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THE KOREAN WAR

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A C-141B escapes the boneyard after a crash.
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The following excerpt from *The Eagle's Talons: The American Experience at War* by Colonel Dennis M. Drew and Dr Donald M. Snow provides an excellent summary of the Korean War so our readers can better enjoy "Korean War Combat Support: A Lieutenant's Journal" by General Bryce Poe II and "Airlift of Cargo and Passengers in the Korean War" by Margarita Rivera.

Military Conduct

Although two-thirds of the population of Korea lived south of the 38th parallel, by 1950 North Korea had a larger, better-equipped, and better-trained military establishment than South Korea, thanks to the considerable aid furnished by China and the Soviet Union. The North Korean army numbered nearly 130,000 (augmented by a politically reliable border constabulary of nearly 20,000) and was reasonably well equipped with World War II vintage Soviet equipment, including some 150 T-34 medium tanks and a considerable amount of light artillery. The South Korean army numbered just under 100,000 and possessed no armored forces and a small amount of artillery. Neither North nor South Korea possessed naval forces other than a few patrol boats. The North Koreans boasted a small air force that included just over 100 combat aircraft of various types, while the South Korean Air Force was virtually non-existent. Thus when the war began, neither side could boast a large, modern military establishment, but the north had a considerable advantage in both numbers and equipment.

When the invasion began in the early morning hours of 25 June 1950, the North Korean plan was to make a quick thrust south through the Uijongbu Gap to seize Seoul (a communications and transportation hub as well as the capital city) and then quickly overrun the remainder of the south. The plan was nearly successful. The ill-prepared and ill-equipped South Koreans fell back in total disarray. Seoul fell in just three days. To meet the emergency, General MacArthur, the American theater commander, sent the American 24th Division directly into the fighting from its relatively sedate garrison duty in Japan. After arriving on the peninsula, units of the division fought a series of desperate delaying actions as they attempted to slow the enemy advance south from Osan to Taejon.

By 5 August UN forces had been forced back into a rectangular pocket, its front roughly following the line of the Naktong River. Although UN forces had their backs to the sea, the pocket included the major port of Pusan through which reinforcements could be landed or, if the need arose, through which UN forces could be evacuated. However, as the North Koreans began their assaults on the pocket (the Pusan perimeter), actions elsewhere were beginning to take their toll on the invading forces.

The UN air forces (almost exclusively American forces) quickly seized control of the sky over Korea and by 10 July had destroyed the North Korean Air Force. With total air superiority, UN air forces turned to the aid of the beleaguered troops within the Pusan perimeter. Close

air support missions blunted enemy attacks on the fragile defenses. More important, UN air forces put severe and continuous pressure on enemy lines of communication beginning well above the 38th parallel. The rapidity of the North Korean's advance had severely strained their logistical capabilities as did the increasing length of their supply lines. Air power administered telling blows and the North Korean logistic system quickly began to crumble. As a result, the vigor of the attacks around Pusan began to dissipate.

The perimeter held, thanks largely to the often brilliant leadership of Lt Gen Walton H. Walker. The American general used the shorter interior lines within the pocket to shift his meager forces to meet enemy attacks at various points on the perimeter. Meanwhile as the battle for the Pusan perimeter raged, MacArthur gathered his forces in Japan and planned the UN counteroffensive.

Several factors influenced MacArthur's thinking. First, Korea was a peninsula and thus vulnerable to amphibious assault at many points along its extensive coastline. Second, North Korean supply lines had followed the general route of advance to the south, converging at Seoul before fanning out across South Korea. Third, North Korean forces were concentrated around the Pusan perimeter with only light forces protecting their flanks and rear. If UN forces could stage an amphibious landing and quickly seize Seoul, North Korean supply lines would be severed and the bulk of the enemy army would be trapped. If this action was combined with a major push from the Pusan perimeter, the North Koreans would be trapped between the "hammer" of the Eighth Army advancing out of the Pusan perimeter and the "anvil" of the UN amphibious invaders. From these considerations, the plan for the Inchon landing was born.

Inchon was far from an ideal invasion point. Treacherous tides and confined approaches made the area particularly inhospitable to a seaborne invasion. On the other hand, these same factors increased the probability of surprise. On 15 September 1950 MacArthur successfully put ashore the newly activated X Corps commanded by Maj Gen Edward M. Almond. The landing and subsequent rapid advance were models of military efficiency and testified to the complete surprise fostered by MacArthur's choice of a landing point. On 16 September the Eighth Army began its offensive from the Pusan perimeter. By that time, the North Korean forces around the perimeter were a hollow shell that cracked quickly. On 26 September the first elements of the hammer and the anvil joined forces near Osan and MacArthur announced the

liberation of Seoul. By then the North Koreans were fleeing north. South Korea was quickly cleared of enemy forces except for those who took to the mountains to wage guerrilla warfare.

UN military success raised the possibility of complete military victory and the accomplishment of much more significant political objectives than those originally sought. On 6 October the UN General Assembly approved MacArthur's proposed advance into North Korea to destroy the remnants of the North Korean army and reunite the two Koreas. On 9 October UN forces crossed the 38th parallel. Although it met some stout resistance, the UN advance was extremely rapid as the North Korean army continued to disintegrate. On 20 October Pyongyang, the North Korean capital, fell, and on 26 October some elements of the South Korean army reached the Yalu River.

The Communist Chinese had given several warnings through back channel diplomatic sources that they would intervene in Korea if United Nations troops entered North Korea. Apparently the Chinese decision to intervene was based on whether or not UN (rather than South Korean) troops crossed the 38th parallel. MacArthur was convinced that the Chinese were bluffing, because he believed China remained in considerable turmoil in the wake of its civil war. Moreover, MacArthur had complete command of the air over Korea, total control of the surrounding seas, and a victorious army that had just smashed the North Koreans in a matter of weeks. These factors seemed to make Chinese intervention both difficult and foolhardy. Yet when UN troops advanced into the north, Chinese troops began moving into North Korea.

The Chinese move into North Korea was undetected by UN forces.* This remains one of the great feats of military security in modern warfare and one of the most prominent failures of American intelligence. By 15 October 1950, while MacArthur was assuring President Truman that the Chinese would not intervene, 150,000 Chinese troops were already in Korea. By November 300,000 Chinese troops had crossed the Yalu River and were ready to fight. Still, UN forces did not expect a Chinese attack.

The Chinese remained in the rugged central mountains away from the bulk of UN forces. Moving only by night and employing superb camouflage techniques, the Chinese covered signs of their presence and remained hidden from aerial reconnaissance. It is difficult to fathom how nearly one-third of a million Chinese soldiers could go almost undetected and ignored for a considerable period of time. Part of the answer is found in the clever Chinese strategy and in their movement and camouflage discipline while another part is that UN forces were not really looking for the Chinese (when examining aerial photography, one tends to see only what one expects to find). Moreover, aerial reconnaissance technology was relatively primitive at the time, and the UN forces had limited reconnaissance equipment available. Finally, one suspects that no one, particularly at MacArthur's headquarters, wanted to find any Chinese forces. Whatever the reasons, the American and UN intelligence failure was complete and led to near catastrophic results.

The Chinese counteroffensive began on 25 November 1950. The Chinese planned to turn the interior flanks of UN forces (which were split into eastern and western forces by the mountainous terrain) and then trap each of the isolated forces in pockets against the seacoast. With this accomplished, the Chinese forces could quickly sweep south and clear the remainder of the peninsula.

In the west some Marine Corps elements of X Corps were quickly surrounded near the Choshin Reservoir, while other elements were simply overrun. MacArthur realized that the scattered units of X Corps were in danger of defeat in detail and ordered the evacuation of the corps by sea, a feat accomplished with great skill by 24 December. The remainder of UN forces fought a delaying retreat and by year's end occupied stable defensive positions along the 38th parallel. The Chinese offensive slowed and finally ground to a halt because of logistic difficulties exacerbated by concentrated UN air attacks.

By New Year's Day 1951 Chinese forces were resupplied and reinforced to a strength of about one-half million men, and they resumed

*To say that the Chinese were totally undetected actually overstates the case. Chinese prisoners were captured. Reports of prisoner interrogations were forwarded to MacArthur but were dismissed as isolated instances not indicating a general Chinese offensive. MacArthur had convinced himself that the Chinese were bluffing.

their offensive all along the front. General Ridgway was now in command of all forces in Korea under the overall theater command of MacArthur in Japan. Ridgway's tired forces slowly retreated south. Seoul fell again to the Communists on 4 January. The Chinese advance continued, but growing logistic difficulties quickly slowed its momentum as UN resistance increased. Finally, the Chinese attack stalled along a line running roughly from Pyongtaek in the west to Smachok in the east.

To this point the war had been characterized by rapid movement. In just seven months the contending armies had covered the length of Korea nearly three times. First, the North Koreans streamed south, then UN forces advanced north to the Chinese border, and then the Chinese advanced south past Seoul. In each case the rapid advances had stretched the attacker's supply lines and logistic systems to the limit. In each case the defenders had fallen back on shorter supply lines and waited for the opportune moment to counterattack. The first seven months of the Korean War markedly resembled the ebb and flow of battle in North Africa during the early years of World War II.

On 25 January 1951 Ridgway began a methodical counteroffensive that met with considerable success. In spite of occasional savage counterattacks, Ridgway pushed the Chinese north and by 19 April had established a strong defensive line slightly north of the 38th parallel. In the meantime, MacArthur had clashed with President Truman over the conduct of the war and the limitations placed on UN military operations. The result was the sacking of MacArthur and his replacement by Ridgway. In turn, Ridgway's vacant position of commander in Korea was filled by Lt Gen James A. Van Fleet.

For the remainder of 1951, the contending forces fought a series of bitter struggles with limited success. The front lines moved back and forth a few miles either side of the 38th parallel with neither side gaining decisive advantage. Both sides had dug in across the peninsula and the war took on the stalemate characteristics of the Western Front in World War I. In a sense, there were no flanks to turn and both sides could only resort to bloody frontal assaults. Although the seacoast provided inviting open flanks, the Chinese were not capable of major amphibious operations. On the UN side, the return to the limited political objective of restoring the original status quo obviated the need for amphibious operations in the north.

By late October truce negotiations (under way since early July but used primarily as a propaganda forum) were moved to Panmunjom and resumed with more seriousness. In light of the negotiations and the fact that UN forces occupied positions satisfactory both in terms of the political and military situation, Ridgway ordered Van Fleet to cease all offensive operations and assume an active defensive.

While the negotiators argued, blood continued to flow in constant but minor fighting. The war was a stalemate, punctuated by patrol actions, outpost skirmishes, and occasional large-scale, but largely unsuccessful, Communist attacks. Finally, after 18 months of fruitless and bloody stalemate, the negotiators at Panmunjom reached bitter agreement. The fighting officially ended on 17 July 1953.

Better State of the Peace

In the popular mind, the Korean War is generally considered either a failure or, more charitably, the absence of a "victory." In Korea the United States did not bring its adversaries to their knees and force their capitulation, an outcome that Americans had come to expect. Rather than an imposed peace, the conflict ended at the negotiating table between unvanquished opponents. The outcome was not like the Japanese surrendering aboard the *USS Missouri*, and it was nowhere near as satisfying.

Judging whether a better state of the peace was achieved is a matter of deciding whether the political objectives of the United States were realized. The difficulty of making that assessment in the case of Korea is that, as noted earlier, the objectives changed. In turn, the contrasting political objectives translated into different military objectives in terms of enemy hostile ability and will. By one set of objectives, we won. By the other, we did not. However, we can say the North Koreans lost. They failed to unite South Korea under their leadership, and they paid a terrible price for their attempt to do so.

General Poe was transferred to Korea at the beginning of the Korean War, where he flew the first USAF jet reconnaissance sortie and 90 combat missions. During this period of his life, he kept a personal journal of his experiences. We asked him to share some of those enlightening memories with our readers so we can learn more about problems/lessons learned from a "warrior" who actually participated in this historical event.

Korean War Combat Support: A Lieutenant's Journal

General Bryce Poe II, USAF, Retired

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Ever since my first military boss, a World War I veteran Master Sergeant, gave me a dime to ". . . buy one of them little pocket notebooks 'cause I never intend to tell you nuthin' twict!" I have tried to keep a journal. The sparse, stained, and shabby pages of the late 1940s and early 1950s bring back many memories and more than a few lessons learned.

There is certainly truth in Daniel Defoe's words of almost 300 years ago: "War is the best academy in the world, where men study by necessity and practice by force, and both to some purpose . . ."

Upon reflection, the most interesting thing to me is that lessons from those early days were never really recognized as such, but rather just became ingrained in everyday actions and decision making, taking their place by osmosis alongside those learned in schools, from technical data and the like.

Pre-Korean War peacetime service, from the time in 1946 that our F6-Ds (Mustangs to the uninitiated) were replaced with the RF-80A that I would fly in combat, brought its share of pertinent experience. While successful combat support in Korea was modeled after that of World War II, operation and support of jet aircraft brought new problems and opportunities to the task.

In that sense I was fortunate to be in what could probably be considered as the Far East Air Force (FEAF) unit best prepared for war. This takes nothing from other organizations that were also ready and acquitted themselves with distinction from the first day. Our 82d Tactical Reconnaissance Squadron—renamed the 8th TRS before the war began—was the first jet unit in the Far East theater and, as a result, had people with the most jet experience. As early as 1948, we had a "500 Club" of half a dozen pilots with over 500 jet hours, exceptional for that day, with support personnel know-how to match.

