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AIR COMMAND AND STAFF COLLEGE

AIR UNIVERSITY

EIGHTH AIR FORCE BOMBING 20-25 FEBRUARY 1944:

HOW LOGISTICS ENABLED "BIG WEEK" TO BE "BIG"

by

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Abstract

Eighth Air Force (8AF) conducted the US's first thousand-bomber raids against Germany in February 1944--recorded in history as Big Week. Until that time the United States Army Air Forces (USAAF) was not able to concentrate such firepower on the enemy in such a short period of time. It took much effort to make Big Week "big" covering the spectrum of planning and execution activities dating back to the end of World War I that were adapted and flexed to be successful in a different context. Indeed, the depth and breadth of the preparations required to successfully execute Big Week on the scale intended is deserving of a closer examination.

Sources include books and periodicals from the Fairchild Library and the Air Command and Staff College curriculum as well as several primary source documents from the archives of the Air Force Historical Research Agency. Information from 1918 through 1947 was reviewed and analyzed in order to produce a thorough review of the components within the operational art element of logistics and the contextual elements that influenced preparations for and execution of Big Week.

Leadership from President Roosevelt to first line supervisors influenced 8AF logistics before February 1944. Major General Hugh J. Knerr was the one man that stood out as the champion of USAAF logistics. He influenced the concept of logistical operations in the European Theater of Operations (ETO) and, more specifically, put logistics on a level of importance equal to that of operations within the United States

Strategic Air Forces (USSTAF). He synchronized logistics with operations and strove for constant improvement by making organizational and process changes aimed at increasing logistical responsiveness, effectiveness, and efficiency.

Many others made important contributions to 8AF logistics capability. The British provided tremendous host nation support including construction of new airfields, skilled and unskilled labor support, supply items, and transportation. The British host nation support 8AF received far surpassed what a cursory review of World War II history leads one to believe and serves as a model for US-led coalition operations in the 21st century. The US Merchant Marine and US Navy provided sealift of goods from the stateside depots to the theater. The US Army provided supply support of common items and Air Service Command (ASC) provided technical and supply support. Last, but not least, both civil servants and civilian contractors provided depot maintenance and in-theater technical support.

Reflecting on what was learned from the experiences associated with preparing for Big Week has served to reinforce the fact that logistical preparation and sustainment was a complex, ever-changing, "brute force" undertaking from which many lessons were learned.

Part 1

Introduction

> *If any indisputable logistic lesson can be drawn from World War II, it is that in any major war involving industrial powers, no nation can hereafter emerge victorious without substantial and sustained superiority over its enemy in the quality and the quantity of its weapons and supporting equipment.*[1]
>
> — Maj Gen O.R. Cook, USA

The objective of Big Week was to defeat the Luftwaffe by destroying its means to continue the war and thus gain air superiority before Operation Overlord.[2] Eighth Air Force (8AF) carried out the bulk of the bombing during Big Week, 20-25 February 1944, with support from Fifteenth Air Force (15AF) and Britain's Royal Air Force (RAF). The VIII Air Force Service Command (AFSC) provided 8AF with superb logistics support resulting in 8AF being able to kick off Big Week with an unprecedented 1,292 operational bombers and its reception of 119 bombers from AFSC repair activities that week to replace 158 aircraft lost in action. On 20 February 1944, 8AF launched 1,004 bomber sorties to begin Big Week.[3]

The performance of 8AF and AFSC logisticians was critical to mounting such a "big" operation. Preparation including industrial mobilization, unit build-up and bed down, stateside logistic support facility expansion and modernization, training and equipping of personnel, and organization of air logistics activities to support operations on a scale the US had never before experienced was necessary for Big Week to occur

when it did. Much of the planning, preparation, and execution of 8AF bombing operations was subject to uncertainties that made logistics support difficult and required improvisation.[4]

This discussion will center on the logistical planning, preparation, and operations in the US and the United Kingdom (UK) that affected 8AF and enabled it to initiate and sustain such "big" bombing raids. The dedication of US Army, US Army Air Forces (USAAF), RAF, US Navy, merchant marine, contractor personnel, and elected officials to effective logistics functions contributed to make 8AF more potent during Big Week than ever before. Examination of the evidence will make it clear that the organizational and process developments which yielded logistical support improvements prior to Big Week was what gave 8AF the ability to initiate and sustain such "big" operations.

Notes

[1] Major General O.R. Cook, "Logistic Lessons of World War II," *Lecture to Air War College USAF HRA, K239.7162241-22* (10 Dec 47), 4.

[2] Stephen L. McFarland and Wesley Phillips Newton, *To Command the Sky* (Washington, D.C.: Smithsonian Institution Press, 1991), 168-169.

[3] USSTAF, "Materiel Behind the 'Big Week'," *USAF HRA, 519.04-1* (20-25 Feb 44). 4. On 20 February 1944, Eighth Air Force had fighter escort support from both Eighth and Ninth Air Force units totaling 902 sorties.

[4] Jacob A. Stockfisch, *Linking Logistics and Operations: A Case Study of World War II Air Power* (Santa Monica, California: RAND, 1991), v.

Part 2

The Foundations of Eighth Air Force Logistics

> *Armies do not go out and have a fight and one guy wins and the other loses and the winner takes all. Throughout history victorious commanders have been those that knew logistics when they saw it. Before any plans can be made to provide an army, logistics must be provided first. History has changed a lot, but logistics has been the crux of every one of these changes; the nail that was missing which lead to the loss of a country lead to a lot of those decisions.*[1]
>
> — Maj Gen Hugh J. Knerr, USAAF

The evolution of a myriad of civil, civil-military, and military organizations, coupled with industrial mobilization planning and implementation, greatly influenced 8AF's logistical capacity, capabilities, and ability to sustain flying operations. The abilities and talents of their leaders were key to the efficiency and effectiveness of these organizations' contributions to the planning and execution of industrial mobilization. Many civilian and military leaders had concepts of how mobilization should be prioritized. Military industrial mobilization plans were created in isolation so were not a reflection of the civilian leadership's expectations and desires and the activities of military leadership were often directly conflicted with the efforts of the responsible civilian-led organizations. As plans and organizations to oversee mobilization evolved, much of the logistical foundation was laid that would permit 8AF to execute Big Week. Thus, review and analysis of these plans and organizations that were precursors to and

supporters of 8AF logistics is important. *The Big "L": American Logistics in World War II*, edited by Alan L. Gropman, offers a detailed accounting of the many organizations that served as the foundation of logistics in WWII, so this work will just quickly review some of the more important highlights that affected 8AF logistics.[2,3]

The military created the Industrial Mobilization Plan of 1924 and revised it in 1934. However, serious flaws existed because the operations staff that prepared the plan did not consult logisticians and the military did not seek input from civilian leadership or industry. Thus, planning during this period was superficial at best and therefore, "the muddling that had accompanied World War I mobilization was being repeated."[4]

President Roosevelt wanted 50,000 aircraft produced per year, yet as of 1940 there was still no guidance as to what types of aircraft to build.[5] In September 1941, faculty from the Air Corps Tactical School drafted Air War Plans Division-1 (AWPD-1) to address what would be needed should the US go to war.[6] In August 1942, AWPD-1 was rewritten to address the requirements for conducting an air offensive against Germany resulting in a new plan known as AWPD-42.[7] In the fall of 1942 the USAAF staff made aircraft utilization projections, by aircraft type, which included allocations for attrition, transit, reserves, training, and modification for November 1942 through December 1944 totaling in excess of 65,000 aircraft.[8] None of the aforementioned plans appears to have addressed the needs of the RAF, any logistical requirements beyond personnel end-strength, or anything more than a generic total of munitions required. Operational planning appears to have taken precedence over logistical planning and resulted in war plans that were incomplete at best.

In the summer of 1943 the Bradley-Knerr committee made an extensive study of air forces installations in Europe and published the Bradley Plan that became part of the Air Force Build-Up Plan. The plan, largely written by Hugh Knerr, prescribed the manning and organization of air units and installations. The Air Force Build-Up Plan provided for coordinated building up of combat units, increased flow of materiel, expansion of maintenance and supply installations, and increased stateside ASC personnel. Headquarters (HQ) USAAF adopted the Bradley Plan and shortly thereafter Knerr was selected to command the VIII AFSC in the UK where it became his task to put the plan into operation.[9]

Proliferation of organizations and procedures hampered industrial mobilization and supply. Military logistic organization and procedures were flawed and inefficient. Results were often only gained through great efforts on the part of logistic leadership. Duplications of supply lines among the US Army, USAAF, and the US Navy complicated and slowed logistic operations. Many of these challenges would only be overcome through great efforts on the part of logistic leadership.[10]

Beginning in early 1942, General Marshall headed the Combined Chiefs of Staff and had authority over the munitions allocation process; however, Churchill and Roosevelt retained the authority to resolve disagreements.[11] The Army and Navy Munitions Board determined US military munitions requirements and the Munitions Assignment Board controlled assignment of all military hardware. The president and his various civilian organizations controlled resource allocation and the means of production. Clearly with no less than four large organizations involved in munitions planning there was high potential

for the major difficulties that would hinder the effectiveness of Allied bombing from late 1943 onward.

