained the upper hand after Lincoln's assassination. For Sherman himself bore in mind the need of moderation in making peace. That was shown in the generous terms of the agreement he drafted for the surrender of Johnston's army—an offer for which he was violently denounced by the Government in Washington. Moreover, he persistently pressed the importance, for the future of the forcibly reunited nation, of reconciling the conquered section by good treatment and helping its recovery."

From: *Why Don't We Learn From History?* by B. H. Liddell Hart.

LOGISTICS WARRIORS: Reality of Special Forces

"Very few regular officers went to Special Forces before the days of its great popularity in the 1960s. There are various reasons for that. Career management advisors in Washington steered ambitious youngsters away, and still do today. The entire concept and existence of Special Forces was so secret that few officers knew either of them or what they did. Most recruiting was word of mouth among friends. The noncoms would talk to those officers whom they thought would be good at the business; the handful of officers opted in by Bank also explained the situation to their friends and acquaintances. So Special Forces in the early days got a few castoffs and less than a normal percentage of quality career officers. It also got some freethinkers who had never adapted to the spit and polish of the peacetime, palace-guard, 82nd Airborne Division. It got the innovators and imaginative people who wanted to try something new and challenging, who chafed at rigid discipline, and who didn't care what the career managers at the Pentagon said or believed. Many were reserve officers who had no notion of wearing stars and hence never designed their careers around the idea of getting certain vital "tickets punched." An amazing number of those early Special Forces officers went on to a full thirty-year career, serving in the final years as full colonels, not a few of them commanding one Special Forces Group or another. They were an incredibly tough and competent little group of officers who knew how to fight and did so at the appropriate times. One of the early officers, "Blind Mike" Healy, retired in the grade of major general. Another, Dave Grange, was recently still serving as the three-star commanding general of Sixth Army. A sprinkling of regular officers began to request assignments, but sometimes found they were not welcomed by the freewheeling reserves. Some left with a bad taste in their mouths, while a few found their niches and stayed.

Although outstanding officers are necessary for Special Forces excellence, the Army discourages repetitive SF tours for officers, with some justification. An officer needs a good, solid base of conventional soldiering to be able to put unconventional operations in perspective. He needs it, too, in order to be accepted and respected by the other line and staff officers with whom he has to deal. Many of the reserve officers who chose to stay continuously with Special Forces hurt their careers. Many left the service after twenty years, and some merely crossed over to comparable jobs with the CIA or AID."

From: *Inside the Green Berets* by Colonel Charles M. Simpson III, USA (Ret).

LOGISTICS WARRIORS: Korea - Mechanization

"Another confusing logistical problem resulted from UN and ROK operation and maintenance of equipment. The ROK forces particularly were handicapped by a conglomeration of vehicles, a lack of sufficient organic maintenance organization and control, and a lack of maintenance equipment. Replacement parts were lacking for obsolete ROK materiel, and Thai and Filipino troops were judged incapable of handling medium tanks or cold weather maintenance. The Greek troops had so little experience with mechanization that they drove many of their vehicles upon debarkation from Pusan to Suwon, some 250 miles, with little or no grease! While the Dutch provided few vehicle or weapons maintenance problems, the French were so accustomed to cannibalizing their US-supplied World War II equipment for spare parts that they had to undergo extensive training to learn new maintenance standards and techniques for replacement equipment."

From: "Allied Interoperability in the Korean War," *Military Review* (Jun 83) by B. Franklin Cooling.

LOGISTICS WARRIORS: USSR—Hardware and Politics

"In the Soviet perception, one must be careful not to confuse the political aspects of military power with the demands of actual conflict. Politics, economics, and military power come together at the level of *doctrine*, the highest conceptual level in the Soviet hierarchy of military thought. In the Soviet system, doctrinal consensus is embodied at the highest level before military strategy is formulated and military forces are planned. Military strategy and planning are therefore subordinate to military doctrine and theoretically subject to the broadest possible political and economic interpretations. This would put the Soviet military at the mercy of the whim of the politician and the economist, if it were not for the fact that there is a clearly prevalent and universal attitude that the success, and even the survival, of the Soviet Union depends on massive Soviet military power.

The Soviet view of war is thus a very "political" one, but it emanates from a simple and practical attitude toward military hardware. Political notions based on military power are not really the concern of the military man. In any case, such notions must flow from the ability to fight effectively. No soviet military officer would be assigned "deterrence" as his primary mission. His task is to be able to fight and to win. Deterrence, if it flows from military capabilities and the broader political and economic context of international affairs, is the business of the political leadership.

Thus, the Soviets do not choose between deterrence and warfighting. Though Western discussion seems to suggest that the Soviets must accept one or the other, the Soviets understand both. War and military forces remain "instruments of politics" in the nuclear age in spite of the fact that the "scale" and "depth" of nuclear war have caused changes in the relationship between war and politics. But a keen eye is kept on the difference between theoretical concepts, the political effect of the *nonuse* of force, and the requirements for the actual conduct of war. The Soviets clearly have grasped the fact that the *prospect* of war in the nuclear age has political significance, but this has not permitted the peacetime configuration of Soviet military posture to become the plaything of academics and politicians.

These considerations do not apply only to nuclear weapons. There might well be a nuclear phase in any major conflict, and the use of nuclear weapons will probably be the decisive act in the war. Still, there is no Soviet tendency to make a fetish of nuclear weaponry. In the Soviet view, nuclear weapons are necessary but not necessarily sufficient. Conventional military forces must be adequate to ensure and consolidate final victory. On the Eurasian landmass this means clear superiority over any potential opponent."

From: *Soviet Perceptions of War and Peace* by Steve F. Kime, edited by Graham D. Vernon.

"When the enemy assesses our forces, he values only those forces which the logistics community has ready for combat, or can get ready in time, and then sustain for a requisite period of combat."

Gen F. M. Rogers (Ret)

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