We also had a high percentage of regulars and were therefore not quite so badly damaged by the sudden and ruthless cutbacks that began in October 1949 when President Truman impounded \$600 million dollars, cutting the Air Force from 58 to 48 groups. Even more drastic action by Defense Secretary Louis Johnson followed at the end of the year. Many key personnel were released from the Air Force by what seemed to be an arbitrary system that was imposed on commanders without any input from them as to who should go and who should stay. Our squadron was hurt by all this but not so severely as larger units with a smaller percentage of the relatively immune regulars. Just two months before the war, at least one group was excused from inspection because so many key personnel had either been discharged or taken off flying status in the name of efficiency.

The squadron was also blessed with a succession of first-rate commanders—experienced, capable, and hard-nosed:

Lieutenant Colonel Charles W. King, a fighter ace who had commanded a jet squadron as early as 1945—P-59s and

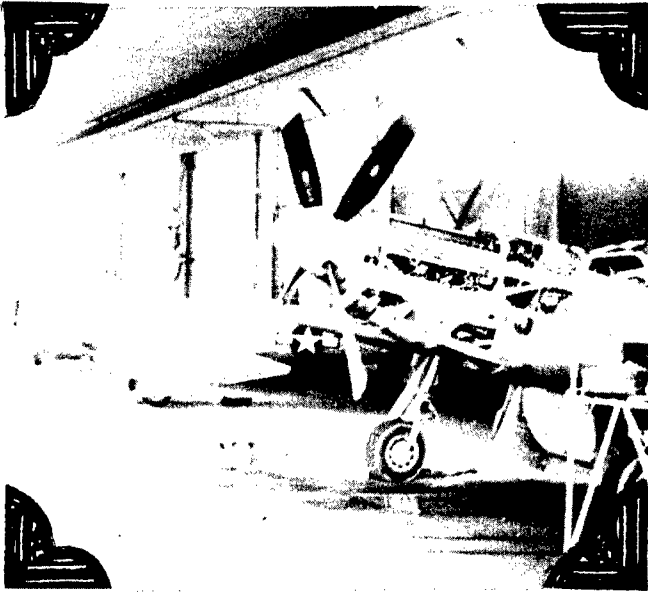
XP-80s—led the 82d to an Air Force record of 10,000 hours without a major accident. This can be better appreciated when we consider it was accomplished at a time when the USAF accident rate ran between 61 and 40 (as I write this, the USAF rate is 1.64). During his command, we learned how to treat our engines, increasing time between changes to a point where the Colonel landed one day, having passed 400 hours on one engine, a new record. We also improved maintenance debriefing so that can not duplicates became rare. The terrible, sometimes fatal problem of loss of hydraulic pressure during operation of the gear had been solved by substitution of a 9-inch B-26 accumulator for the inadequate 6-inch accumulator (the bright idea of a 161st TRS crew chief at Langley AFB, Virginia, in 1947).

Lieutenant Colonel Jacob Dixon followed and was commanding the 8th at the time the war started. He maintained the safety record and, in addition, began a series of long-range cruise control and tactics tests that produced data that was to prove vital in the early days of the war. During this time, we continued to improve operations to where we doubled the landings per tire—to the high 30s. We had gotten rid of the shoddy retreads that came apart on takeoff. Maintenance techniques were developed to solve the problem caused by denting the scupper drain on engine removal, thereby setting the stage for later fires on engine start.

Both commanders pressed aircrews to get into the shops and learn about our equipment, good advice at a time when some pilots knew almost nothing about the aircraft they flew. My favorite example is the man who bragged that he had perfected getting "that extra boost of speed" by flying at very low level and then pulling up sharply so "the jet wash from the engine could push off the ground."

The North Korean invasion was a lesson in itself. I was playing tennis at Yokota Air Base, Japan, with two friends, Lieutenants Shawe and Williams, when Colonel Dixon pulled us off the court and to the flight line. Shortly thereafter, the four of us were airborne en route to Itazuke in southern Japan. So far as we were concerned, it was a "come-as-you-are" war.

Fortunately, at the time the war began, FEAF, and in particular 5th Air Force, while severely limited by cutbacks in fuel and types of weapons, were still in the flying business, active and competitive. Like our photo work, practical missions that often resulted in operating from a remote site with one or two aircraft, crew chiefs, and a two-man photo cell, the F-80C and F-82 fighters and the B-26 light bombers were on the ranges with live ammo, maintaining a limited level of practice high and low level navigation and tactics. The 49th Wing had won the annual theater gunnery competition and was hoping to fly its F-80Cs to the Zone of Interior (ZI) for the finals. To facilitate this, Lieutenant Edward "Rabbit" Johnston developed a long-range tip tank by fitting a Fletcher with multiple center sections. That tank literally kept us in the war in the early days.



F6-D (Mustang) and FP-80A at Langley AFB during transition to jets, 1947.



RF-80A of the 82nd TRS (later the 8th Tac Recon) over northern Japan, 1948.



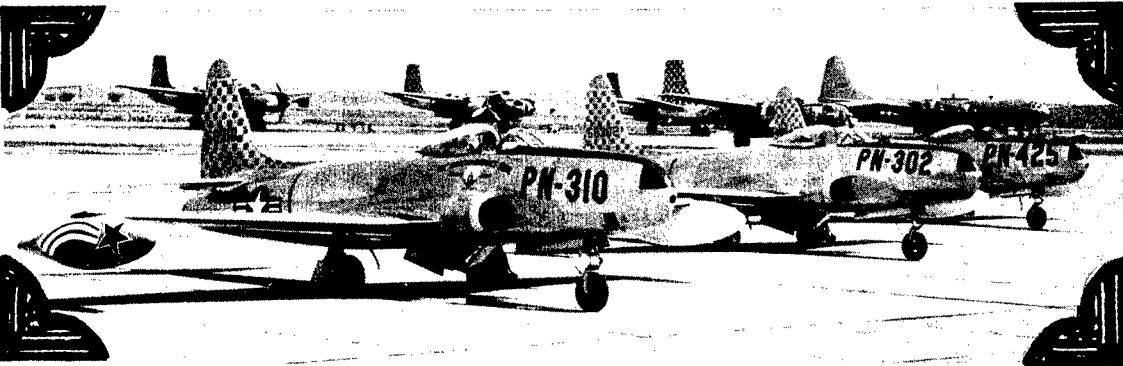
Lear, Poe, Dunlap, Boyd, Tyler, and Williams – TDY at Misawa AFB, Japan, summer of 1949.

Lt Col Charles King — my CO in 82nd TRS Jet and 8th TRS Jet from Aug 1948 until his return to the ZI at end of 1949.

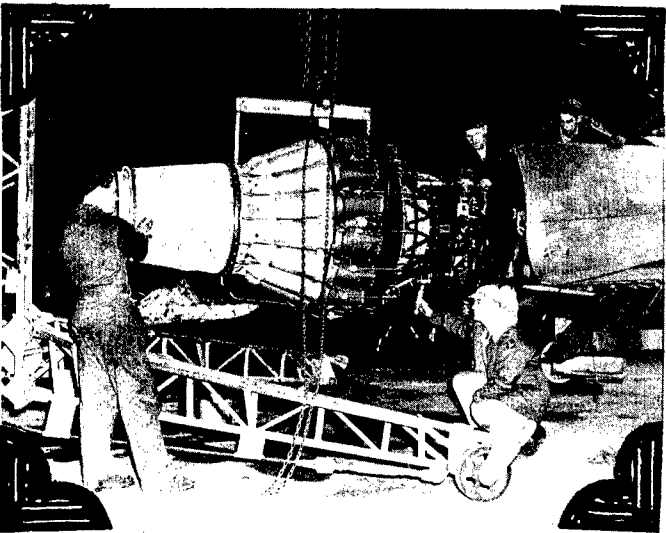




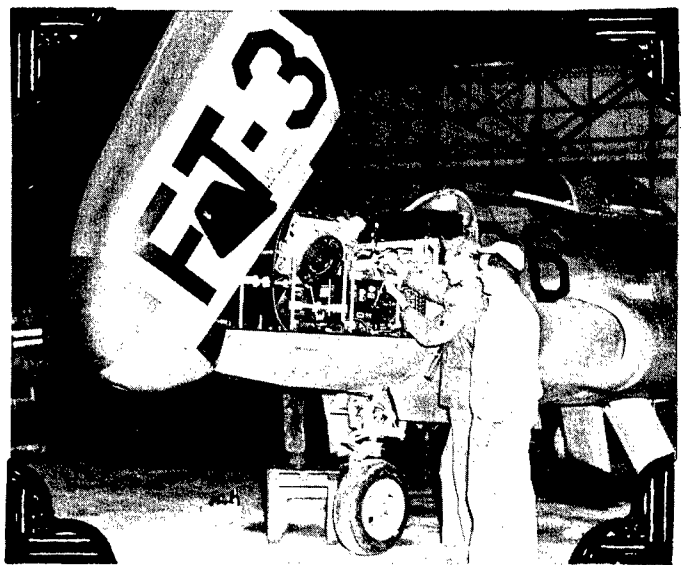
Photos taken 17 July 1950, early in the Korean War, by RF-80A, 8th TRS.



FP-80As (later RF-80A) of the 161st TRS (Jet Propelled) as painted for the Bendix Air Races. In the background are RB-26s of the night photo squadron.



Engine change (RF-80A) and part of our team.



Camera compartment (RF-80A) and some of the people that kept me flying.

All of this gave us a real leg up compared to many ground force Army units in Japan who had essentially no weapons larger than regimental and little opportunity to work with those they had.

In our squadron, with an eye to the stateside air races, we experimented with auto chrome cleaner plus filling of fastener heads, hard on our personal pocketbooks but adding 5-10 mph top speed. The slow cycle time of the World War II aerial cameras was a problem and would have made us vulnerable at low altitude. Lieutenant Wes Brothers, Squadron Engineering Officer, had come up with one solution, three years earlier, when he hooked up two cameras with a C-47 wingtip light flasher device that operated them alternately, giving on two rolls of film the 80% forward lap needed for stereo. Warrant Officer Harry Lear had also made an excellent Sonne camera for low level strip work by matching two liberated German 88mm lenses with a modified camera magazine and a rheostat that could be set on the ground for the predicted airspeed. By early 1950, true Sonne cameras had begun to appear as well as a few of the new, high-speed "silver motor" K-17 cameras. However, the latter still did not allow maximum speed at minimum altitude, and for low altitude oblique shots of small targets, we drew a grease pencil rectangle on the canopy, held our heads 12 inches away (the camera focal length), and manually triggered one frame when the target was centered.

In many ways the initial weeks of the war were chaotic, but by operating from Itazuke, the 8th Fighter Bomber Group's well-established home base, support operations went well. As new outfits took over our facilities at Yokota, we moved down parts and other items and, although there were difficulties, things went smoothly. Another advantage was the availability of items common to our RF-80A and the 8th's F-80C, an advantage increased by the early August conversion (or reversion?) of two squadrons of the 8th to the Mustang and their move to nearby Tsuiki, Japan, leaving only one 8th Group F-80C equipped squadron at Itazuke.

We continued to do well in mission accomplishment once we moved to K-2 at Taegu AB, Korea, on 2 October 1950, but it took a great deal more effort and ingenuity. Wes Brothers was Engineering Officer and, as his Assistant, I had a ringside seat to the intense activity and hard work that kept our aircraft flying.

The contribution of this talented officer is a lesson as to what just one individual's ability and dedication can accomplish. When we were roommates at West Point, Wes confided that what he really wanted to be was "a grease monkey." He'd built his own car before entering service and, while a cadet, was given a one-of-a-kind award of \$800 by the Ordnance Department to build a model of an invention he designed to operate the twin engines of a tank with a single throttle. The wingtip flasher camera setup was only one example of his approach to aircraft problems. We nearly always had at least one plane in commission just because Lieutenant Brothers personally got his hands dirty. Just as important was the respect and confidence in him held by senior NCOs on the line and in the shops. It was mutual, the solid baseline of leadership, since they knew he understood their talents and their problems.

As an aside, we should note that Wes did all this while also staying in the top one or two of pilots in missions flown. In later years, he became a renowned Air Force test pilot, with the F-104 and Gatling gun among his personal successes.

Taegu gave us an overwhelming operational advantage—shorter distances to targets. No longer did we need to carry the clumsy extended tip tanks, and no longer did we have the heart-stopping minimum fuel approaches into foggy Itazuke.

We paid for that, however, with support difficulties that ranged all the way from housing and feeding, through the shops and flight line, to the runway itself.

To begin with, Taegu was about as crowded as an air base could be. The three F-80C squadrons of the 49th Group had arrived a week earlier, and the night photo RB-26s of the 162d TRS arrived the week after us. Aircraft were parked within a few feet of the 5,700-foot pierced steel planking runway, while a tent and shack city grew on the nearby hillside. The parking areas were so close to the runway that a single landing accident destroyed four parked fighters. Facilities were so scarce that some of our photo lab work was done in a schoolhouse eight miles off base.

While many of our people and much equipment were flown in, enjoying the priority the Air Force gave our mission, some ground personnel, and the heavier items, came by ship to Pusan, Korea, and then by road, an agonizing process controlled by Army agencies in Japan who, so far as I could see, recognized no priorities at all.