In 1940 Roosevelt created an Advisory Commission to address industrial mobilization. The activities of military leadership to secure control of the economy contributed to the commission's ineffectiveness resulting in Roosevelt's disenchantment with it.[12] The president replaced the Advisory Commission with the Office of Production Management (OPM) on 7 January 1941. The OPM surveyed industry to determine output by examining the potential to standardize production processes for the purposes of producing large quantities, and as a result identified a critical shortage of machine tools.[13]

In July 1941, Roosevelt created the Supply Priorities and Allocations Board within the OPM, gave the board the authority to set priorities, and appointed Donald Nelson, of Sears Roebuck, its leader. Late in 1941 Nelson cut back on production of automobiles, appliances, and raw materials for civil sector use. Unhappy officials who sought assistance from Department Secretaries or the president whenever things did not go their way rendered the board ineffective.[14]

In January 1942, Roosevelt created the War Production Board (WPB) and appointed Nelson chairman. The WPB, like its predecessors, lacked the authority to make decisions that would affect the civilian populace and its authority was further diluted when the president later created the Office of War Mobilization.

On 10 February 1942, the last automobile was produced for civilian use and the entire industry, consisting of 7.5 million people employed by 1,000 prime and tens of thousands of subcontractors, became part of the defense establishment. The automobile industry produced tens of thousands of aircraft including the bulk of the B-24s, 50

percent of the aircraft engines, almost a third of the propellers, 33 percent of the machine guns, and 20 percent of the munitions that supported the war effort. The WPB "had the power to compel acceptance of war orders by any producer in the country, and could requisition any property needed for the war effort."[15]

The military put much effort into planning, but those plans were incomplete because they were formulated in a vacuum. The military did not seek the advice of captains of industry nor did it consult with elected officials. The proliferation of civilian, civil-military, and military organizations, often with overlapping functions and lacking authority, resulted in duplication of effort, confusion, and frustration. The military tried to gain control of the economy, contrary to the desires of the president, adding to the problems. The military would have been better served by trying to work with the civilians rather than against them. The military leadership's behavior was counterproductive and retarded the efforts to build and sustain the logistics tail necessary to conduct large air operations like Big Week. Cook, Deputy Director of Service, Supply & Procurement, summed it up well,

> It is, therefore, imperative that advance plans provide for more effective civilian war agencies. Most serious duplications, wasteful methods, and complex procedures existed during World War II, when the organization of these agencies was largely improvised. Their very multiplicity impeded the accomplishment of essential activities.[16]

Notes

[1] Major General Hugh J. Knerr, *"Strategic, Tactical, and Logistical Evaluation of World War II," Lecture to Air War College USAF HRA, K239.716246-18* (19 Oct 46), 3.

[2] Joseph E. Muckerman, II, " 'L' is for Logistics." *Joint Force Quarterly* (Summer 1997) no. 16, p. 121.

[3] Jan P. Muczyk, "The Big L: American Logistics in World War II." *Airpower Journal* (Spring 1999) Vol. 13, no. 1, pp. 119-120.

[4] Alan L. Gropman (ed.), *The Big "L": American Logistics in World War II* (Washington D.C.: National Defense University Press, 1997), 10-15, 94, 98-100.

Notes

Organizations and planning that focused on industrial mobilization were born out of the National Defense Act of 1920 and the Industrial Mobilization Plan of 1924. The War Industries Board, established in 1917, was the focal point for the nation's resource and acquisition management. The National Defense Act of 1920 established the Planning Branch, the Army and Navy Munitions Board, the Army Industrial College, and directed the Assistant Secretary of War to prepare industrial mobilization plans. The War Industries Board was short-lived and abolished in the wake of post-WWI acquisition reform that replaced streamlined procedures of expediency with peacetime bureaucracy. The Industrial Mobilization Plan of 1924 called for instantaneous industrial mobilization initiated upon declaration of war (M-day). Military leaders felt civilian leaders would not accept any proposal to mobilize the economy gradually before war declaration. This assumption proved to be false. Additionally, the plan put the military in charge of the economy. That thought made President Roosevelt uncomfortable, even after the attack on Pearl Harbor. The industrial mobilization plan of 1934 had many basic flaws besides the fact it only addressed war on a single front. Other flaws exhibited by the 1934 plan included calling for the military to control the economy, not seeking any industrial mobilization before declaration of war nor addressing the needs of the civilian populace or potential allies.

[5] Ibid., 21.

[6] Major H. Dwight Griffin, et.al., *Air Corps Tactical School: The Untold Story* (Washington, D.C.: U.S. Government Printing Office, 1995), 45.

[7] Haywood S. Hansell, Jr. *The Strategic Air War Against Germany and Japan, A Memoir* (Washington, D.C.: Office of Air Force History, 1986), 62-63. AWPD-1 called for a total of 61,799 aircraft, of which 4,328 were to be based in Britain, and required 2,118,625 total Army Air Force personnel. AWPD-42 included munitions requirements and called for a total of 8,214 aircraft, including a 50 percent reserve, to be based in Britain.

[8] "AC/AS Plans: 1942-1945," *USAF HRA, 145.92-18* (1943), various.

[9] USSTAF. *"Materiel Behind the 'Big Week'," USAF HRA, 519.04-1* (20-25 Feb 44), 1-2. A key feature of the plan was the requirement to establish third echelon maintenance activities (a.k.a. sub-depots or service groups) manned by Air Service Command (ASC) personnel at each operational base. The sub-depots would be augmented as necessary by depot field teams dispatched from fourth echelon (depot) maintenance organizations (a.k.a. Base Area Depots and Advance Depots) to take care of abnormal loads of battle damage repair.

[10] United States Army Service Forces, *Logistics in World War II: Final Report of the Army Service Forces* (Washington, D.C.: U.S. Government Printing Office, 1947), 247-250. "Large headquarters with ill-defined and duplicating functions were the rule and achieved only partial success in coordinating supply…The organization and proper position of the logistical arm had long been a subject of debate in the Army and in the AAF." Recommendations by the Commanding General, Army Service Forces for standardizing organizations and procedures to improve efficiency and effectiveness were misunderstood and rejected by the War Department. A lack of doctrine resulted in each Theater Commander establishing complex, unique logistic organizations. A lack of

emphasis by the Army on logistics training prior to the war, due to outright neglect, resulted in too few persons possessing extensive knowledge of its functions.

[11] Gropman (ed.), *The Big "L": American Logistics in World War II*, 265, 283. The US produced the majority of the Allies' munitions. By 1944 the United States produced about 60 percent of all Allied forces munitions and from war declaration through V-J day the US produced more than twice that of Germany and Japan combined.

[12] Ibid., 19-31. Meanwhile, the Army and Navy Munitions Board was still a separate organization and the military was trying various ways to gain control of the mobilization effort. Every attempt the military made to gain control of the economy would eventually be thwarted by the President but there can be no doubt that this behind the scenes activity created more problems than it solved and negatively influenced civil-military relations. President Roosevelt appointed William S. Knudsen, a General Motors Corporation executive, as the Advisory Commission's advisor for industrial production and the commission reported directly to the President. Donald M. Nelson, the chief merchandising executive at Sears for over a decade, was also an advisor. Nelson had an in-depth knowledge of American industry and sold the idea of giving industry the incentive to build munitions factories by allowing them to amortize all construction costs over a 5-year period. Nelson's innovative idea was probably the one bright spot in the commission's performance.

[13] Ibid., 23-25. President Roosevelt appointed Knudsen as Director General of the OPM. This probably contributed to the OPM's ineffectiveness, as he was not considered a strong leader. The OPM was plagued by organizational design defects resulting in duplication of effort and lacked authority it needed so it could not dictate to industry, which still preferred to cater to the civilian population. Even President Roosevelt's declaration of National Emergency on 27 May 1941 did not enhance the OPM's clout. However, despite all the problems with the OPM, much was accomplished. In March 1941, the OPM prioritized raw material usage and production of non-defense products while the Army and Navy Munitions Board prioritized production of specific defense products. Considering the long lead times normally required to procure and manufacture machine tools it is clearly significant that the shortage was identified by the OPM early in the mobilization effort. The OPM also initiated retraining programs to increase the pool of skilled labor and encouraged industry to hire women.