Combat support, in particular spare parts and fuel, became quite difficult. That it did not significantly reduce mission effectiveness is a tribute to everyone involved. A great deal of ingenuity went into solving problems. We had "honest brokers" at Itazuke who would search for items, put them on airlift aircraft, and call us so we could meet the plane. We also flew back ourselves to track down special items, sometimes on air evac flights, where we learned of the courage and dedication of flight nurses, always shorthanded and without enough morphine, working with dozens of wounded for four hours, taking one hour to off-load, and another to sterilize and fumigate the aircraft, and then sleeping four hours en route back to Korea to start it all over again. When in Japan we searched all the base dumps and boneyards for items left on wrecks in happier and less demanding times and slipped quietly into warehouses in search of items as mundane as safety wire, hydraulic lines, and tank caps.

When aircraft were no longer serviceable, they were stripped of everything useful, right down to fasteners. This applied even to those flown back to Japan for salvage—I remember taking two back with airspeed and tailpipe temperature as my only instruments, not even an rpm gauge (making starts on "rumble" and depending on good weather or hitching on to helpful air defense fighter formations). Finally, that wonderful Shooting Star would accommodate homemade "suitable substitutes" that gave the local Lockheed tech rep grey hair.

It worked pretty well. Our neighbors of the 49th reported an in-commission rate of 82.55% that first month of October and, with the somewhat greater emphasis given our limited reconnaissance capability, my guess is that our old RF-80As did at least as well.

Fuel was a different matter. In the early days stateside, we often laboriously filtered jet fuel from drums through multiple shammy filters. Time just did not allow that and we had a serious problem with contaminated fuel. That often manifested itself as a real scare when, throttled back at low altitude and distracted by target search, we suddenly found the rpm well below idle and had to gently build up power as both altitude and airspeed dropped. At the time we blamed rust scales from inside the drums. After the war, I read that another cause was the failure to clean drums that had been used earlier to mix napalm. Whatever the reason, the problem persisted during my time.

Another fuel problem, not just in Korea but all across the Air Force, was the periodic filling of jet fuel tanks or trucks with hi-octane, or vice versa. Hard to believe with today's professional fuel operations, but then it happened all too often.

As you might imagine, crowded parking, dusty, dirty, and muddy surfaces, and proximity to runway made for a lot of foreign object damage (FOD). Although our centrifugal flow engines were not as subject to FOD as recip props or the follow-on axial flow engines of later jets, it was bad enough. As a result, fighters were often towed to the end of the runway, but our location usually made that unnecessary. We certainly had to be careful, however, and I can remember being the object of justifiable loss of temper by the 162nd TRS commander when he was seeing off his first night RB-26 missions and, returning from a late day mission, I carelessly boosted a cloud of pebbles through our neighbor's parking area.

Living conditions were spartan but certainly good enough. At first Wes and I lived on the flight line, not only closer to our engineering tasks but in the more comfortable circumstances that are the tradition of the professional NCO. We both regretted later being forced to move up the hill to the officers' area. Food was ample, but what I remember most was Australian bully beef and Japanese white fish—a diet we were already used to, thanks to a long-standing and bitterly resented West Coast strike of US longshoremen. Occasionally, we were able to find high priority and very rare items in Japan. The most carefully supervised landing of my career was on return to Taegu with a new aircraft that had no cameras but four cases of whiskey, paid for by 20 people, in the nose.

Somewhat surprisingly, considering the rain and mud, water was in short supply, made even more scarce by the very large requirement of our photo processing facilities. One personal legacy of the lack of bath water was a kind of jungle rot on shoulders and back where we perspired under parachute harness. My own resisted penicillin for a year after returning to the ZI.

Finally, as is often the case, the combat units had priority in a good deal of new equipment, modifications, etc.. This was double-edged, sometimes a good thing, but other times not so well received.

The transition to a new 7½-inch accumulator from the jerry-rigged B-26 nine-inch model was welcome, but really didn't work any better. Another that comes to mind was a new artificial horizon nicknamed the "baseball" because of its shape. Its performance was much better than the one it replaced; that is,

it was more reliable and much less likely to tumble. The problem was the display itself, which was exactly the opposite to everything any pilot had flown with before. My introduction was on one of the rare missions where we left our RFs and climbed into an F-80C to lead to a special target. At wheels up, in weather, with 15 aircraft behind me, I had a terrible time deciding whether I was climbing or diving. Fortunately, we quickly broke out on top. I was told that the instrument presentation was based on tests as to just what movements caused the quickest operator reaction but that none of the "operators" used in the design phase were pilots.

Experimental photo equipment was also received with mixed emotions. Brigadier General George W. Goddard—the Air Force's pioneer and unquestionably best expert in aerial photography—and his people brought a number of new camera systems to Taegu. Some, like the cartridge system for night photography by B-26s, went on to become invaluable assets. Others, like the still and moving picture cameras we flew in the 8th, did not perform as well. The General will always be a hero of mine, but those cameras really needed more testing stateside where a person wouldn't get shot at.

It may have been the pressure to get "pretty pictures" to help convince the folks at home it was a real war that led to the premature field test. I can understand that now, but most of us resented it at the time. My own pride was hurt when a long string of successful missions was broken by two successive camera failures with new color film. When my classmate Lieutenant Roy Hudspeth brought back a "G-force protected 35mm movie camera" somewhat diminished in value by a 20mm hit right on the lens, our regret for the lost camera was quite a bit tempered by the fact it had not worked properly on earlier sorties. In fairness, we lost no one in the process and all were delighted to see some of the few successful photos in *Life* magazine.

It is hard to believe those days are almost forty years gone. Still, the six months of war before I rotated home remain one of the most important learning experiences of my career, one that helped carry me—in other places and at higher rank—through times when I was tempted to pay attention only to what I was good at and enjoyed doing rather than what truly deserved my attention. 417

Korean War

June 25, 1950 - July 27, 1953

POWs Returned — 4,439

Still MIA — 8,200



"Since 1953, North Korea has carried out a number of incursions and terrorist attacks against the south. Some 40,000 U.S. troops remain in the country to deter another full-scale invasion."

Reader's Digest, September 1988



"The US forces in Korea had the greatest impact on Korean society, greater than any other foreign presence in her history."

The Impact of US Forces in Korea by Lee Suk Bok

Airlift of Cargo and Passengers in the Korean War

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Introduction

Airlift in support of combat has proven to be a major element in military operations. In modern combat, logistics personnel are required to go into combat zones as quickly as possible and, once in place, to provide supplies and equipment to the fighting forces. As the complexity of war has increased, so too has the support for our forces.

In this paper, I will explore the airlift of cargo and passengers as it evolved in the Korean War. First, I will discuss a brief background of the state of the transport services prior to the outbreak of the war, including events which helped develop transport philosophy.

Then, I will cover airlift of cargo performed both by conventional transports and by helicopters and also discuss transport of passengers, including troop movement and evacuation of the wounded.

Background

Airlift, simply defined, is the movement of goods and people to where they are needed, when they are needed. (6:vii) Although the definition of airlift is simple, the unification of airlift was not easy.

Early in World War II, the Secretary of Defense created the Air Transport Command (ATC). Since the Navy already had its own agency, the Naval Air Transport Command (NATS), service rivalries played a strong role in the resistance to unification. The Joint Army-Navy Transport Committee (JANATC) worked to reduce duplication between the services, but did not consolidate intertheater airlift until later. Over the years, however, much thought went into the consolidation of transport services and, finally, in 1947 the Secretaries of Defense, Navy, and Air Force began discussions on the consolidation of ATC and NATS. (6:172-173)

In June 1948, in accordance with Secretary of Defense Forrestal's directive to consolidate airlift resources into one transport agency, the Air Force established the Military Air Transport Service (MATS). This command was composed of the ATC, four NATS squadrons, the Air Weather Service (AWS), the Air Rescue Service (ARS), and the Airways and Air Communication Service. (2:3) This newly founded command was just starting to organize when it was confronted with an enormous test of its abilities.

The Berlin Airlift

The Berlin Airlift was a huge effort which concentrated on providing food, supplies, and fuel to the 2.5 million military and civilian residents of West Berlin during the Soviet blockade. The airlift was sustained from 26 June 1948 through 1 August 1949 and delivered more than 2,223,000 tons of materials on 266,600 flights. (6:175) The Berlin Airlift proved that cargo and passengers, in large quantities, could be moved anywhere in the world. General Lucius D. Clay, USA, wrote:

We are gaining invaluable experience in the use of air transport to support military operations and for civil use. The cost of the airlift could well be justified in the contribution to national defense. (6:181)

Operation Swarmer

Operation Swarmer was a jointly held Army-Air Force war exercise which was held in North Carolina in April-June 1950. Its aim was to test strategic airlifting seizure and continuous flow in combat conditions. The exercise involved airdrop and airlifting of regimental combat teams, and used a third of the nation's airlift capability—a force greater than that which supplied Berlin.

Important lessons emerged from Operation Swarmer:

(1) *First tactical suitability test of C-119.* The plane did an excellent job of air-dropping heavy equipment (jeeps and trailers) by parachutes.

(2) *Poor communication systems.* High priority messages on teletype took up to five and one-half hours to get to their destinations; pickup and delivery of supplies were hard to keep track of; and communication and navigation aids were susceptible to jamming.

(3) *MATS not fully structured for such an operation.* MATS structure was appropriate for long-range, intertheater airlift, but not for an intense airlift in combat conditions. (6:192-193).

Korean War

Preparation for War

As in previous occasions, the United States was not ready for war in 1950 when North Korea invaded South Korea. Isolationism had once again set in and, except for NATO, we assumed other countries' problems were their own affair. After World War II, rapid demobilization had left our military capability in shambles. Personnel, facilities, equipment, and supplies had all decreased. Important bases had been closed or reduced to minimum operation. Also, critical personnel, such as pilots and mechanics, had been released. Needless to say, we had to scurry to bring a suitable force together.

Because of the short supply of ready aircraft and crews at the outbreak of the war, the Air Force contracted with civilian airlines to ferry supplies and personnel to the Pacific. Few of the major airlines (PanAm, Northwest, and United) were willing or able to provide this service, but the smaller airlines were anxious to participate in this operation. The carriers flew two routes: Seattle-Anchorage-Aleutians-Japan and Hawaii-Midway-Wake Island-Japan. (8:228)

To handle air support operations, the Air Force established two airlifts:

(1) *The transpacific airlift*, set up under MATS (included 60 civilian air carriers, the MATS Pacific division, a squadron of Royal Canadian Air Force aircraft, elements of Canadian Pacific Airlines, and some Belgian aircraft).

(2) *The intratheater airlift* between Japan and Korea (operated by the Far East Air Force (FEAF)).

Airlift of Cargo

Air Transports

The efficiency of intratheater airlift in Korea was due in large part to pooling all air transports with crews trained to perform a variety of missions operating under a single command. We organized the Combat Cargo Command (CCC), later renamed the 315th Air Division (Combat Cargo), and gave it operational control of some 250 transports, most of which had thousands of hours of previous service. The aircraft were a combination of C-46s, C-47s, C-54s, and C-119s. Of these aircraft, only the C-119 was specifically designed for military cargo operations. The CCC accomplished their mission by air-dropping (parachuting) and airlanding supplies and equipment.



Air resupply for the air fleet. A C-47 wing bound for Korea is disgorged from a C-119 Flying Boxcar.

Major General William Tunner, a veteran of the World War II Hump and the Berlin Airlift, became the commander of the FEAF CCC. When General Tunner arrived in Korea in the fall of 1950, there was little order to air transport operations. He saw the need to consolidate air transport capability to make better use of limited resources. Under his direction, the command quickly reorganized their operations and pooled their transports.

The command's capability was extraordinary. With less than 24 hours' notice, the transports were able to land supplies at an airstrip or drop supplies to scattered locations. With 72 hours' notice, CCC could deliver an (airborne infantry) assault behind enemy lines and maintain it with supplies for as long as was necessary. (3:26)

Korea provided airlift challenges unlike those experienced in "Hump" operations or in the Berlin Airlift. In those situations, delivery points were always fixed and schedules planned in advance. In Korea delivery points shifted constantly as mandated by combat and no real scheduling was possible. A newly organized joint Army, Air Force, Navy, and Marine logistics allocation board met daily with General MacArthur to review requests for supplies. The board allocated frontline supplies and prepared freight manifests for delivery within 24 hours.

Airlift was especially important because of the difficulty in getting desperately needed supplies from ships in harbor. Loading problems and poor roads made it difficult to access cargo destined for use by the fighting forces. Many times, although supplies were in-country, troops could not get to them. Airlift was used as a corrector of these logistical bottlenecks. (8:235)

The C-119 was popular for air-drop missions because of its roller-bearing floor, wide doors, and specialized cargo release

equipment. Transportation personnel carefully packaged cargo on wooden pallets to facilitate release and to absorb much of the landing shock. Bases in Japan had much of this equipment prepackaged for these missions.

Air-drop missions were not limited to supplies only. The 315th dropped many large pieces of equipment (such as field artillery, trucks, jeeps, radio equipment, ammunition, water, gasoline, rations, medical supplies, ambulances, etc). In one instance, they air-dropped a bridge (in eight sections) to the Marines. The planes allowed some supplies, such as clothing and blankets to free-fall, and identified other items with different colored parachutes to indicate the contents of the package. These planes flew a total of 181,659 cargo sorties and delivered over 476,000 tons of ordnance.

Helicopters

Our forces also used helicopters for airlift missions. The Army operated a transport company with 21 Sikorsky H-19s and two smaller personnel helicopters to ferry troops, armament, and cargo. (1:60) The Marines used helicopters for hauling cargo. HMR-161s carried ammunition, food, water, medical supplies, or whatever else might be needed. They also performed other missions, such as laying telephone wire, relieving battalions, dropping patrols in isolated sections, and lifting combat troops across obstacles. (4:16-17)

Airlift of Passengers

American Nationals

During this war, we airlifted many different types of passengers. Of these, the first airlift of passengers occurred shortly after Communist-backed North Korea attacked South Korea. This initial attack occurred on 25 June 1950. The primary concern of the Far East Command at this point was the evacuation of all American nationals from Korea. This task was assigned to the Far East Air Force. On 27 June 1950, under cover provided by F-80s and F-82s, the air evacuation took place moving a total of 748 people on C-47s and C-54s. By 29 June, the FEAF had transported 851 people, including personnel from the United Nations Commission on Korea. These numbers were comparable to the 905 people who were evacuated from Korea by sealift. (5:7-13)



Helicopters came of age in Korea, adding new dimensions to the movement and rescue of frontline forces.

Combat Troops

Airlift of troops provided the opportunity for expedited delivery of combat forces where they were most needed. It also provided advancement on enemy positions which many times meant victory over enemy forces.

During the first days of conflict, the 374th Wing's troop carrier planes ferried ammunition and supplies to Korea. The 374th Troop Carrier Wing was assigned to the Fifth Air Force located at Tachikawa Air Base, Japan. During the night of 30 June, the 374th was advised they would be moving the 24th Infantry Division and a 21st Infantry battalion combat team to Korea. Most of the 374th's C-46s, C-47s, and C-54s were already loaded with supplies, but were unloaded during the night, and by the next morning were ready for their mission.

Because of poor weather conditions, a full-scale airlift did not take place until 2 July. At first, C-54s ferried troops, but the poor conditions of the runway at Pusan could not take the beating of the heavy planes. So, from mid-afternoon on 2 July until completion of the airlift on 4 July, the troops used lighter C-46s and C-47s for the airlifts.

This first movement of troops into Korea signaled the need for close coordination between Army and Air Force planners. To integrate the efforts of air and ground forces, they formed a joint battle information agency, the Joint Operations Center at Taejon, which included Air Force combat and Army air-ground operation sections. Later, they added a Navy liaison section.

But the Center still needed to solve many problems. Initially personnel could not determine the positioning of friendly troops. Also, they could not communicate with the high echelons of Fifth Air Force in Japan because of poor telephone and teletype lines which were down 75% of the time. However, by working together, they were eventually able to find some solutions to these problems.

Paratroopers

We also airlifted paratroopers extensively. One such example was the use of the 187th Airborne Regiment to secure Sukchon and Sunchon. The 187th was the Army's pride and joy. These men had been extensively trained for the roughest jobs and the Army was anxious to use this elite force.

On 20 October 1950, the Regiment used 71 C-119s and 40 C-47s to conduct surprise attacks at Sukchon and Sunchon. During these attacks, they delivered 2,860 paratroopers, along with 301 tons of equipment, including jeeps and artillery. The attacks were such a surprise that many enemy positions were abandoned with guns and ammunition left behind by retreating forces. The paratroopers did encounter some heavy opposition but were able to secure and expand their positions. Within three days, the 187th had captured or killed 6,000 North Koreans. (8:238-241) No doubt these victories were greatly enhanced by the element of surprise which airlift provided.

Of course, not all troop airlift operations were successful; but the use of airlift contributed significantly to many of our victories. In subsequent US involvement in Korea and elsewhere, airlift has always played a key role. In the words of General Michael O'Daniel, Commander, 8th Army I Corps:

The airlift to Korea is one of the greatest developments of this war. It gives a commander advantages he has never had in wars before. (8:242)

Wounded

Air Evacuation. The air evacuation of the wounded was called the major miracle of war. The full-scale evacuation of the

wounded was a major military development of the Korean War. Through use of air evacuation, the death rate of seriously wounded soldiers was half what it had been in World War II. Though at the beginning of the war, personnel resisted air evacuation, they eventually embraced it as the proper way to handle the wounded. The 801st Medical Air Evacuation Squadron was in charge of these missions.

The common method of air evacuation was to assign medical personnel to Combat Cargo Command planes bound for Korea. Once the cargo was unloaded, Army personnel took the wounded on board and administered preliminary care en route to base hospitals in Japan. The Air Force furnished planes, flight nurses, medics, medicine, and equipment for care provided in flight. The Army furnished ambulances, holding facilities, medics, and labor for loading and unloading the wounded. This system was so effective that by the end of December 1951, the planes had airlifted 201,926 patients. (7:161-162)

A systematic pattern was followed for the evacuation of patients. Patients whose hospitalization was likely to take less than 30 days were air evacuated mainly by C-47s to southern Korea. Those expected to be hospitalized six months or less were moved by C-54s and C-46s to base hospitals in Japan. All those whose recovery would take more than six months were airlifted to the US by MATS, thus clearing hospitals in Japan for other patients. (7:161)

By the end of the war, the 801st had airlifted over 300,000 patients. None of the evacuated died in air crashes. Unfortunately, three nurses and four medics were lost in air crashes during the evacuation. Considering the magnitude of the operation, having lost only seven people was extraordinary.

Helicopter Evacuation. In combat situations, the tendency had been to move mobile surgical facilities as close to the wounded as possible. Because of fluid tactical movement, poor roads, and mountainous terrain, this was not advisable in Korea. This situation created the need to move patients to the rear quickly and safely.

The mission of a detachment of the 3rd Air Rescue Squadron was to recover downed pilots. Occasionally, the Army requested evacuation of seriously wounded soldiers from mountainous areas and, if the 3rd was not busy performing its primary mission it would oblige. (9:111)

Thus was born helicopter medical evacuation. The versatility of the helicopter made it very popular for many difficult missions. It was able to weave through the mountainous terrain and land where other aircraft could not. This allowed recovery of wounded that otherwise could not have been saved.

In January 1951, three Army helicopter detachments were sent to Korea to perform this mission. Each detachment was composed of four helicopters, four pilots, and four mechanics operating either Bell H-13s or Hiller H-23s. (9:111) These aircraft were later joined by H-5s and the Sikorsky YH-19s which were tested in Korea.

Helicopter evacuation was limited to cases involving head, chest, and abdominal wounds, multiple fractures, and severe loss of blood. Even in these cases, it was only used if an ambulance could not access the patient, or if the ambulance ride was judged too dangerous. (9:112)

There were certain risks involved with using helicopters for these missions though. They were extremely vulnerable to enemy fire due to their lack of speed and inability to fly at high altitudes. Because they lacked gliding abilities, any fire damage to the craft was usually fatal. (9:112)

Helicopter medical evacuation saved the lives of many patients who would not have survived if transported by other

means. This rapid mode of transport especially saved those who would have died of shock or head injuries and greatly reduced the risk of infection. By 1 November 1951, helicopters had evacuated 8,000 casualties. (9:113)

Conclusion

We must recognize the importance of airlift in wartime while we are at peace so we can better prepare for combat scenarios. Major General Robert Harper, former Commander, Air Transport Command, supported the concept of a strong peacetime strategic airlift capability. He felt strongly that airlift's true value was the successful prosecution of war. He wrote:

We should not lose sight of that fact in peace because there is always the danger of organizing our air transport on the basis of efficiency, economy, and convenience suited to the peacetime situation.... Our valiant, well-equipped and thoroughly trained fighting forces will be of little use if we cannot establish them quickly as offensive spearheads in advanced zones from which they can operate effectively against enemy bases. (6:170)

In General Harper's words, there is an obvious lesson to be learned. The need to be ever-prepared for the event of war is

crucial because, when faced with the reality of war, it is too late to prepare. We must plan for airlift, as well as other military operations, if we are to minimize loss of lives and assure victory.

(Ms Rivera was a student at AFIT when she wrote this paper. She graduated in September 1989.)

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AL7

Eighth Army in Korea

Because US forces spearheaded the United Nations effort in Korea, the Eighth Army was to be the host and parent to all the friendly forces as they arrived. The Turkish Brigade, for instance, came under the control of an American Division within the Eighth Army.

Within days after the first arrival of friendly troops, the US organized the United Nations Reception Center. All clothing and equipment, plus familiarization training, came through the center. While this reception was taking place, US Army officers watched from a distance to determine which troops were in "ready" and which troops were in "unready" training proficiency. Of course, each country's bureaucracy had marked their troops as "ready," but the officers found much difference in the various stages of readiness. Programs then were lengthened for some troops; equipment was altered; and, in some cases, additional work uniforms had to be issued. Logistics factors had to be radically altered.

Doctrinal differences also caused logistical imbalances because some foreign troops would use more concentrated firepower than US forces, while others would use much less. Other non-US troops' doctrine required they move forward faster and organize high ground rather than the US preferred slopes; this difference caused varied pressures on the transport teams.

Rations difficulties were absolutely monumental. The Turks avoided pork, the Hindus disliked beef, while both requested huge quantities of interesting herbs and spices never before used by US mess sergeants. The Thais and Filipinos looked askance at potatoes and longed for more rice, while the Dutch yearned for simple blocks of cheese and milk solids. All the Europeans desired much more bread than the US ration contained. However, to many non-US troops, it was "bully-great fun" to eat the strange American rations. From US forces Tokyo—all these differences in tastes were accounted for and special modifications were

arranged. Only the Canadians, Norwegians, and Swedes ate the usual US rations, all else—except the British Commonwealth Contingents who supplied their own—had a special packet.

Clothing supplies were easier to contend with because US issue was in popular demand. However, sizes were all smaller and hundreds of new classifications had to be added. Shoes had to be resized because few US shoes were wide enough for Turkish feet. Pusan was the main center for all this logistical classification.

Rail support from Pusan North was poor; there are few feeder lines and only one double track from Pusan to Seoul. Transporters never had enough rolling stock and had to import as many trucks as possible. With all that, it was still very hard to get supplies to the forward areas. In many cases, things were hand-carried the final few miles to the waiting troops.

There was never enough ammunition in the forward depots, so a rationing system had to be devised for light and medium artillery shells. This system worked and the shell supply stabilized.

Periodically, civil relief operations would throw a great monkey wrench into the hardworking logistical gearbox. New offensives meant thousands of refugees needing food, clothing, and medicine. The Far East Command worked rapidly to procure some of those items in Japan and other Far Eastern sources. The Civil Assistance Command of Eighth Army was astoundingly successful in controlling disease, helping orphans, rebuilding factories, and other infrastructure needs. In addition, more than 100,000 POWs were being supported on an island 30 miles southwest of Pusan.

All in all, the multinational support effort of the Eighth Army in Korea was a definitive lesson in coalition logistics.

(From US Army in Korea official reports,
The US Army in the Korean War)

Most Significant Article Award

The Editorial Advisory Board has selected "Air Base Vulnerability: The Human Element" by Lieutenant Colonel John A. Ballard, USAF, and Captain Jon A. Wheeler, USAF, as the most significant article in the Summer 1989 issue of the *Air Force Journal of Logistics*.

PACER EAST was an exercise to reconstruct a severely damaged C-141B. SMSgt Pate, then an aircraft battle damage repair (ABDR) Maintenance Superintendent at the 2955 CLSS, was involved in the entire operation. This article relates step-by-step how he and his team tackled this demanding project and how their work benefited the Air Force.

PACER EAST: A C-141B's Rescue From the Boneyard

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Background

On 13 January 1987, a C-141B crash-landed at the Marine Corps Air Station, Iwakuni, Japan, during a routine shuttle run. There were no serious injuries to the 36 personnel on board. However, the crash did cause significant damage to the aircraft. The Air Force immediately sent engineers from Lockheed Aircraft and the Warner Robins Air Logistics Center, Georgia, to the scene of the accident.

Assessing the Damage

The engineers assessed the damage and found:

- Both left and right main landing gear ripped from the plane.
- Heavy structural damage inflicted to the lower fuselage which included aircraft skin, formers, stringers, and both longerons at BL 9.
- Bulkheads at Fuselage Stations (FS) 998 and 1058 damaged beyond repair when landing gear was torn from the plane.
- Right wing heavily damaged by fire.

After inspecting the plane, the engineers determined the aircraft was recoverable and began searching for an organization to repair the damage.

Answering the Call

Recognizing the training opportunity this type of project offered, the 2955th Combat Logistics Support Squadron (CLSS) from Warner Robins volunteered for the job. The CLSS needed

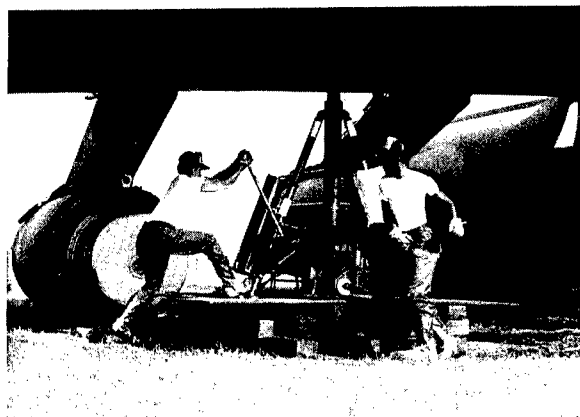


Crash site prior to moving.