[14] Ibid., 25-31. The President created the Office of Price Administration and Civilian Supply in April 1941. In July, the organization's leader decided to end automobile and major appliance production for the civilian population but President Roosevelt disagreed and moved the Civilian Supply function to the OPM. This particular reorganization proved essential to the success of satisfying the defense requirements of the Victory Plan. Nelson headed the Supply Priorities and Allocations Board, still worked for Knudsen as part of the OPM, but possessed particular authority his boss did not. The board set out to first establish an allocation process and then set priorities within the allocations. In December 1941 industrial production rates were stagnating due to prioritization problems associated with both raw materials and the mix of consumer to defense goods produced as a result of the OPM's lack of authority. The board was challenged with coordinating

with the military services, who still retained their procurement authority, the Joint Chiefs of Staff, and other powerful organizations.

[15] Ibid., 31-35, 38, 55. The WPB absorbed the OPM and its Supply Priority and Allocation Board as well as the National Defense Advisory Committee. During the war the National Defense Advisory Committee grew to over 20,000 strong and many of these personnel were physically located at manufacturing facilities throughout the country. Nelson and his staff were occupied by three problems throughout the war as they tried to increase production:

1. Supplying raw materials from which the war materiel and essential civilian products were made,
2. Providing the plants and equipment in the factories to manufacture the tools of war, and
3. Staffing the plants with enough people with the right skills.

The industrial output of the US grew "almost geometrically" into 1944 but demand consistently exceeded production because of "overestimation of capacity by those not responsible for producing materiel." Aircraft production floor space increased from a pre-war measurement of 13 million square feet to 167 million square feet in 1943.

[16] Major General O.R. Cook, *"Logistic Lessons of World War II," Lecture to Air War College USAF HRA, K239.7162241-22* (10 Dec 47), 7.

Part 3

The Pillars of Support

Other military organizations provided logistical support to 8AF and the VIII Air Force Services Command in the UK. The USAAF's ASC provided stateside depot, technical, research and development, and acquisition support to 8AF. The Army Service Forces (ASF) Service of Supply (SOS) provided 8AF with items common to the US Army and the USAAF. Although 8AF and VIII AFSC together had a very large logistics capability and capacity of its own, it depended on ASC and the ASF for supplies and support and could not have succeeded without their assistance.

On 17 Oct 1941, ASC was established and made responsible for acquisition of weapon systems and providing the war fighting commands with fourth echelon (i.e., depot level) maintenance support.[1] HQ USAAF established maintenance policies and procedures while ASC issued technical instructions.[2] However, there is evidence that field commanders occasionally issued guidance without ASC coordination.[3] In early 1942, ASC also became responsible for providing air bases with third echelon (i.e., sub-depot or intermediate-level) maintenance support.[4] By June 1943, ASC's workforce of about 50,000 worked day and night to support the war effort.[5] The expansion of ASC's depots and acquisition effort was vital to 8AF's ability to generate and sustain Big Week raids.

The aviation industry in America during the inter-war years focused on research and development. This focus tended to result in the production of aircraft in small lots, so the ASC acquisition function faced the challenge of trying to convert the industry to the mass production ethos.

> In 1940 when President Roosevelt set a goal of producing 50,000 aircraft per year, and funds were appropriated in large amounts, severe problems developed for acquisition. … Many of the carefully developed procedures relating to advertising and competition had to be set aside simply because of a shortage of time…[6]

Additionally, on 9 April 1942, Congress simplified accounting and contracting by appropriating funds for war materials directly to the service departments.[7]

"World War II demonstrated the importance of scientific research in a spectacular manner. Never in the history of warfare were there more rapid and far-reaching scientific and technological developments in weapons."[8] Some of the most significant technological developments were the identification of suitable material and process substitutions to satisfy military requirements. Synthetic rubber is a good example of a substitution that was made in World War II. Much time and effort was required to research and develop suitable substitutes and they played an important part in providing the logistical support necessary to sustain combat operations. In hindsight Cook observed, "A most important logistic lesson is that our safety depends on the continuation of this close collaboration in the development of new instruments of war."[9]

Improvements in supportability were also gained through the combination of engineering expertise and quality maintenance. "By strict adherence to the best standards of inspection and routine maintenance, it was possible to lengthen the time interval between overhauls and thus to increase the force available for operation."[10] As early as

July 1941, greatly reduced maintenance and supply demand resulted from lengthening of aircraft inspection intervals by 25 percent.[11] The official history maintained…

> During the earlier years of the war…the desperate need for aircraft in most theaters argued so strongly for repair of the crippled or damaged plane that air depot and service groups were strained to provide the special skills, equipment, and materials to meet the demand.[12]

The spare parts shortages that existed through the end of 1942 made this problem more acute and the difficulty was not overcome until late in the war.[13]

Between 1931 and 1939 the Air Corps had fewer than 2,000 aircraft and depots had adequate capacity as they overhauled an average of 166 planes and 500 engines annually.[14] USAAF expansion after the summer of 1940 was so rapid that ASC found it almost impossible to meet the steadily growing maintenance demands. The USAAF did not initiate depot expansion plans until late 1940 and therefore, by 1941 the depots were wholly inadequate. From January 1942 through January 1944, depot modernization and expansion, along with the addition of eight depots and many sub-depots, capacity outstripped the availability of qualified technicians.[15]

There were just not enough skilled technicians to meet demands and there was not time to properly train unskilled laborers. ASC found itself in competition with the more attractive war industry employers in recruiting civilian laborers and generally suffered from a lower priority for civil service personnel fills. A training program for military personnel, which graduated hundreds of thousands of technicians, and special technical training programs for civilian employees recruited to work in stateside depots only partially alleviated the personnel shortage.[16]

ASC also turned to the private sector for solutions. ASC increased depot capacity by contracting for maintenance of training and transport aircraft and adopting mass

production methods to improve productivity.[17] Production line techniques alleviated some problems associated with integrating unskilled labor into depot and flight line maintenance functions worldwide. A task performed by one mechanic was broken down into several simple steps to quickly make new employees productive and conveyor belt systems were used to support engine overhaul, repair of parts and accessories, and even some phases of aircraft inspection and repair.[18] Depot management statistically measured and monitored production to identify areas for improved productivity and often adopted the innovative ideas of technicians for improving tools, equipment, and processes. The combination of special civilian training programs, use of military personnel in depots, use of contractors to augment depot capacity and process improvements remedied the depot personnel shortage and improved quality and productivity.[19]

ASC's acquisition, engineering, research and development, and depot maintenance activities were beneficial to 8AF operations. The improvements made within ASC to some extent improved 8AF and VIII AFSC logistical support capabilities. Whether in the form or a new aircraft, a repaired part, an aircraft modification, or a technical directive to maintainers, ASC's performance directly impacted 8AF's performance.

Similarly, 8AF's performance directly reflected that of the ASF. General Marshall's reorganization of the War Department as America entered the war had created three separate but equal commands under the Chief of Staff. The new commands were the Army Ground Forces, the USAAF, and the ASF. In the theater there was the SOS commander who supported the operational USAAF commanders but many of them felt the SOS infringed upon their responsibilities, and many misunderstandings resulted.

ASF established command in the UK in 1943 with headquarters functions split between London and Cheltenham, which resulted in much inefficiency. "This split in SOS HQ was brought about by the desirability of having SOS planning staffs near the various other planning agencies in London, and by the inability of facilities in London to accommodate the entire staff."[20] Communications support was inadequate and travel was time consuming so the geographical separation caused acute problems.[21]

> …SOS was the "rear area" organization of the theater. Under field service regulations, the rear areas of a theater were organized as a "communications zone," an autonomous theater-within-a-theater. The communications zone commander was responsible to the theater commander for moving supplies and troops from the zone of the interior forward to the combat zone. In this regard, he relieved the theater commander from…rear area activities… In the European Theater of Operations (ETO), however, there was as yet not a combat zone—the entire theater was essentially a rear area. This geographic coincidence…exacerbated the ambiguities over…logistical roles.[22]

The USAAF maintained its own supply system for things unique to its mission. Therefore, split USAAF supply support responsibilities existed as supply support of common items was provided by the ASF SOS. This split was the source of much contention.[23]

Knerr, Commanding General of VIII Air Forces Services Command and later the United States Strategic Air Force's Deputy for Administration, was responsible for all USAAF logistics in the UK. He hotly contested the US Army's Tables of Organization and Tables of Equipment that placed artificial limits on the manpower and equipment authorized. Knerr wrote in 1945, "The tables of organization and tables of equipment are a convenient and simple means for a staff agency in the United States to do its job easily but they place the people in the Theater of War in a straight jacket."[24] He provided many examples of the impact strict adherence to these tables had on the war. Problems

included a lack of vehicles to move ammunition, a lack of vehicle maintenance equipment, a lack of ordnance equipment, and insufficient quantities of high explosive bombs due to an increase in usage during late in 1943. These problems made the execution of Big Week more challenging for 8AF logisticians. More importantly, the latter problem meant that not every bomb dropped would produce the desired effect increasing requirements to revisit targets.[25] Knerr believed the Army should reinvent its manpower and equipment authorization policies. He wanted the Army to use authorization tables more flexibly like the USAAF supply tables; treated more as guidelines than strict policy.[26] Although Knerr tried to resolve many of these problems before February 1944, the Army did not adopt his suggestions.