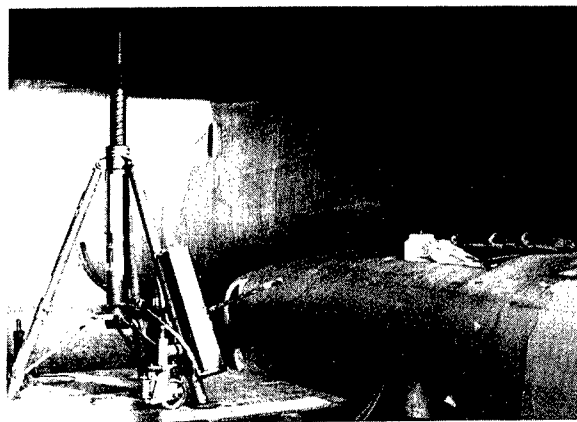
experience in this type of work to enhance their aircraft battle damage repair skills. While the damage to the aircraft could hardly be called "battle damage," it would afford the squadron the opportunity to become more familiar with field repair of major structural damage to the C-141. Consequently, the CLSS was given the task of not only recovering the aircraft, but also repairing it.

Devising Plan of Attack

Before work could actually begin, the engineers had to devise a plan to move an aircraft the size of a C-141 with no main landing gear or main landing gear support structure. Engineers



30-ton jacks on top of cross ties and steel plates are used to level the aircraft.





the aircraft to serve as ballast to compensate for the missing number four engine and outboard wing.

Once we had leveled the aircraft, we began excavation around the plane. We used backhoes initially until the work required was too close to the aircraft. To prevent further damage to the aircraft, we used shovels under the wings and fuselage. Once sufficient space was available, we placed runway matting beneath the wings to provide a base for standard 40-ton wing jacks.

To install nose jacks, we dug pits on either side of the aircraft nose. Once these were in place, the aircraft could then be jacked to the maximum allowable height.

Our next task was to attach the tow fixture to the airframe at FS 1058. Fortunately, the fuselage jack points were intact and could still be used. The tow fixture had been constructed with cups that were designed to fit over the jack ram. Two 70-ton capacity jacks would be used to move the fixture beneath the aircraft. Once these jacks were seated, they would provide enough stability to the aircraft to allow us to remove the wing jacks.

After the wing jacks were removed, we filled in the area beneath the wings to ground level using rocks and fill dirt. Next, we replaced the runway matting and again installed the wing jacks. The pits on either side of the aircraft nose had to be filled as well to raise the aircraft higher.

After raising the aircraft above our newly reestablished ground level, we could then excavate beneath the fuselage. We had to remove enough soil to allow a 60-ton capacity low-boy trailer with the base of the tow fixture attached to be backed beneath the fuselage. When excavation was completed, we had a 7-to-8-foot clearance between the FS 1058 and the ground.

Once the aircraft was securely attached to the trailer, Marine Corps and Naval personnel prepared a road bed that would allow us to tow the aircraft to the active runway and then to the repair location.

Since the width of the trailer was significantly less than the width of the wheel base of the C-141, we were concerned about the lateral stability during the tow. To provide stability, we positioned K-loaders with air bags beneath the wings which would move along with the tow.

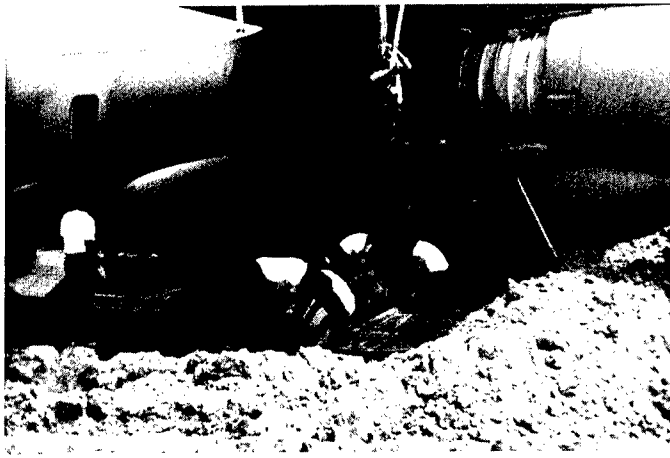
from Warner Robins decided to use a fixture that would work like a "fifth wheel" assembly. This assembly would be attached to what was left of the mainframe at FS 1058. Once the assembly was attached to the airframe, the aircraft would be raised high enough to position a 60-ton capacity low-boy trailer beneath the 1058 frame. The aircraft could then be towed backwards to an area more suitable for performing aircraft maintenance.

Recovery

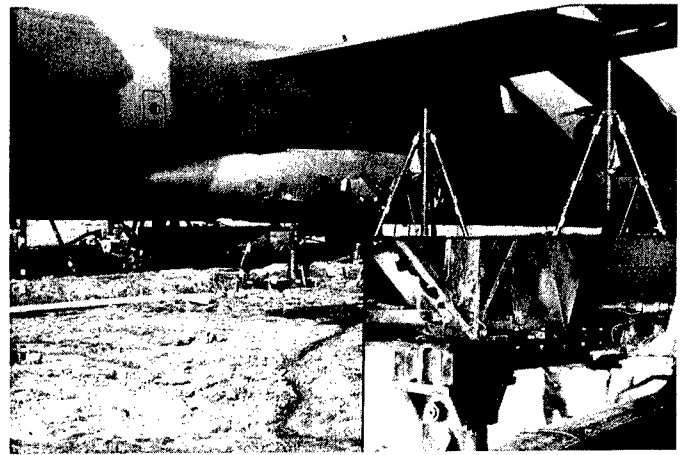
Actual recovery of the aircraft began in June 1987. Our first step was to level the aircraft. To accomplish this, we built platforms of railroad cross ties with plate steel beneath the left wing jack points, using aircraft nose jacks to accomplish the leveling. Once the aircraft was as level as possible, we removed the number one and two engines and pylons. For lateral stability during the remainder of the recovery, the number three engine and pylon were to stay with



Damaged belly skin with severed longerons.

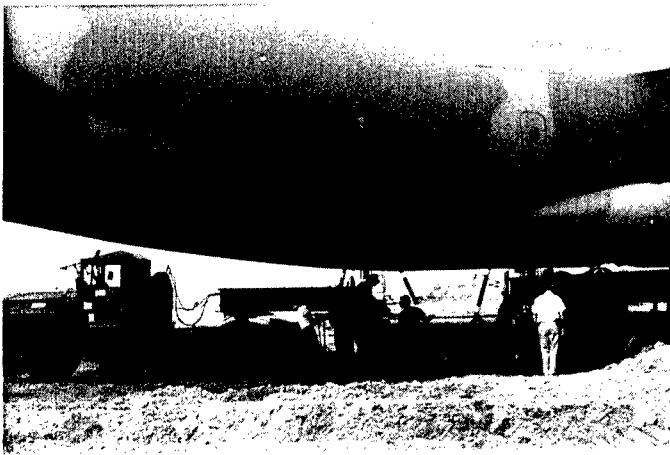


Members of the 2955 CLSS position runway matting beneath the right wing.



The aircraft is ready for excavation beneath fuselage. The tow fixture has been attached to the 1058 frame.

Clamps were used to attach tow fixture to the 1058 frame.



Tow fixture is secured to a 60-ton capacity low-boy trailer.

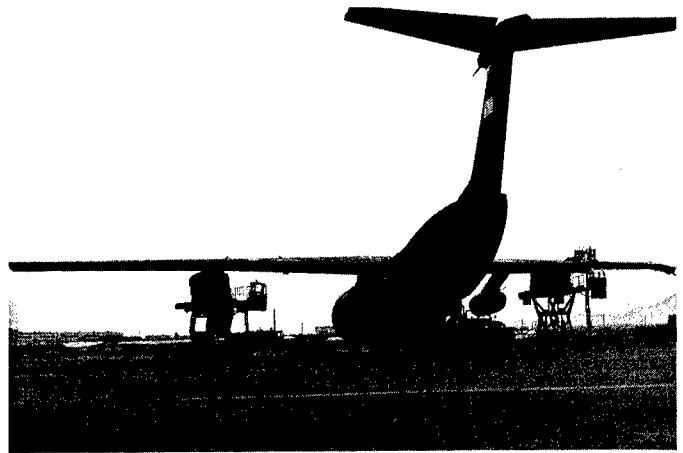
Repair

A new team of technicians from the 2955th CLSS deployed to Iwakuni in January 1988 to start the repair process. Their task was to change the mainframes at FS 998 and 1058. This task was complicated by the fact the aircraft had to be worked in an open area, as there were no hangar facilities at Iwakuni capable of housing a C-141B.

As the team departed for Iwakuni, I took another maintenance team to Travis AFB, California, to cannibalize ("cann") an entire right wing from another badly damaged C-141. Never before had a wing been removed from one C-141 for reinstallation on another aircraft in the field. Never before had a C-141 wing been shipped via a C-5. The removal, transportation, and installation of the wing would all be an Air Force first. (NOTE: C-141 wings were removed from a burn-damaged aircraft in the mid-70s. These wings were completely stripped and sent to Davis-Monthan AFB, Arizona, for storage. These wings are currently being repaired for installation on the donor aircraft at Travis AFB.)

A second team of technicians deployed to Iwakuni in April 1988 to relieve the first team. Their tasking was to complete repairs to the fuselage and to prepare the replacement wing for installation.

In late August, our team arrived at Iwakuni to install the wing, landing gear, and other systems in final preparation for flight.



The aircraft is towed onto the runway for the trip to the repair area.

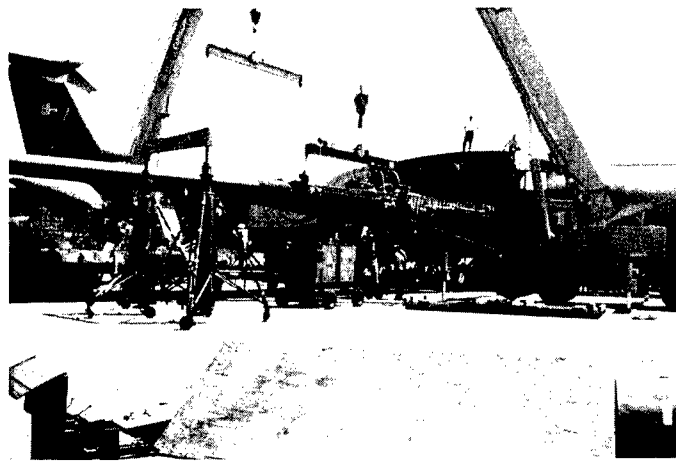
On 1 September, we began working on the wing change. Originally scheduled for two days, we decided to take advantage of the favorable weather conditions and not only remove the old wing but also install the replacement wing. The process of removing the old wing, positioning the new wing, and installing the tension bolts took 4½ hours.

After the initial positioning of the wing, alignment and complete attachment lasted another four days. We accomplished alignment checks on the nightshift because thermal expansion of the aircraft structure during daylight hours made accurate readings impossible.

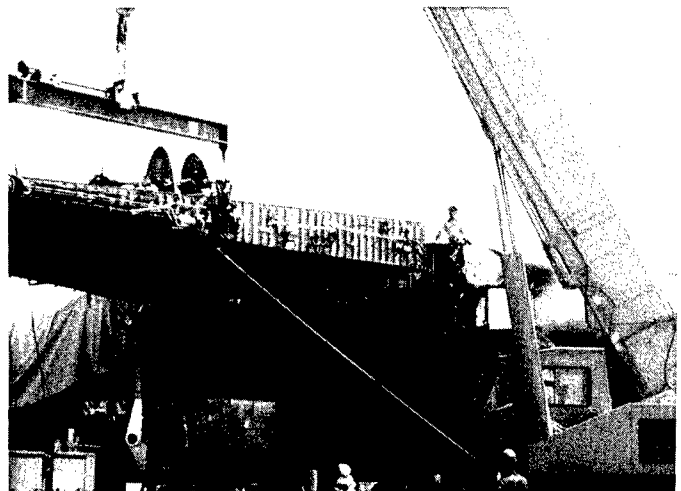
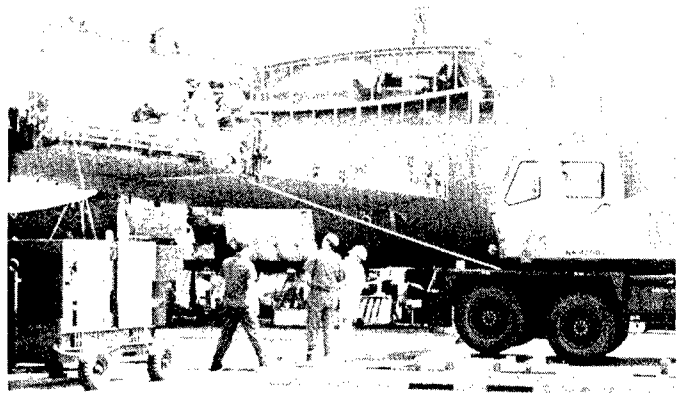
Once the wing was fully attached, we installed leading edges, flap tracks, trailing edge panels, and all other items that had been removed for shipment of the wing from California. Next, we installed the main landing gear struts and wheels. Then, we took the aircraft off the jacks and shoring, so it could rest on its own gear.

Due to a shortage of parts, we returned to Warner Robins in November to assist in the assembly of the remaining plumbing for the landing gear and collection of other components not yet received.

In January 1989, we returned to Iwakuni to complete the project. We were augmented with personnel from the 63rd Field Maintenance Squadron (FMS) and Avionics Maintenance



The replacement wing is hoisted from its transportation dolly and moved in for attachment.



Squadron (AMS). These personnel would install the engines, auxiliary power unit (APU), and all avionic gear. AMS personnel would also ensure all systems required for a transoceanic flight were functional. All work progressed very well and, on 28 February, we started the engines for the first time.

No major problems were encountered during the engine runs. Some instruments required changing, and there were some minor hydraulic leaks and pressurization problems associated with rebuilding the aircraft. Other than these, the required systems worked as advertised.

Our only setback occurred while rigging the landing gear. During the fourth retraction of the right main gear, the main landing gear actuator support yoke snapped. Since this failure would only prevent the gear from retracting, we decided, after inspection, to fly the aircraft with the landing gear down to Yokota AB to replace the yoke assembly.

The aircrew arrived at Iwakuni during the week of 13 March, and the aircraft records were turned over to them on 16 March. The crew performed their preflight and taxi checks that afternoon. On Saturday, 18 March, the aircraft flew for the first time in over two years as the crew completed a closed-loop pattern to test the airworthiness. Later that day, the aircraft departed for Yokota, with the en-route team following the next day.

The aircraft spent a week at Yokota. In that time, we replaced the broken yoke assembly on the right main gear, finished rigging the gear, and installed the main gear doors. On 25 March, 67-0029 departed for Warner Robins ALC with intermediate stops at Hickam AFB, Hawaii, and Norton AFB, California. The aircraft arrived at Warner Robins AFB on 27 March, where it underwent programmed depot maintenance. The aircraft returned to active service in December 1989.

Exercise Valuable Experience

Significant Firsts

A number of significant firsts were realized during Project PACER EAST. For the first time, a C-141 wing had been removed from one aircraft, transported, and installed on another

aircraft. Never before had an aircraft the size of a C-141 been recovered and moved with its main landing and support structure missing.

CLSS Capabilities Recognized

The abilities of the CLSS were highlighted, and acknowledged, during this project. While support functions were handled by center personnel at the Warner Robins ALC, the active duty members of the 2955th accomplished the majority of the work at Iwakuni. These individuals possessed the knowledge, dedication, and drive to accomplish seemingly impossible tasks.

Conclusion

There is an active duty CLSS at each of the five air logistics centers. These units have similar abilities and offer the Air Force a significant major aircraft damage repair capability. This capability was demonstrated not only during PACER EAST at Iwakuni but also in the recovery of C-130 aircraft from Cape Romanzoff, Alaska; Lajes Field, Azores; and the center wing box change on a damaged C-5 at Dover AFB, Delaware. These projects represented dollar savings well in the millions for the taxpayer and added strategic and tactical airlift capabilities for the Air Force.

It is organizations such as these that are the backbone of our combat capability. It is through their dedication and hard work that we will maintain a strong Air Force.



Military Logistics After Gorbachev: Tomorrow's Challenges

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In one of his lesser known works, Rudyard Kipling wrote that "transportation is civilization."¹ To paraphrase this master of Victorian literature, "logistics is civilization." Whether the topic is speeding auto parts to Detroit, getting commuters home on time, or delivering World Series programs in time for the first pitch, the timely delivery of what we need where we need it is indeed the story of late twentieth century society.

Just as everyday life has become irreversibly intertwined with logistics effort, so too has the effective use of military force. At no time in the world's history have armed forces been so dependent upon the sinews of war. While there may still be an army or two that require only a gunsmith and a Toyota service representative, the fate of the First World's and Second World's defense forces hinges upon those people who create combat resources and move those assets to where they are required, and the technicians who integrate them with the right systems. In short, the cliché "For Want of a Nail" did not lose its validity with the departure of the horse.

Too often in the literature of logistics, we focus on broad issues where political and economic factors boil down to what information a Congressional Committee wants or the economic issues revolving around "still another" stretch-out of weapon procurement schedules. Rarely in the public literature do logisticians address the future of our nation's Grand Strategy and the role of military logistics in fulfilling those objectives.

The reason for this may lie in the fact that programs nurtured for years can be obliterated by a Congressional Committee with the stroke of a pen; hence, the drive is to "keep what ya got," rather than waste excessive amounts of time worrying about tomorrow's problems. Another consideration is that there are few psychics preparing MAJCOM or Air Staff manpower documents, and the most solid projections of where Air Force logistics will be in 20 years can come off like bad science fiction, or worse, bad judgment. Finally, the elements of Grand Strategy, international relations, and global economics are beyond the scope of our expertise as logisticians. Our job is to implement policy, not create it. However, times are changing and we, as a community, must be aware of the subtle shifts which may drastically affect operations tomorrow.

Today, logistics planners must face two broad challenges which will dictate the future of our combat forces and their ability to assert the national will. The most immediate, yet *not* the most significant, is **financial**—obtaining defense dollars during a period of economic retrenchment. Conversely, the most important, yet easiest to delay considering, is the dramatic change inside the Soviet Union, known around the world as *perestroika* (restructuring of society, economy, and military) and *glasnost* (openness). Budget battles are common and we are more willing to tackle these familiar problems rather than jump into the murky waters of global politics. Shifts in the bedrock of our national strategy happen once or twice in a century and are not normally part of the logisticians' mandate.

Changes in the international milieu are afoot that could make the American military of tomorrow as different from today's forces as an F-15 unit is from a Roman Legion—not because of a radical advance in technology, but because the nature of potential conflict itself may be shifting. If there ceases to be a clear, overt threat from the Soviet Union and its Warsaw Pact Allies, we may need a military dramatically different than the one we have. We may need forces capable of fighting in jungles rather than on the open plains of Germany.

Our military may constrict and restructure itself to face those who represent a less visible threat (often in Third World locales) on a less intense scale. Indeed, as one wag put it, "Peace seems to be breaking out"; and with that, the goals and methodology of the Western way of war may change. We are, in short, facing a "one-two" punch of economics and *glasnost*.

I'm a Wrench Turner, Not an Economist!

The budget deficit is one of those issues that the man on the street can relate to—has anyone ever bounced a check? Same principle, except the Treasury is not charged a \$15 fee. The solution, insofar as the public is concerned, is to have the Government spend less. Few areas of the budget are as tempting or as vulnerable to slashing as defense dollars. Among those defense dollars, even more prime targets² are logistics and combat support programs because they are not as visible as a smart bomb, ship, or fighter plane.

The logisticians' curse is eternal damnation for the person who created the tooth-to-tail analogy. Being in the tail hurts worse as the fiscal year progresses. Yet trench fighting to sustain key logistics programs is almost easy when compared to a fundamental shift in the threat and the subsequent challenge to redesign a force structure to satisfy new priorities.

The Reagan Administration infused money into the Department of Defense in unprecedented peacetime amounts. There were significant improvements in the force structures of all the services, though in individual cases some service lobbies may have done better than others. The challenge for the 1990s, however, will be to preserve the overall gains made under President Reagan and enhance the combat potential we have. This will not be easy simply because the "mad money" is gone. People and equipment programs that are *must have*, rather than *nice to have*, will be the order of the day. As military analyst William S. Lind noted, "Just spending money does not guarantee an effective defense."³

There is a finite amount of revenue to be generated from taxes, fees, and other sources. There is an even more limited amount of money not tied into entitlement programs and, therefore, available for Government agencies to battle over. The economic constraints we will face are very real but are not, in themselves, "showstoppers." Thankfully, the United States is not on the brink of economic collapse. Although we may have seen the best years

insofar as real budget increases are concerned, there is every reason to believe that solid, "no-frills" budgets allowing for a strengthening of select military programs can be sustained. Nevertheless, it will not be an easy sell to either the Congress or the public.

The enormous budget deficit and the stock market crash of 1987 coupled to create an audience which was receptive to the thesis of Dr Paul Kennedy's popular 1987 book, *The Rise and Fall of the Great Powers: Economic Change and Military Conflict from 1500 to 2000*. Kennedy, a leading thinker in the so-called "Declinist" school of thought,⁴ has painted the picture of an America in a nearly irreversible decline as a world power. Indeed, he writes:

The task facing American statesmen over the next decades...is to recognize the broad trends underway, and that there is a need to "manage" affairs so that the relative erosion of the United States' position takes place slowly and smoothly, and is not accelerated by policies which bring merely short-term advantage but longer-term disadvantage.⁵

Kennedy's contention is that the great powers throughout history have depleted their national treasure and ultimately surrendered their preeminent global position due to military spending and "imperial overstretch" or simply having too many global commitments. Ergo, when the scale has tipped from a long-term balance of butter and guns to more guns than butter, the state in question does mortal damage to itself and has set the stage for its own decline.

Although popular and thought provoking, Kennedy's assertions cannot be borne out by recent history. In fact, this century's best example of economic and political decline, and one with which most American military officers will be familiar, is the recession of the British Empire. The demise of this greatest of all imperial bodies cannot be directly attributed to military spending or imperial overstretch. Economic and political exhaustion from two world wars, yes. A loss of interest in being a colonial power, probably. But, not due to the costs of maintaining its global position. Although no one can doubt the size of Britain's imperial obligations, her policy had traditionally been to spend vast amounts during war, but otherwise ignore the forces during peace. Hence Kipling's:

Tommy this, and Tommy that, and chuck him out the brute. But its Saviour of 'is country when the guns begin to shoot."

As Princeton University's Dr. Charles A. Kupchan wrote rebutting the Kennedy work:

Elites were so preoccupied with the harmful financial effects of high levels of military spending that they delayed full-scale rearmament until the late 1930s, weakening Britain's ability to deter German aggression.⁷

In this case, the failure to allocate resources to the military weakened the security of England and, in part, brought on the greater price tag of World War II. An examination of the decline of other major powers suggests that military spending may have been a contributing factor; it was not so integral as to be *the* reason for a state's decline.⁸ Defense expenditures have not been the historic evil portrayed in some circles, yet limits have been reached.

Although the United States is not in an irreversible downward economic spiral, common sense dictates we reexamine our global commitments to bring our military forces into line with our financial ability to support commitments. With United States treaty obligations to over 40 nations and limited means with which to meet those requirements, something must give.

Past experience has shown that it is not practical to maintain an Army/Navy/Air Force designed for a European War, another for a limited war in Asia, and still a third for unconventional warfare in Latin America. So, too, is it unsatisfactory to suggest

that unit "A" can do mission "B" if only contingency "C" does not develop. War planners continually face these issues and logisticians should be at their side to ensure combat support is not sacrificed on the altar of budget savings.

Professionally, we must determine what we need to do to attain the goals established by the commander-in-chief. We will need to find the right mix of finite forces and finite resources that will allow the maximum flexibility of action for commanders. We must also recognize we do not have a blank check, so we must be forthright in stating whether or not we can do the mission with the forces/funds available. If so, then proceed to do the job. If not, change the mission or delegate (where possible) to another regional power to meet the requirement for us. Share the burden. The task of sorting priorities, propelling some programs to new heights while condemning others to an early grave, will be unattractive and difficult, but must be done with dispatch. The nature and capabilities of the Air Force may change, but we will not be alone. The Army and Navy will also need to adapt.

When considering the joint effect of changing economics and *glasnost*, one naval observer dubbed the Navy of tomorrow a smaller, "Peaceful Navy" plying coastal waters,⁹ while an Army officer speculated that their mission would shift from deterrence to intervention requiring more mobile but less potent formations.¹⁰ Clearly, then, all our services must brace themselves for possible dramatic and fundamental changes.

New economic realities will leave us with new planning guidelines not experienced for decades:

- Tight overall budgets with limited or no real growth.
- Personnel problems—too few; wrong skills; sinking morale.
- "Reduced" starts of new system procurement.
- Potentially hollow forces, accentuated by false savings associated with shifting of active duty missions to the reserve component.¹¹
- Continued erosion of the defense industrial base insofar as some key defense industries are concerned (military aircraft and shipbuilding).

In a sense the logistics community has it "easy" in that, once the financial battles are fought, it will require virtually the same basic support to attain any military objective the planners derive. The only variable is the size of the operation needing support. A smaller, more conventionally oriented military will not necessarily be easier to support. Our concerns will not be with tactics, but providing support in the right amounts. If we do our job correctly, the "warlords" will be able to accomplish their taskings more capably. On the eve of a "brave new economic world," it is worth recalling the words of Rear Admiral Henry E. Eccles:

Sustained combat effectiveness, not sheer size, is the proper objective of logistic effort.¹²

Isn't Gorbachev a Sparkling Wine from Ithaca?

Most of us are now aware of the peace offensive launched by Soviet Communist Party General Secretary Mikhail Gorbachev. Gorbachev has found himself in charge of a decaying empire genuinely needing political and economic reform if it is to survive long into the century.¹³ The political changes which he has initiated are bold and startling. Gorbachev has managed to capture the imagination of observers on both sides of the Iron Curtain; has profoundly changed the international environment; and, arguably, is driving the international agenda.¹⁴ Whether his motives are sincere or sinister, or whether reforms to political,

economic, and military policies are transitory or set in concrete, this mild-looking Soviet politico will have more impact on the future of American military logistics than a room full of Congressional budget cutters.