ASC and ASF SOS support was critical to 8AF and VIII AFSC but obviously the theater logistics organization evolved throughout the war and was characterized by functional overlaps and power struggles. Even after the VIII AFSC shouldered the responsibility for supply distribution the ASF provided it some supply support. ASC support was undeniably a key to 8AF success and improved greatly between 1939 and 1944. ASC's improvements combined with those within the theater of operations enabled 8AF to initiate and sustain operations on the scale and duration of Big Week for the first time.

Notes

[1] Lois E. Walker and Shelby E. Wickam, *From Huffman Prairie to the Moon* (Washington, D.C.: Office of History, 2750th Air Base Wing, Wright-Patterson Air Force Base, Ohio, 1986), 146-147.

[2] AAF Historical Office, *"Army Air Forces Historical Studies No. 51: The Maintenance of Army Aircraft in the United States 1939-1945," USAF HRA, 101-51* (1945), 133. In Feb 1942 improvements in engine construction enabled overhaul schedules to be changed. Only when inspection revealed it was necessary were aircraft reconditioned. In 1943 the "obsoletion" policy requiring the retirement of combat

aircraft after six to eight years of service was changed and replacement was not required until "whenever superior equipment was available."

[3] Major General Hugh J. Knerr, *"Knerr Correspondence," USAF HRA, 519.1613* (Oct, Nov, Dec 43). Author's note: Although the commanders who did this probably felt operational necessity justified their actions, they increased the complexity of logistics support by creating non-standard configurations. Their actions negated the advantages of interchangeable parts and lengthened the time it took for VIII Air Force Service Command intermediate and depot maintenance activities to return affected aircraft to service.

[4] Wesley Frank Craven and James Lea Cate (eds.), *The Army Air Forces in World War II, Vol. 6, Men and Planes* (Chicago: The University Press of Chicago, 1955), 391.

[5] Walker and Wickam, *From Huffman Prairie to the Moon*, 145.

[6] Alan L. Gropman (ed.), *The Big "L": American Logistics in World War II* (Washington D.C.: National Defense University Press, 1997), 123.

[7] Ibid., 122, 282.

[8] Major General O.R. Cook, *"Logistic Lessons of World War II," Lecture to Air War College USAF HRA, K239.7162241-22* (10 Dec 47), 18.

[9] Ibid., 18.

[10] Craven and Cate (eds.), *The Army Air Forces in World War II, Vol. 6, Men and Planes*, 389-392. "The basic data from which policies and instructions were derived came from reports which flowed in from the depots and stations and from various inspection activities… Although jurisdiction of ASC did not extend overseas, it was responsible for providing service units, equipment, and supplies for all AAF commands."

[11] AAF Historical Office, *"Army Air Forces Historical Studies No. 51: The Maintenance of Army Aircraft in the United States 1939-1945,"*, 134-135. The suggested inter-overhaul time for the B-17 increased from 4,000 flying hours or 30 to 60 months of service in 1940 to 8,000 flying hours or 84 months of service in 1944.

[12] Craven and Cate (eds.), *The Army Air Forces in World War II, Vol. 6, Men and Planes*, 393.

[13] Ibid., 393. By 1944 aircraft production allowed replacement of heavily damaged planes by new ones and battle damage repair became less critical. ASC was then able to establish criteria for determining whether or not it was more cost effective to repair or replace badly damaged aircraft and the job of the depots "became mainly one of modification and overhaul."

[14] Ibid., 389.

[15] AAF Historical Office, *"Army Air Forces Historical Studies No. 51: The Maintenance of Army Aircraft in the United States 1939-1945,"* , 121, 124, 136-139.

[16] Craven and Cate (eds.), *The Army Air Forces in World War II, Vol. 6, Men and Planes*, 395. In 1941 there was an urgent need for more and better maintenance and the quality of maintenance continued to be low during the early months of the war due to a lack of adequately trained engineering officers and civilian mechanics to man the depots. In part this was caused both by the increased production pressure associated with the parts shortage that existed through 1942 and the fact that ASC was lowest priority command for personnel fills.

Notes

[17] Ibid., 391, 395.

[18] Ibid., 396.

[19] AAF Historical Office, *"Army Air Forces Historical Studies No. 51: The Maintenance of Army Aircraft in the United States 1939-1945,"*, 118-122, 127-128, 135. During the period January 1942 through January 1944 stateside depot maintenance facilities returned approximately 25,000 aircraft and 90,000 engines to service. In 1943 alone, 236,622 aircraft visited the 200-plus sub-depots for repair and other work. Finally, an Air Inspector survey conducted in the summer of 1943 attested to the fact that Eighth Air Force was satisfied with the third and fourth echelon maintenance support it was receiving from ASC.

[20] General Board United States Forces, European Theater, *"Logistical Build-Up in the British Isles," USAF HRA, 502.101-128* (9 Jun 53), 4.

[21] Ibid., 4-5.

[22] Alan L. Gropman (ed.), *The Big "L": American Logistics in World War II* (Washington D.C.: National Defense University Press, 1997), 345.

[23] United States Army Service Forces, *Logistics in World War II: Final Report of the Army Service Forces* (Washington, D.C.: U.S. Government Printing Office, 1947), 248, 341. Within the ASF "there was an unnecessary overspecialization in types of service troops, thereby making it difficult to secure maximum flexibility in the utilization of service personnel." Although it was believed units comprised of both USAAF and US Army personnel would improve the situation, and some experimenting with this type of organization was done, the idea "was not pushed vigorously."

[24] Major General Hugh J. Knerr, *"Air Force Logistics," USAF HRA, 519.8086-1* (10 May 45), 2.

[25] Ibid., 6-7

[26] Ibid., 2.

Part 4

Eighth Air Force Logistics

> *Let us, the next time, have our logistics prepared before we plan to operate. We managed to skin by, in this last war, particularly in training personnel, on the logistic side by pulling ourselves out by our bootstraps….Here 273 groups were set up but not a Depot Group was thought of. That meant that the very late start that was made had to be taken care of in the theater, and in the European theater our logistic establishment in the Burgenwood (sic) area was simultaneously a training school and the support for the operating pilot. But that is a bad situation to be in.*[1]
>
> — Maj Gen Hugh J. Knerr, USAAF

The British provided the materials for and constructed 91 of the 138 airfields required for American flying operations allowing for the forward deployment of USAAF units. Bed down of American flying units in Britain was critical to massing a strategic bombardment force within striking distance of Germany.

> The buildup of American air and ground forces in Britain (Operation Bolero) was determined by the logistics constraints the British-American coalition faced before the Normandy invasion. During the first year or so of its operational status from August 1942, Eighth Air Force's buildup was greatly helped by Britain's industrialization and the RAF's maturity.[2]

An enormous effort was required bedding down the units and the British support was the key to success. However, the logistical sustainment of the deployed units was also critical in order to increase pressure on Germany and to step up those efforts during Big Week. This could only be accomplished by having flyable airframes and the right

munitions for the mission. Unfortunately, the emphasis at home on aircraft acquisition subordinated problems of supply and maintenance and they received inadequate attention from USAAF senior leadership until they became acute.[3]

As evidenced by the data in Table 1 the logisticians found a way to conquer obstacles and get the kind of results necessary to support an effort the magnitude of Big Week. Although some of the success is attributable to the improvements made stateside, the bulk of the credit goes to the American and British logisticians in the UK and those braving the Atlantic sea lines of communications. The US made dramatic improvements across the spectrum of logistics in less than one year that would enable 8AF to sustain crippling bombing missions against Nazi Germany from Big Week onward.

Table 1 VIII Air Force Service Command Production Comparison

	Dec 42	*Nov 43*
Aircraft Assembled	12	463
Engines Overhauled	35	714
Aircraft Modified	5	619
Tons of Bombs Delivered	2,329	18,000
Propellers Repaired	65	375
Supply Tonnage Received	4,000	20,600
Truck Tonnage Hauled	2,700	22,194

Source: USSTAF.*"Notes for Supply and Maintenance Chapter," USAF HRA, 519.057-4* (1942-1945), 1.