What exactly Gorbachev is up to is anyone's guess. In that C-SPAN is not covering the inner workings of the politburo, and minutes of the General Secretary's staff meetings have yet to be published, we must rely largely upon his public statements and actions to back them up. As events have evolved, *perestroika/glasnost* has had effect in three major areas: domestic economic and industrial policy, domestic political reforms, and revisions in military doctrine which will provide domestic security while lessening the economic burden on the Soviet economy.

Before we get caught up in the *glasnost* frenzy, we must remember Gorbachev is still a Communist.¹⁵ General Sir John Akehurst, Deputy Supreme Allied Commander Europe, notes:

Soviet political ideology and long term aims remain the same even if they are wrapped in a different parcel. Gorbachev seeks to make his own system work better, not turn it into a different one, devoid of its heritage.¹⁶

Even more succinctly, Admiral William J. Crowe, Jr. commented: "No Soviet leader will go down in history as a freedom fighter—at least not in our sense of the term."¹⁷ Gorbachev may be the most important Russian leader since Lenin, and he may be the most popular export Moscow has, but he is not a liberal Democrat. He is pursuing a Soviet agenda which may or may not have elements of mutual benefit with the US. His agenda undoubtedly has areas of potential conflict as well.

Although a more pacifistic Soviet Union holds great promise for a new age of international relations, it also promises more subtle dangers of economic rivalry; possible US decoupling from Europe; and, not insignificantly, a challenge for the leadership of the Western World. There is already ample evidence that a lack of coordinated Western response to Gorbachev's initiatives has resulted in success for Soviet objectives and disunity among the Allies.¹⁸ His reforms do have real potential for near-term political harm.

There is also the danger of unfulfilled reform which could produce either a radically unstable USSR or retrenchment by hard-liners who would make Stalin look like a Combined Federal Campaign key-worker. But let us take Gorbachev at his word. What is the current status of *perestroika/glasnost*?

Soviet Industry

The ultimate focus of *perestroika* is the decay, corruption, and lack of productivity of Soviet industry. It is an understatement to say that 70+ years of Communist rule have turned Russia into an ineffective producer of goods and services. The weak state of Soviet industry has ultimately caused Gorbachev to question his nation's total security from economic, political, and military perspectives. Indeed, the fragility of the Soviet Union's economic condition calls into question their ability to wage any sustained conventional war.¹⁹ For these reasons and more, Gorbachev concluded that the October Revolution has stagnated and Soviet socialism requires new dynamism.²⁰

The Soviet Union is not an effective competitor in the world market, nor is it a producer of consumer goods sufficient to meet demands of either quality or quantity. Gorbachev's initial phase of *perestroika* targeted worker productivity. The proletariat were urged to work on days off, contribute free labor, and to drink less vodka which in turn would boost productivity and increase overall product quality. This largely failed.²¹ Ultimately, it was

concluded that free-market-type incentives, not ideological exhortations, were better motivational tools.

Gorbachev then began the process of reducing the presence of central planning in many key industries. Central planning and production control had long stifled even the most aggressive factory manager. As noted Sovietologist Robert Kaiser observed:

Soviet society is not flexible or adaptable and the chance of truly effective reform in Gorbachev's lifetime is negligible.²²

Fear of failing to meet quotas and scarcity of quality resources hampered the urge to do anything out of the norm. *Perestroika* has been an effort to instill, to quote an old US Steel ad, "The kind of productivity that makes America great" in a Slavic context. Keep in mind, though, that economic, not political reform, is Gorbachev's prime objective. The creation and exchange of new ideas is supposed to make Socialism work, not create the world's largest debating society.²³

Success for Gorbachev's new economic policies has not been forthcoming. There has been no ground swell of productivity, and the freedom encouraged in the Eastern Bloc, such as Poland's Solidarity trade union movement, may have infected the Worker's Paradise. At one point during July 1989, as many as 250,000 workers were believed to have been on strike in the USSR for higher wages, more goods, better services, and better housing.²⁴ Since many of the workers striking are already among the highest paid in the Soviet Union, this can hardly be what Gorbachev wants or needs.

Boosting worker productivity has its limits, and personal initiative takes time to develop. So *perestroika* is entering a new phase. This phase will solicit increased Western capital to pump new life into the Russian financial system. Although this will make Russia more dependent upon Western financial institutions, it will also place those lending bodies at the mercy of future Soviet regimes which may not be as tolerant of Western economic partners. Recent bouts with Third World states who verge on default on loans unless new terms are arranged should be a warning to institutions considering loans to Moscow.

Tension between the Superpowers will not necessarily evaporate. If *perestroika* is successful, even a "Finlandized" Russia with its vast labor pool and natural resources would be a significant competitor for markets and resources. An economically transformed USSR could indeed become an even greater potential military threat. Using the past seven decades of development of the New Soviet Man, invigoration of technology and industry is probably a generation or more away. Nevertheless, trade wars can generate as much heat as conventional wars.

Soviet Polity

Even with a willingness at the highest level of Soviet society to get changes rolling, such actions are out of character for the Russian people. Many layers of bureaucrats between Gorbachev and the people are not happy with the sudden changes that surround and disturb the existing order.

Taking the initiative to speak out about "what's wrong" has been severely circumscribed in Russia, both by the Tsar and Lenin, so a redress of the political system was dictated. This has been fairly successful, insofar as Western observers can see. The establishment of the new Congress of People's Deputies was an historic event in that it created the first potential forum for a legitimate political opposition since the revolution.

The Communist Party has been embarrassed by the lack of support it received even in elections which it controlled. There

was no vote of confidence for the Communist Party and the floor of the Congress has witnessed often acrimonious debate over topics as diverse as economic mismanagement by Party members, atomic power plant accidents, use of chemical weapons by Soviet troops during civil disturbances, and the Soviet adventure in Afghanistan. The seed of democracy may be sprouting in Moscow, but as with economic reform, the advent of *glasnost* has also brought trouble.

Seventy years of frustration with queues to buy meat and fresh vegetables and ethnic differences which the Soviet Union has passed over have resulted in protests, riots, and strikes in Georgia, Armenia, and the Baltic States. The spectre of small-scale revolts and civil war cannot be totally ignored.²⁵ Indeed, at this writing, the official Soviet toll for deaths during communal violence is over 200 for 1988-89 and growing.

Gorbachev's democratic reform may be letting the genie out of the bottle. Even if he can control the ethnic and nationalist feelings of the people, there is an inherent danger that hard-liners could outmaneuver the moderate faction in parliamentary procedure and return to the top undoing any and all of the reforms of Gorbachev. An unstable Soviet Union under the control of Stalinists would be a significant danger to the world at large and the United States in particular.

A related problem linked to *glasnost* is that the simple appearance of a democratic organ in Russia has swept the Western public off its feet and has created domestic political problems for some members of the Western alliance. In the minds of many Europeans, the seeming erosion of the Soviet threat is perceived as real and immediate, while cautionary warnings are looked upon as relics of the Cold War. The external political reaction is a cause of concern which we should not discount too lightly. General Sir John Akehurst recently observed:

Pick up any newspaper these days especially the Continental European ones and the public clamor—both informed and uninformed—for NATO to lie down and have its tummy tickled by Gorbachev is strident and persistent.²⁶

Although "Gorbymania" may be a short-term problem as issues of arms reduction, redeployment of troops, and balance of forces are negotiated, these good feelings are of little long-term harm. The pressure to enter into arms reduction treaties may be intense, but Allied Governments should be capable of staying the course and not allowing emotion to cloud serious political negotiations.

If the reforms sponsored by Gorbachev remain intact and are allowed to grow, the threat to the West will, in fact, be reduced as the Soviet people engage in an extensive internal dialog and shift from ideological evangelism to economic and social change. It is unlikely these good feelings will diminish, unless the Soviets replicate the actions of the Chinese in Tienanmen Square.

Soviet Military

The needed economic and political reforms cannot proceed without attention to that most honored of Russian institutions, the military. Even under the Tsar, the Russian military totalled over 4 million men, and modern Soviet leaders find they need as many, if not more, to maintain security and political supremacy.²⁷ As with our military, the Soviet armed forces are a major consumer of resources. Unlike our system, however, there is not sufficient "slack" in materials and products, so the Soviet Military has become the largest consumer of high quality products in Russian society. The military is also a political block

which Gorbachev must court; negotiate; and, when needed, bludgeon into line just as he might the Committee for State Security or the coal miners.

In spite of the obvious national security factor, Gorbachev has made it clear he views Soviet military reform as a major factor on the road to economic success. The drain on economic resources, the constant requirement to upgrade conventional and nuclear weapon systems, and the eternal drain of manpower into the military and away from the civilian production pool have not improved the total security of the state.²⁸

Through replacement of certain aging officers, he has been able to make the military more compliant with his desires.²⁹ Revisions in doctrine have provided the world with hope that the massed Russian tank armies in Eastern Europe may eventually be reduced in size or actually go home. Retiring older weapon systems has also relieved at least some small amount of the trouble the Soviet logistics system has with maintaining and supporting a myriad of those older systems.

In his notable 1988 Declaration of Peace presented to the United Nations, he stated his desire for lower world tensions and announced the Soviet Armed Forces would seek to attain national security through creating and sustaining minimum forces adequate to maintain security and founded on a doctrine of defensive defense. Pledges of reducing the numbers of troops in some Eastern European states, proposals for reduction of nuclear weapons, and recent statements which imply repudiation of the Brezhnev Doctrine³⁰ have placed western military and diplomatic staffs on the defensive, scrambling to react.³¹

The actual, tangible products of *perestroika*, insofar as military logisticians are concerned, have been limited. The elimination of intermediate range nuclear weapons through the Intermediate Nuclear Forces (INF) Treaty was historic, but even this revolutionary step was turned into a propaganda victory for Gorbachev, prompting syndicated radio talk show host Rush Limbaugh to dub the General Secretary "The Prince of Peace."

Much of Gorbachev's *perestroika* and *glasnost* has been targeted at Western headlines rather than reducing forces. Slight changes in the Eastern European Order of Battle, alterations of doctrine, and even suggestions that the Soviet Army might eliminate or reduce conscription are hardly irreversible acts of policy.³² There is reason to suspect that even among the Soviet officer corps, the issues of future strategy, tactics, and doctrine are still being debated and are not yet fully decided.³³ Western observers should remember that troop trains, after all, can run in two directions.

Acting as a "Devil's Advocate," this internal Soviet debate can partially be explained by inertia inherent in any bureaucracy. Even the US Army continues to debate, reorganize, and academically struggle over the AirLand Battle concept years after it was adopted as official doctrine. Gorbachev's concepts of reasonable sufficiency, defensive defense, and strategic stability³⁴ have met with internal opposition as well as disbelief from the West. US Navy Captain Gerald G. O'Rourke noted:

In practical terms, credibility is a non-issue. . .the East-West contest may well continue for generations to come, but under different rules. . .³⁵

Within a few years, however, the deadwood may be gone and the Red Army might be in the thick of nation building.

As the ideological battle between East and West shifts from one of confrontation to one of competition, changes in the size and mission of Soviet armed forces will have a number of impacts on Western militaries:

- Our missions will change.
- Budgets will decline as does the threat.

- Equipment may not be correct for secondary military missions that rise to prominence.
- Conventional forces will supersede nuclear elements in strategic and economic planning.

Other observers note that, while the course Gorbachev charts may ultimately be beneficial to the West, the current results do not justify a radical shift in national security policy or a sacrifice of current capabilities for short-term fiscal savings.³⁶ Indeed, looking toward a future Soviet threat, British Foreign Minister Sir Geoffrey Howe observed: "Soviet forces, though perhaps smaller, will also be . . . leaner and more efficient."³⁷ As with Soviet economic and political reform, we do not know where Soviet military changes will end up.

The only certainties are the fluidity of the international situation and the need for US military to focus greater attention on non-NATO national interests. We may also be on the verge of a military hemorrhage unlike any since the post-war demobilization of forces.³⁸ We must prepare and have a plan for our military that will meet a radically changed threat. The danger to US interests may now lie with the smaller but less constrained adversaries on the global scene. As Major General Perry M. Smith wrote:

We must shift our attention. . . . away from the Soviet Union and develop strategies, weapon systems, tactics, and doctrines that will allow us to deal with different and potentially more dangerous threats.³⁹

As logisticians, we need to begin to draft policies and establish priorities to meet these changes before events overtake us. We must prepare for potentially leaner times, wherein greater joint integration must be achieved, where each service must come to rely upon the logistics capabilities of the other, and where our national policies will not fail for want of a nail or a C-17.

Where Do We Stand?

On the economic front, we find very real fiscal limitations and a suggestion that popular support for vast new defense spending is at an end. And, certainly, simply pouring more money into defense will not substitute for clear, well-thought-out financial and procurement policies. We may have an enemy, and we may not. We might have a requirement for expanded conventional forces. We might be directed to demobilize two or three divisions, transfer several fighter wings to the reserve component, and cut acquisition programs. Force constriction could be the death knell for our current combat support structure. The roller coaster of procurement and acquisition must be brought under control and stabilized, lest we have no foundation to create future combat resources. As Admiral Eccles wrote:

Economic capabilities limit the combat forces which can be created. At the same time logistic capabilities limit the forces which can be employed in combat operations.⁴⁰

In 1988, for example, the military aviation industry lost 28,000 jobs due in part to some end-of-production closings while others, such as the V-22 "Osprey," were cancelled after Congressional battles.⁴¹ Once this skilled pool of aircraft workers is gone, it might take a decade to rebuild it. Witness the struggle of the space program after Apollo ended.