Leadership and Organizational Evolution

The USAAF established VIII AFSC to provide 8AF combat units with supply, intermediate-level and depot-level maintenance, and transportation support. However, in many respects the AFSC concept was in direct conflict with the ASF SOS.[4]

Air service groups provided intermediate-level maintenance support for two combat groups, possibly with the squadrons dispersed, with one air depot group supporting two air service groups. However, in Europe an entire combat group and sometimes two groups usually operated at a single airfield complicating intermediate-level maintenance operations.[5]

VIII AFSC established two depots in Great Britain and one at Langford Lodge, Ireland.[6] Due to a government contracting oversight, Lockheed had control of all personnel working at the depot in Ireland complicating operations.[7]

Knerr spearheaded the logistic efforts within 8AF up to and beyond Big Week. His past experiences in corporate America combined with those gained while part of the Bradley-Knerr Committee did much to influence the logistics organizations, processes, and effectiveness supporting 8AF flying operations. Knerr arrived in Britain in July 1943 as the Deputy Commander, VIII AFSC.[8] AFSC was separate from 8AF and subordinated to the numbered air force A-4 (logistics) staff, resulting in conflicts between staff office and operating agency. Knerr pressed for a reorganization of the 8AF consistent with the recommendation he made to the Bradley Committee, elevating AFSC to status equivalent to other staff functions. He also wanted to consolidate A-4 and AFSC headquarters and reorganize HQ 8AF around two deputies—one for operations and one for logistics. Knerr believed an air force commander in constant contact with his two deputies could eliminate the need for much staff work and get faster results by being able to make major

decisions quickly. Knerr became the head of the 8AF A-4 staff on 11 October 1943, while still acting as deputy commander of VIII AFSC, and shortly after that he became the Commanding General of VIII AFSC. Knerr, by December 1943, "…absorbed the personnel and functions of A-4 to become in effect the sole logistical agency entitled to act in the name of the Commanding General, Eighth Air Force."[9]

8AF took staff and other resources from VIII AFSC without warning to stand up Twelfth Air Force (12AF) in October 1943. This unforeseen loss of resources degraded VIII AFSC capabilities for some time.[10] VIII AFSC anticipated the activation of IX AFSC and so when this occurred it did not affect VIII AFSC as the need to support 12AF had.[11]

Reestablishment of the Ninth Air Force (9AF) in Britain prompted further organizational changes. In late December 1943, Gen Spaatz, the commander of the newly created US Strategic Air Forces (USSTAF), decided he would have two deputies, one for administration and one for operations. The deputy for administration would direct the logistics efforts of the 8AF and 9AF while the deputy for operations would direct the strategic operation of both the 8AF and the 15AF.[12] With the birth of the USSTAF organization, Knerr became the Deputy for Administration. Knerr stated, "We had a good demonstration of the smooth operation of that partnership thesis during this war in Europe and we should never forget that lesson because it produced results."[13] Under this new command structure Knerr would make the final preparations and execute support of 8AF bombing operations during Big Week.

Workloads resulting from initial combat operations were greater than anticipated. In April 1943 VIII AFSC modeled itself after ASC by establishing three operating

divisions--Supply, Maintenance, and Personnel. This organizational change replaced the traditional general staff structure and resulted in a more effective operation. AFSC decentralized operations in conjunction with this reorganization, allowing headquarters to focus on management and process improvement. In 1943, logistics organizations and processes were specialized and optimized, and the reduced threat of bombardment in the UK allowed for more efficient centrally located functions.

VIII AFSC sustainment of 8AF combat operations became a major problem and the "…anxious examination of the factors affecting the rate of bombing operation in the fall of 1943 had emphasized anew the basic importance of its varied functions."[14] VIII AFSC had not addressed all the organizational overlaps, inefficiencies, and difficulties. Despite much organizational improvement, its effectiveness suffered.

Infrastructure, Personnel, and Training

"…Britain contained a core of civilian workers with maintenance and supply management skills" but "…logistics met with an immediate shortage of British labor at ports and construction sites."[15,16] Although the number of USAAF personnel in Britain increased by 300 percent in 1943, build-up of AFSC personnel lagged behind that of combat forces handicapping logistics.[17] Despite the fact that 1000 8AF personnel completed technical schools each month in 1943, Knerr said the biggest problem he faced in 1943 was a shortage of personnel and those personnel he did have required training. He solved the problem, at least for the maintenance function, by cycling personnel through the air depot groups for formal training. Once trained they were reassigned to air service groups and "maintenance was no longer a problem."[18]

In late 1943 and early 1944 thousands of unskilled and untrained men were shipped to the UK to help man rapidly expanding depots. In order to use new personnel quickly, production line methods were instituted. Although this approach was not efficient, there was no other way to productively employ these people more rapidly.[19]

In June 1941, a Factory Representative Section was established in London and when the VIII AFSC was activated it became responsible for the section. The factory representatives assisted the RAF and the USAAF with technical problems in the field and at depot. By May 1944 the Factory Representative Section had 222 civilians representing 34 different American manufacturing companies. My experience during the Persian Gulf War, where Grumman technical experts deployed to the war zone in support of the EF-111s, serves as a testament that the services of civilian factory representatives in the theater can be vital to our success. Then as now, the factory representatives were invaluable in sustaining the bomber fleets throughout Big Week.[20]

Supply

"The decision in 1939…to put almost all of the funds made available to the Air Corps into complete aircraft explains in large part the critical shortage of spare parts which persisted through 1942."[21] Throughout 1942, aircraft grounded for lack of parts was a concern throughout the USAAF.[22] To make matters even more stressful for VIII AFSC, on 1 December 1942 the unanticipated withdrawal of supplies and essential personnel to support 12AF created much chaos.[23]

Through most of 1943 the 8AF's logistics system suffered shortages due to shipping losses and the support it provided to 12AF. "Shortages of spare parts for such items as superchargers, bombsights, and trucks (which themselves were in short supply) were

frequent."[24] However, by the beginning of 1944 more than 190,000 supply items were cataloged, spares were at satisfactory levels, and "no aircraft was long on the ground for lack of spare parts."[25] The improvement is attributable to the synergistic effects of:

1. Decreases in shipping losses,
2. Redeployment of 9AF to Britain,
3. Local purchase and local manufacture,
4. Improved transportation, maintenance, and supply distribution processes,
5. The learning curve, and
6. ASC service life extension and economic repair policies.

US forces in the UK were reliant on merchant shipping for support but it was subject to German U-boat attacks. U-boats caused the loss of 6.3 million tons of cargo in 1942 but losses steadily declined in 1943 due to ships being escorted, and an increase in US ship production. Cargo reaching the UK increased from about 50,000 tons in May 1943 to about 1,000,000 tons in December 1943 while monthly losses decreased from over 700,000 tons in November 1942 to approximately 100,000 tons in June 1943.[26,27]

Problems with manifests and marking of supplies delayed deliveries to units. In 1942 it was common for ships to arrive in the UK without the SOS having received a copy of the manifest or loading information, and even when documentation was received in a timely manner it was often too general, making planning almost impossible.[28] Actions were taken to standardize markings and documentation and dramatic improvement was realized in just a few months.

> As late as the first quarter of 1943, only 46 percent of the manifests and Bills of Lading were being received five or more days before the arrival of the ships and 24 percent were not received at all. However, during the months (sic) of April 1943, 80 percent were received five or more days ahead of ships, and in May 90 percent. Thereafter, delays in receiving documentation ceased to be a serious problem.[29]

SOS unfamiliarity with USAAF markings and procedures delayed distribution of supplies and prompted VIII AFSC's establishment of in-transit depots at sea and aerial ports. Further improvements in distribution were realized by dividing the British Isles into two geographic zones and Northern Ireland was later established as a third zone. In-transit depot zoning was based on the capacity of the geographic area to receive supplies and ships in the US were then loaded with supplies based on the zone they were to land at. This reduced the amount of intra-theater transportation required within the UK. [30]

Consequently, VIII AFSC distributed all USAAF supplies received in the UK. With respect to 8AF, Army SOS acted as wholesale supply and VIII AFSC acted as retail supply.[31] On 14 December 1943 the Commanding General, VIII AFSC, reported that in-transit depots could deliver bulk supplies at port to a depot or base within 72 hours. He also reported that 88.5 percent of requisitions were satisfied immediately and requisitions for items not on hand were being filled in less than 24 hours. These process improvements may seem simple but they did wonders to make the flow of USAAF supplies to and within the UK more efficient and reliable.[32]

It took the USAAF nearly two years to develop an effective supply statistics system to aid in spare parts requirement forecasting. As early as 1942 supply planning was accomplished using automatic supply tables based on peacetime consumption rates for 30, 60, 90, and 180-day stock levels in 20, 40, and 80 aircraft units. The tables were developed and implemented to help reduce pipeline times for parts in high demand with low availability because some were taking up to two months to obtain from the US.[33] Supply conferences were held in April and November 1943 to fine tune the tables.[34]

In September 1943 ASC discontinued automatic re-supply shipments for all but new aircraft types. An agreement to ship 50 percent of the six-month requirement as soon as possible and the remainder 60 days later resolved the problem. Further process refinement was done to avert both shortage and overstock conditions and resulted in depots being authorized 90-day stock levels of specialized aircraft parts. Sub-depots were authorized a six-month level of common supply items. The pre-positioned pipeline stocks were used to fill supply demands at all echelons of maintenance.[35]

In October 1943 the VIII AFSC began to use three month forecasts to account for the effects of sortie rates, enemy opposition, repair facilities, and other factors that were not accounted for by the automatic supply tables. Supply transactions were recorded manually and by late 1943 the aircraft fleet size made it evident that automation was necessary. However, this automation did not occur until after 1944. Therefore, Big Week did not enjoy the speed and efficiency of an automated supply demand forecasting process. [36]

8AF equipment shortages became acute due to a lot of equipment being shipped to support 12AF. This hampered bed-down and support of new units arriving in theater.

> During the early part of 1943, the movement of air echelons to the United Kingdom prior to the movement of ground echelons, service units, and their equipment, contributed to low serviceability. A new unit for example seldom reached a serviceability of higher than 50 percent during the first month of operations.[37]

To alleviate theater shortages the USAAF began to require units deploying to the UK to ship their own equipment to theater one month before deployment.[38] Given the lead times associated with the manufacture of peculiar support equipment items this policy maximized the number of combat ready aircraft during Big Week.

Before February 1943 all requisitions were passed through HQ VIII AFSC, slowing the process and making it inefficient. After February 1943 the supply channels for Air Force-unique supply items were decentralized. Only those needs that could not be satisfied by military supply within the theater were passed to HQ VIII AFSC and were filled preferably by ASC's stateside depots. If ASC could not satisfy the demand, local purchase was used as a last resort.[39] Supply stocks after the winter of 1943-1944 were adequate and overages were shipped back to the US.[40] Reinvention of supply demand processing procedures beginning in February 1943 improved supply support.

In a fine example of cooperation and teamwork, the "…British dispensed all the petroleum, oil, and lubricants (POL) in Britain, even though most of it came from the United States under lend-lease."[41] British POL manpower brought some relief to VIII AFSC in light of the personnel shortages it was experiencing.

By May 1942 it was realized that operational requirements would not permit the delays associated with waiting for parts from the US so local procurements commenced. The Army SOS established the General Purchasing Board in May 1942 for the purposes of locally procuring goods and services.[42] Shortly thereafter, the SOS commander granted VIII AFSC limited procurement authority.[43] This decentralized procurement tool gave logisticians powers similar to today's International Merchant and Procurement Authorization Card (IMPAC) program.[44] Also, by early 1943 local manufacture of some spare parts by ETO depots also aided in partially alleviating shortages.[45]

A Mutual Aid Agreement establishing Reverse Lend-Lease with the British was signed 23 February 1942. In the first two years of the war approximately 422,721 tons of supplies were procured from the British.[46] "From June 1942 to July 1943, the British

provided US forces in the UK half or more of their quartermaster, engineer, Air Corps, medical, and chemical warfare service supplies."[47] During the war the US received over $6.7 billion worth of goods and services from the British through Reverse Lend-Lease.[48]

The supply support received from the British was significant as the US suffered losses of 100,000 to 700,000 tons of shipping per month from late 1942 to mid-1943. Logisticians made good use of local purchase, local manufacture, Reverse Lend-Lease, and pooled common supplies. These resources brought relief to weary maintainers by reducing the number of aircraft part cannibalization actions required to satisfy supply shortfalls while maximizing the mission capable rate. The RAF's extensive use of US-built aircraft allowed the RAF and USAAF to create a large pool of common supplies in early 1943. VIII AFSC eventually took over procurement responsibility for the common supply pool and many items were obtained from UK sources reducing pipeline time and transport burdens.[49] It would not have been possible to execute Big Week in February 1944 if it had not been for the materials the US received from the British through local purchase and Reverse Lend-Lease coupled with the synergistic effect of pooling common aircraft supplies and local manufacture capabilities.

Maintenance and Munitions

During 1943-44, the average life of an 8AF heavy bomber was 215 days, during which it flew missions on 47 days and was undergoing maintenance, repair, or modification for a total of 49 days.

> The quality of maintenance was often the margin of difference between the life and death of an aircrew or the success and failure of a mission. …The greatly increased rate of operations, the high incidence of battle damage, and the growing complexity of the military plane during World War II made maintenance one of the most vital functions in the waging of the air war.[50]

Maintenance system operations were flexible and the amount of maintenance was determined by the availability of equipment, supplies, and manpower.[51] Prior to mid-1944 heavy bomber maintenance organizations were constantly challenged by having to expend much labor and many parts to keep war-weary aircraft flying since replacement aircraft were not available in sufficient quantities to stabilize aircraft availability with respect to losses.[52] Fighter and medium bomber serviceability was higher than that of heavy bombers "primarily because of a much lower percent of battle damage and less extensive modification requirements."[53] Large theater depots also put much flexibility into theater maintenance, relieving VIII AFSC organizations on the air bases of a wide variety of labor intensive tasks.[54] In late 1943 Knerr established sub-depots at various operational bases to enhance field maintenance capability. He also implemented a mobile aircraft repair team concept to support on-site repair of aircraft too badly damaged to fly to depot. In existence between 1943 and 1945, mobile repair teams comprised of a supply truck, a repair truck, and specially trained personnel were very important to the base maintenance activities. Because mobile repair teams repaired damaged aircraft that landed off station and aircraft damaged beyond base maintenance capabilities; base maintainers could concentrate on minor repairs and aircraft regeneration.[55]

Knerr reorganized the VIII AFSC and instituted a system to monitor and control aircraft production. He established "statistical reporting and control procedures at all bases" so commanders knew what the situation and requirements were.[56] This included, beginning in September 1943, collecting three-month sortie forecasts from the combat commands to forecast and adjust depot workloads in order to reduce backlogs.[57] Late in 1942 the British agreed to let Americans replace British workers at the Burtonwood depot

and "under American leadership and production methods the production of engines and instruments increased at a rapid rate..."[58] Depot capacity was also increased when Warton Air Depot was activated in September 1943. Several smaller sub-depots, known as advance depots, were activated at selected operational air bases to further enhance field capabilities.[59] Knerr's reallocation of repair and modification work in December 1943 took advantage of the efficiency of specialization by spreading backlogs and making the depot in Ireland responsible for aircraft modification kits.[60] The necessity of modifying all incoming aircraft frequently reduced theater aircraft serviceability rates as much as 16 percent.[61] "Following this reorganization, the volume of work accomplished was vastly increased."[62]

Lockheed Corporation, under US contract, manned the Irish depot. Lockheed's depot support was considered advantageous because they provided in-theater specialized engineering work, modifications, development of special tools, design changes, and kit manufacture for all types of USAAF equipment.[63] Finally, "Between 12 and 20 February 1944 no bombing missions had been flown; hence the backlog of aircraft in repair had been diminished and an unprecedented number of bombers were available."[64] This period of inactivity was due to poor weather conditions. Maintainers took advantage of the situation and gave 8AF an unprecedented number of fully operational bombers, 1292 to be precise, entering Big Week.[65]

8AF had a sufficient tonnage of munitions and quantities of ammunition available to support Big Week. However, there was disagreement between the types of munitions available and the types the flying units needed to destroy the targets assigned. Knerr believed the disagreement was due to improper communication of field requirements to

munitions production plants in the states. The shortage of desired bomb types began in December 1943 and was not corrected as of 1 April 1945. The lack of proper bomb types to support Big Week, given the bombing accuracy of the B-17 and B-24, degraded mission effectiveness.[66]

Transportation

Knerr tried to address airlift problems, which he had foreseen, with distribution and control of airlifted supplies by trying to secure dedicated airlift he had apparently been promised. In the summer of 1943 he wrote, "Not more than 3 percent of the required airlift has ever been forthcoming in the United States from that promised service."[67] With the exception of inter and intra-island air service 8AF was relieved of airlift functions and they were placed under the Air Transport Command sometime in the summer of 1943. Knerr later wrote in his lessons learned, dated 10 May 1945, that air cargo had been delivered to places where it was "extremely difficult to assemble and process" and that units and equipment were separated from each other delaying unit mission execution in the theater.[68] A military airline was formed by 8AF for moving troops and supplies throughout the UK and proved its merit by moving an average of 300 tons of cargo and 2,500 personnel per month in 1943.[69]

The ASF controlled what was shipped via sea to the UK. Knerr felt the ASF mismanaged sea shipments and although it never happened, he felt the Air Force should have been allocated dedicated sealift.[70]

Knerr addressed many key logistical problems in 1943. Not the least of his efforts included resisting the return of the Truck Transport Service to the SOS because "until the Air Forces took over segregation and distribution of their own supplies from shipside

(sic) to consuming unit, they starved."[71] In addition to inter-service squabbles over control of the ground transport function was the shortage of vehicles. "A truck shortage adversely affected distribution, although it was mitigated by Britain's fine transportation system."[72] In addition, 8AF trucks were pooled into a single organization and were effective and efficient in moving supplies from port to base and laterally between bases.[73]

The bottom line on transportation was that 8AF made the best of a bad situation. They operated an intra-theater airlift service but depended on Air Transport Command for inter-theater airlift. It appears that this combination of inter-theater and intra-theater support satisfied the airlift needs of 8AF despite its dependence on another command for the former. Despite the sealift problems Knerr felt the ASF created, he never was able to secure dedicated sealift so we will never really know if it would have improved 8AF logistical support during the month proceeding Big Week.

8AF Logistics – The Bottom Line

World War II as exemplified by 8AF's tremendous efforts up to and through Big Week "dramatized as never before the importance of the essentially undramatic functions of transportation, supply, and maintenance and lent new strength to calls for centralization of responsibility."[74] From 1942 right on through Big Week improvements were constantly sought in all logistical functions to make them more responsive and effective. Many of the accomplishments were achieved because of the outstanding leadership of Hugh Knerr who ultimately became responsible for all 8AF and 9AF logistics. Although in late February 1944 many logistics organizations and process deficiencies still existed, many problems had already been addressed and yielded the logistics capability to initiate and sustain operations the size of Big Week. The

improvements made within all of the logistical functions combined with continuous process improvements put the "big" into Big Week.

Notes

[1] Major General Hugh J. Knerr, "Strategic, Tactical, and Logistical Evaluation of World War II," *Lecture to Air War College USAF HRA, K239.716246-18* (19 Oct 46), 4-5.

[2] Jacob A. Stockfisch, *Linking Logistics and Operations: A Case Study of World War II Air Power* (Santa Monica, California: RAND, 1991), 18.

[3] Wesley Frank Craven and James Lea Cate (eds.), *The Army Air Forces in World War II, Vol. 6, Men and Planes* (Chicago: The University Press of Chicago, 1955), 390.

[4] USSTAF, *"Notes for Supply and Maintenance Chapter," USAF HRA, 519.057-4* (1942-1945), 10.

[5] Stockfisch, *Linking Logistics and Operations: A Case Study of World War II Air Power*, 19. Further complicating an already complicated task, commanders of combat units wanted command of Air Force Service Command intermediate-level maintenance (air service group) activities on their bases. This quickly became the practice, diluting the authority but not the responsibility of the VIII Air Force Service Command commander.

[6] Major General Hugh J. Knerr, *"Knerr Correspondence," USAF HRA, 519.1613* (Jul-Aug 43).

[7] USSTAF, "Notes for Supply and Maintenance Chapter," USAF HRA, 519.057-4 (1942-1945), 6.

[8] *"Biographical Data, Personnel Index," USAF HRA, 519.293-1* (1945). Knerr was a graduate of Annapolis who became an Army artillery officer in 1911. He joined the Air Corps near its birth and retired from active duty in 1939 only to be recalled in 1942 having spent the interim years at the Sperry Gyroscope Company "in work that … proved invaluable both to him and to the Military Service."

[9] Wesley Frank Craven and James Lea Cate (eds.), *The Army Air Forces in World War II, Vol. 2, Europe: Torch to Pointblank—August 1942 to December 1943* (Chicago: The University Press of Chicago, 1949), 742-743. As a member of the Bradley Committee in the spring of 1943, Knerr had prepared a special report on air service in Africa. In the report Knerr advocated the elimination of the problems caused by the logistics function being subservient to the staff and operations functions by the simple expedient of elevating the agency to the staff level of command.

[10] Stockfisch, *Linking Logistics and Operations: A Case Study of World War II Air Power*, 18-19.

[11] USSTAF, *"Notes for Supply and Maintenance Chapter,"* 6-11.

[12] Ibid., 752.

[13] Knerr, *"Strategic, Tactical, and Logistical Evaluation of World War II,"* 5.

[14] Craven and Cate (eds.), *The Army Air Forces in World War II, Vol. 2, Europe: Torch to Pointblank—August 1942 to December 1943*, 742.

[15] Stockfisch, *Linking Logistics and Operations: A Case Study of World War II Air Power*, 18.

Notes

[16] Alan L. Gropman (ed.), *The Big "L": American Logistics in World War II* (Washington D.C.: National Defense University Press, 1997), 346.

[17] Ibid., 364.

[18] Air Historical Office, *"Notes on an Interview with Major General Hugh J. Knerr," USAF HRA, 168.2-12* (24 Nov 47), 1-2.

[19] Craven and Cate (eds.), *The Army Air Forces in World War II, Vol. 6, Men and Planes*, 395-396.

[20] *"Civilian Technicians and Representatives," USAF HRA, 519.8023* (1941-1945).

[21] Craven and Cate (eds.), *The Army Air Forces in World War II, Vol. 6, Men and Planes*, 390.

[22] Ibid., 394.

[23] USSTAF, *"Notes for Supply and Maintenance Chapter,"*, 2.

[24] Stockfisch, *Linking Logistics and Operations: A Case Study of World War II Air Power*, 19. "During early 1943 spare parts for 50-caliber aircraft machine guns became so scarce that the total supply was pooled in a single depot with telephone requests being doled out by special truck delivery."

[25] USSTAF, *"Materiel Behind the 'Big Week'," USAF HRA, 519.04-1* (20-25 Feb 44), 3.

[26] Alan L. Gropman (ed.), *The Big "L": American Logistics in World War II* (Washington D.C.: National Defense University Press, 1997), 347-348, 359, 361-363.

[27] Major General William E. Kepner, *"Supply (Congressional Committee)" Kepner Collection, USAF HRA, 168.6005-84* (3 Jun 45), 2.

[28] General Board United States Forces, European Theater, *"Logistical Build-Up in the British Isles," USAF HRA, 502.101-128* (9 Jun 53), 25-26. "Entries on the manifest such as '1000 boxes of Quartermaster Class I supplies' were not uncommon." Pg. 25.

[29] Ibid., 25-26.

[30] USSTAF, *"Notes for Supply and Maintenance Chapter,"* 3, 128.

[31] Ibid., 3.

[32] Major General Hugh J. Knerr, *"Knerr Correspondence," USAF HRA, 519.1613* (Oct, Nov, Dec 43).

[33] USSTAF, *"Notes for Supply and Maintenance Chapter,"* 3.

[34] *"Stock Control in the ETO," USAF HRA, 519.8024-1* (1945), 1, 8-9.

[35] Ibid., 25, 31.

[36] Ibid., 3-5, 10.

[37] USSTAF, *"Notes for Supply and Maintenance Chapter,"* 5.

[38] Ibid., 4.

[39] *"Stock Control in the ETO,"* 15-16, 19-23, 36-37. Combat group demands not met were first sent to the air service group, then the depot, and if neither organization could satisfy the demand, it was then sent to headquarters VIII Air Force Service Command. A three-tier supply priority system was established in which priority was based on urgency of need. Aircraft grounded for lack of parts (AOGs) were given highest priority and those requirements were sent via tele-type to the air service group. If the air service group could not fill the request a tele-type was sent to the air base depot, and if it still could not be satisfied, a cable was sent to the responsible stateside depot.

Notes

[40] USSTAF, *"Notes for Supply and Maintenance Chapter,"* 5. AOG (Aircraft On Ground awaiting parts) rates fell from five percent in December 1942 to 2.3 percent in November 1943.

[41] Stockfisch, *Linking Logistics and Operations: A Case Study of World War II Air Power*, 19.

[42] General Board United States Forces, European Theater, *"Logistical Build-Up in the British Isles,"* 15.

[43] *"Stock Control in the ETO,"* 22-23. Local purchases were limited to 25 pounds sterling ($100), required written approval of the station commander, and could only be done when urgency of need did not permit procurement through the British Equipment Liaison Officers. Station purchase (i.e., contracting) officers had standing authority to make purchases not exceeding five pounds sterling.

[44] Deputy Assistant Secretary of the Air Force (Contracting). *Contracting Toolkit: IMPAC*, n.p.; on-line, Internet, 5 January 2000, available from http://www.safaq.hq.af.mil/contracting/toolkit/impac/.

[45] USSTAF, *"Notes for Supply and Maintenance Chapter,"* 2.

[46] *"Stock Control in the ETO,"* 19. Reverse Lend-Lease arrangements were used to make routine purchases exceeding 25 pounds sterling and were processed through the Commanding General, VIII Air Force Service Command and the RAF Equipment Liaison Officers.

[47] Stockfisch, *Linking Logistics and Operations: A Case Study of World War II Air Power*, 18.

[48] Gropman (ed.), *The Big "L": American Logistics in World War II*, 273, 277.

[49] USSTAF, *"Notes for Supply and Maintenance Chapter,"* 4.

[50] Craven and Cate (eds.), *The Army Air Forces in World War II, Vol. 6, Men and Planes*, 388, 394.

[51] Ibid., 389.

[52] Stockfisch, *Linking Logistics and Operations: A Case Study of World War II Air Power*, 43-44.

[53] USSTAF, *"Notes for Supply and Maintenance Chapter,"* 4. For example, medium bomber serviceability went from 29 percent in July 1943 to 92 percent in November 1943.

[54] Craven and Cate (eds.), *The Army Air Forces in World War II, Vol. 6, Men and Planes*, 391.

[55] USSTAF,*"Notes for Supply and Maintenance Chapter,"* 6, 11. Transport of aircraft via truck to depot in the UK was infeasible due to the physical constraints associated with humpback bridges, narrow winding roads with reverse camber, and bridge clearances.

[56] USSTAF, *"Materiel Behind the 'Big Week'," USAF HRA, 519.04-1* (20-25 Feb 44), 2-3.

[57] Major General Hugh J. Knerr, *"Knerr Correspondence," USAF HRA, 519.1613* (Jul-Aug 43).

[58] USSTAF, *"Notes for Supply and Maintenance Chapter,"* 6. Although it is not clear from the historical account if VIII Air Force Service Command sought to replace

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British personnel at Burtonwood depot with Americans because the British were not productive or if the decline in British employee productivity was caused by the agreement, but it is clearly documented that productivity increased.

[59] Ibid., 6.

[60] USSTAF, *"Materiel Behind the 'Big Week',"* 3-4.

[61] USSTAF, *"Notes for Supply and Maintenance Chapter,"* 5. The shortage of station overhead personnel also necessitated the use of skilled service personnel for overhead functions.

[62] USSTAF, *"Materiel Behind the 'Big Week',"* 4.

[63] Ibid., 6. Despite initial USAAF reservations regarding Lockheed's control of depot personnel at Langford Lodge, which occurred due to an error made by the government in writing the contract, it appears the contractor managed the personnel satisfactorily.

[64] USSTAF, *"Materiel Behind the 'Big Week',"* 4.

[65] Ibid., 4.

[66] Major General Hugh J. Knerr, "*Letter from USSTAF in Europe Deputy Commanding General, Administration to Commanding General," USAF, HRA 519.8671-3* (1 Apr 45).

[67] Major General Hugh J. Knerr, *"Knerr Correspondence," USAF HRA, 519.1613* (Jul-Aug 43).

[68] Major General Hugh J. Knerr, *"Air Force Logistics," USAF HRA, 519.8086-1* (10 May 45), 7.

[69] USSTAF, *"Notes for Supply and Maintenance Chapter,"* 12.

[70] Knerr, *"Air Force Logistics,"* 7.

[71] Major General Hugh J. Knerr, *"Knerr Correspondence," USAF HRA, 519.1613* (Jul-Aug 43).

[72] Stockfisch, *Linking Logistics and Operations: A Case Study of World War II Air Power*, 19.

[73] USSTAF, *"Notes for Supply and Maintenance Chapter,"* 12.

[74] Craven and Cate (eds.), *The Army Air Forces in World War II, Vol. 2, Europe: Torch to Pointblank—August 1942 to December 1943*, 742.

Part 5

Success Reaped the Hard Way

> *Perhaps the most significant lesson of World War II is that the military potential of a nation is directly proportional to the nation's logistic potential. The first hard fact to be faced in applying that lesson is that our resources are limited. The next is that the slightest delay or inefficiency in harnessing our logistic resources may cost us victory.*[1]
>
> — Maj Gen O.R. Cook, USA

Logistics indeed made Big Week "big" with respect to 8AF bombing operations. 8AF generated 3,880 bomber sorties that delivered 8,231 tons of bombs to targets throughout the Third Reich in just five days. The number of operational bombers declined to about 900 but, within five days after Big Week ended, maintainers had already returned about 150 of the approximately 200 bombers that had received battle damage back to combat ready condition.[2] Big Week was "big" because although Allied air superiority was not won until later, Gen Spaatz hypothesized that Big Week probably did spell the beginning of the end for the Luftwaffe daylight fighter.[3]

Leadership greatly influenced the logistics capability and support the USAAF was able to establish in the UK. On the negative side it took a long time for the civil-military organization to evolve into an effective one and it appears the military spent more time trying to take charge of the economy than to work within the president's system.

Cook said, "Time is the most precious element in logistic preparation for military security. Measures must be prepared in advance for the all-out, logistic mobilization that

must be completed between the time when the danger threatens and the time that war actually strikes."[4] Indeed, the military did not adequately plan for industrial mobilization and that contributed to the myriad of problems encountered.

Congress' streamlining of acquisition procedures and granting of obligating authority to the armed services greatly reduced the lead times associated with the major procurements necessary to prepare for and prosecute the war. However, military management of acquisitions was not perfect. In 1942 there was an imbalance between the number of whole aircraft procured and the spare parts required resulting in a parts shortage. Fortunately, the spare parts situation improved by 1943 and maintainers had the spare parts needed to support Big Week.

ASC's research and development activities enabled technologies to be exploited and thus improve combat capability through a controlled aircraft modification program. Technology insertion was a positive influence on the logistics.

Functional overlaps, process inefficiencies, and what could be labeled intra-service rivalry between the VIII AFSC and the ASF's SOS caused many of the processes critical to providing and sustaining aircraft maintenance to break down. VIII AFSC addressed most of the problems during 1942 and 1943 but Knerr, because of his overall dissatisfaction with ASF support, made every effort to make 8AF as logistically independent from the US Army as he could and got results.[5]

VIII AFSC suffered personnel shortages and those personnel it did receive often required training. The leadership's adoption of production line maintenance processes was not the most efficient use of personnel but did allow for the speedy incorporation of unskilled personnel into the depots and service groups.

"Host nation support, or whatever resources happen to be in the place one fights, can contribute greatly to a logistics system's capability."[6] British airfield construction allowed the US to mass bomber units on the island. Inter-service supply support was critical to 8AF maintenance. Finally, British dispensing of POL made efficient use of manpower, which was important to the undermanned VIII AFSC.

Civilians also provided critical support to the logistics team. Civilians in ASC worked acquisition programs and provided supply and repair support. The Lockheed employees at Langford Lodge depot provided in-theater support in a much more timely manner than if they would have been located in the US. Factory representatives further enhanced theater maintenance capabilities. In-theater depots, sub-depots, and intermediate-level maintenance organizations provided in-depth aircraft repair service independent of stateside organizations. By the time Big Week arrived these organizations had evolved into effective logistical support to the combat units and enabled sustained bombing raids of 1,000-plus bombers. In addition, they developed and provided limited but valuable local manufacture capability alleviating part shortages.

Knerr was the single greatest influence on the capabilities and effectiveness of 8AF logistics. From the time he served on the Bradley-Knerr Committee to plan the organization and build-up of forces through his tenure as the USSTAF Deputy of Administration he constantly improved all logistical functions. His institutionalization of statistical monitoring and requirements forecasting was used effectively to minimize depot backlogs. Additionally, Knerr's implementation of mobile repair teams for battle-damaged aircraft helped sustain the bomber fleet. Finally, he championed making the logistics and operations functions equal at the headquarters level. This gave logistics the

clout needed to ensure logistics considerations were taken into account and that logistics and operations were synchronized. "Responsiveness and flexible logistics support requires a management system that consciously links operations and logistics."[7] A good example of Knerr's effort to synchronize operations and logistics was his ability to get operations to produce three-month sortie forecasts that he used to plan logistical support.

The processes of producing or allocating munitions, or both, were broken because units did not always have the types and quantities of munitions needed to destroy the assigned targets. Big Week was "big" but it did not pack the "punch" it had the potential to because of the many munitions substitutions that were made.[8]

Ship escorts, establishment of distribution zones, ship loading based on destination of goods, improved documentation and communication, establishment of in-transit depots, VIII AFSC's pooling of trucks for supply distribution, and theater controlled intra-theater airlift all were very positive influences on operations.

8AF logistics prior to Big Week was the story of the "brute force" logistics. Knerr's effort to synchronize logistics and operations and provide responsive, effective, and efficient logistics serves as the benchmark for all airmen. At the end of the day the logisticians conquered many challenges through innovation and adaptation which yielded improved productivity and paved the way for Big Week. Indeed, Big Week would not have been "big" were it not for the dedicated efforts of the logisticians for months and years prior to 20 February 1944.

Notes

[1] Major General O.R. Cook, "Logistic Lessons of World War II," *Lecture to Air War College USAF HRA, K239.7162241-22* (10 Dec 47), 6.

[2] USSTAF, *"Materiel Behind the 'Big Week'," USAF HRA, 519.04-1* (20-25 Feb 44), 4.

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[3] Richard G. Davis, *Carl A. Spaatz and the Air War in Europe* (Washington, D.C.: U.S. Government Printing Office) 1993, 327.

[4] Major General Hugh J. Knerr, *"Strategic, Tactical, and Logistical Evaluation of World War II," Lecture to Air War College USAF HRA, K239.716246-18* (19 Oct 46), 7.

[5] Major General Hugh J. Knerr, *"Air Force Logistics," USAF HRA, 519.8086-1* (10 May 45), 1.

[6] Jacob A. Stockfisch, *Linking Logistics and Operations: A Case Study of World War II Air Power* (Santa Monica, California: RAND, 1991), 52.

[7] Ibid.

[8] Knerr, *"Air Force Logistics,"* 6-7.

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