If tight budgets and relaxed tensions allow the shipbuilding and transport aircraft manufacturers to close or shift into washing machines, tragic results could occur. Stability of the industrial base is essential for the United States to seriously contemplate pursuing an international agenda. Our national response to the changing international environment and, presumably, a new national Grand Strategy will establish the parameters of a new

foreign policy. The policy, not the means to attain it, will be established by the Executive Branch after consultation with the Legislative Branch. Then, and only then, can we be expected to provide input on how the services will carry out those objectives.

Is There a New Mr "X" in the Wings?

Since the end of World War II, American foreign policy stems from George Kennan's article, "Sources of Soviet Conduct," published in *Foreign Affairs*. It advocated a policy of containing Soviet influence which would ultimately prompt the Soviet system to collapse. In spite of the later disclaimers of its author, containment seems to have worked.⁴²

Regardless of whether or not containment pushed the Soviet system to change or as Gorbachev has written, "The changes underway are just another step in the development of Socialist democracy,"⁴³ the changing relationship between Washington and Moscow may be the event of the century. As touched upon earlier, this euphoric feeling should be tempered with a dose of reality.

It may take up to 15 years⁴⁴ for the USSR to retool its military industry for consumer production; and, under the best conditions, it might take 25-30 years for *perestroika* to succeed.⁴⁵ By his own rules, Gorbachev has a mere ten years in office which places an even greater pressure on him for change. Neither his success nor his place in history has been secured.

Former President Richard Nixon warns that no concessions should be made that we would not make to the *least* progressive Soviet leader lest we find ourselves trapped by trade or arms agreements signed by Gorbachev, but abused by some future hard-line regime.⁴⁶ In short, as President Reagan used to say, "Trust but verify."

The Question of Europe

As the threat of a major confrontation with the USSR declines, it would be reasonable to conclude there would be less need for an active military presence in Europe. There has already been speculation by the Commander of US Forces in Korea that local defense capabilities and reduced tension could result in a drawdown of our forces stationed in Korea. Can Europe be beyond consideration for similar reductions?⁴⁷

Western Europe as a whole has the population, natural resources, technological and industrial base, and the military capability to be the preeminent power in the twenty-first century.⁴⁸ Coupled with the 1992 creation of a Europe without borders, a diminished Soviet threat, and, indeed, the prospect of non-communist regimes in Eastern Europe, American forces could be severely reduced.

Still, the potential removal of the USSR as a foe does not guarantee there will be no European war, nor would we be able to dissolve our armed forces. Two world wars were fought there, in which Russian communism was not a direct issue. We have no way of predicting what circumstances might plunge Europe into conflict against the will of both Moscow and Washington. The Third World has been in a virtual state of war since 1945, so out-of-area dangers will still lurk and military power will still be required.

The new Grand Strategy should reconsider all our military commitments, assess our operational and support capabilities, and create a synthesis which will provide a credible American foreign policy backed up by military power. Unless we are capable of a given task or have the will to create the power to achieve it, it should be deleted as an objective of national

strategy. Until such a new national strategy is forthcoming, though, the logistics community should begin to draft concepts capable of reacting to either "business as usual" or a world with reduced superpower tension.

The Logistics Agenda

The logistics community must concentrate its efforts on the basics. As stated earlier, the combat support needed to sustain military operations differs primarily in quantity. As Admiral Eccles wrote, "First and foremost is the fundamental relationship whereby scope and timing of strategic plans are both governed by logistic capabilities."⁴⁹ So the primal element of a new logistics plan for the post-Gorbachev world is to balance our true capabilities with requirements. Where there are gaps, fill them in. This means creation of combat support capability. It also entails maintaining the industrial foundation upon which we must build.

Getting There

All our military forces will have one need in common: they will need some sort of lift to get them where they need to go. A Rapid Deployment Force equipped solely with M995 trucks might be adequate to deter Canadian or Mexican war planners, but it would be woefully inadequate for defending US interests in Latin America or the Middle East. Improved lift would also help counter any potential threat from a Soviet Union returned to "the Bad Old Days."

When addressing the 1988 Forum of the National Defense Transportation Association, Army Under Secretary Michael P. Stone remarked that enhanced air and sealift would be crucial during any crisis, especially one in which the Soviets enjoy secure land lines of communication.⁵⁰ Realistically, any deployment away from the continental United States virtually grants the adversary a "home team" advantage. This can only be worn down by adequate lift capability.

Although a recent creation, the United States Transportation Command (USTRANSCOM) may be the single most important agency in the Department of Defense. USTRANSCOM is charged with operational transportation support of Army, Navy, and air forces. C-141s, troop transports, and cross-continental rail movements all fall under USTRANSCOM's responsibility. Therefore, USTRANSCOM is the appropriate office to initiate a joint logistics procurement effort for strategic lift.

Nowhere in our planning does our inability to do more than one major task at a time become more apparent than in the shortage of strategic lift. Under the auspices of the US Transportation Command, a "Purple" agenda should be formulated that would establish strategic lift, both aircraft and fast transport ships, as the number one priority for United States forces. This requirement should be pressed even at the expense of more visible fighting hardware.

There is no reason to formulate a global strategy based upon guaranteed nuclear escalation or defeat.⁵¹ If our forces are committed with a reasonable assurance that they can be logistically supported (as opposed to serving as a mere tripwire), this will add to conventional deterrence and to the confidence factor of our people on the ground. The threat of swift, effective retaliation helped keep the enemies of the British Empire at bay for a century. So too would a military force with both the capability and sustainability to keep the enemies of American interests in repose. Getting forces in-country, as well as keeping them supplied, is essential to a credible strategy. We cannot have

a credible defense policy without lift, and we cannot have lift if the industrial base evaporates.

Horseshoes and Nails

The second requirement on a logistics agenda for the future should be spares. Forces training for combat should have the maximum amount of materials available. This includes boots, artillery, mess kits, missiles, flight suits, and ammo. Munitions should be produced, stockpiled, and indeed used without fear of exceeding practice quotas. Ample material should be on hand so fighter pilots need not approach live ordnance training as though it were an early Christmas present. Nor should Naval gunners or Army surface-to-air missile crews lack ample hands-on training to demonstrate their proficiency. With some exceptions, most munitions are middle-tech and fairly easy to produce.

Items related to combat, be they rifles, gas masks, or A-10 brake shoes, should not require excessive lead time to obtain. These are basic, high use items that should be available for consumption. Commanders who consider altering their operations or training simply based on conservation of resources are operating from the wrong point-of-view. Resource management exists to support the mission; the mission does not exist to support management of resources. The limiting factor is the will to channel funding into supplies versus more glamorous high-tech acquisition programs.

People and Organization

The right mix of talent and motivation has always been essential to military operations. The human element has been able to get our forces through thick and thin in every war America has fought. The people and organizational issues that challenge us today will be even more critical as budgets are restricted and missions redefined.

Organization

The Air Force continues to redefine its combat support role and mission requirements.⁵² The Air Force's combat support community continues to experiment with different organizational concepts and skill requirements. The effort to establish a doctrine for combat support has immeasurably improved the understanding of "logistics" on both the part of the operations community and the "loggies." Still, like the search for the Holy Grail, the search for the perfect organizational structure should continue.

Just as the Civil Engineering community may have created the "ultimate" combat engineering unit through "Red Horse," other functional communities should seek similar mixtures of combat power and effective support. Similarly, we should not be blinded by doing business "the way we always have." In spite of the strong service corps ties that bind, the Army is experimenting with multifunctional combat support organizations to support operations on the Corps level⁵³ which cross the lines of the various "lobbies" and which can provide the Corps commander support when it is needed.

Creation of a more effective combat support structure will be essential for Air Force operations tomorrow, but it will not be painless. For the Air Force to adopt such a structure may mean even further specialization or even the merger of some skills such as personnel and administration or vehicle operations and maintenance. The organizational challenge will be intense

as commanders are pressed to do even more with fewer resources.

Morale

Just as real a problem as a shortage of funds, a changing mission, or a reduction in available manpower, morale of combat support forces will be crucial to the mission. We are already experiencing a widening civilian sector pay gap, longer periods between enlisted promotion and "pin-on," forced cross-training of airmen, and increasingly long work hours. The future will require adept management and leadership from combat support supervisors, who will be called upon to "pump up" troop morale. These pressures are only likely to increase, mandating skillful interaction with subordinates to get the job done. Professional knowledge and leadership will be crucial.

More attention than ever will need to be paid to squadron loyalties, affiliation with the flight-line mission, functional expertise, and general professional development. Seemingly unimportant things like "badges" and master technician patches will gain even more prominence in the morale of combat support personnel. Effective motivation of people "on-hand" will not be the only human resource challenge.

Finding the right people with the right job skills will rise in importance. Admiral Eccles noted that logistics needs more "Buck Rogers" personnel than "Joe Doaks" if we are to maximize our combat support.⁵⁴ Functional managers may be required to "beat the bushes" for skilled officer candidates rather than settle for the "luck of the draw" from the Air Force Military Personnel Center.

As important as selecting new officers, recruiting and retaining exceptional NCOs and airmen will make or break tomorrow's combat support capability. Several career fields already take an "activist" approach to "head-hunting," and others should consider sustaining "advertising" campaigns and other programs to increase their visibility. As Major General George E. Ellis, USAF, Retired, wrote, "We must use our todays to shape our tomorrows."⁵⁵ This is no less true of people than it is of aircraft or radar components.

The Total Force

The final element of people and organization is the effective use of combat support manpower in the reserve component. The right mix of combat and support forces has always been hard to determine. Unfortunately, the drive to reduce manpower requirements and spending may serve to degrade the capabilities of both the active and reserve forces.

Although the reserve component is capable of remarkable feats, placement of an increasingly heavy combat and combat support burden on Guard and Reserve units may be unwise. The reserve program is truly the ultimate force multiplier, but the time needed to create an effective manpower pool significantly lags behind the active force for the most obvious reason: The Reservists and Guardsmen are citizen-soldiers. Reserve component forces only train two days per month, which may not be adequate for certain technologically intricate jobs. The time required to meet many enlisted skill requirements can drag out for many more months than their active duty counterparts. Understanding this is essential to understanding reserve force capability.

The lengthy process began in 1985, wherein reserve transportation elements were given wartime tasking, and the long "generation" period required for them to reach the

appropriate levels of readiness should be remembered. Although significant limitations were overcome and units were able to perform their wartime mission only partially manned or equipped, it did take a tremendous effort from the major command level downward to help make it happen. While the Air Force's reserve program is a solid success, the programs of other services, notably the Army, lag behind even though much progress has been achieved in terms of training and equipping the force.

Momentum is building toward "dumping" a myriad of jobs onto the reserve component to solve manpower and funding problems of the active force. This could result in the misuse of the tremendous potential of reserve personnel and be a misstep in our national strategy. The Air Force is in a unique position to observe problems in other service components and avoid repeating them.

When pressured to cut either combat power or support elements, the Army's method of sustaining their active duty combat force was to shift combat support units and missions to the reserve component or increase reliance on host nation assets. The Army currently has 81% of its combat support in the Reserve and National Guard, and there is evidence that these units cannot accommodate this responsibility.⁵⁶

In an article published in the Army Command and General Staff College's publication, *Military Review*, exercises involving support for the US Army's III Corps at Fort Hood, Texas, raised serious questions about the wisdom of placing a majority of the service's supporting arms in non-active status.⁵⁷

The exercises had a myriad of events deploying required manpower within timing constraints. The Corps projected 90% of combat service support units needed were in place rather than a 60% figure normally used. The exercises revealed combat support elements failed to provide needed support to combat forces before or after combat was initiated.⁵⁸ Transportation, medical, and maintenance organizations and other units were found to lack manpower or equipment to support the offensive effectively.

In this case shifting the less-than-glamorous logistics role onto the reserve component for paper financial savings promises real operational problems. Missions for the reserve component should be carefully developed in order to take advantage of the people and material resources available. The reserve force can be overtasked just as intensely as the active community. The mission, be it control of the air, land, or sea, should be considered first, rather than balancing financial or manpower requirements.

OK, What's the Point?

This review of potential changes serves no greater purpose than to direct the thinking of the combat support community toward changes which may be just around the corner. These changes *will* alter the course of the Air Force and, like it or not, *will* affect how most of us do our jobs. We cannot change the future by wishing it to be so. We need to take action *today* to ensure we are ready for tomorrow.

- Military is in a double clutch, between financial constraints and a changing international situation that will upset our preconceived notions about whom we may fight and where the war may be waged. We should plan for a smaller military with more diverse taskings.
- Short-term economic fixes, such as weapon system acquisition drawouts, are not the stuff to see the forces through this potentially radical transformation. Short-term

economic difficulties may lie ahead; but, hopefully, there will be no need to plan based upon constant downward spiral. Money will be available for priority programs.

- In the post-Gorbachev world, the military challenge will be to identify those priority programs by asserting the validity of missions and systems as never before. Redundancy may be eliminated; effectiveness against any threat should be stressed.
- The combined services logistics communities should formulate a purple agenda of priorities free of intraservice/interservice squabbles. If required, they should press for sacrifice of procurement of more glamorous systems in favor of the stuff that successful military operations are made of—transport, supplies, and people.

Let us remember what General Henry H. Arnold wrote at the conclusion of his book, *Global Mission*:

The principles of yesterday no longer apply. . . . We must think in terms of tomorrow. We must bear in mind that air power itself can become obsolete."

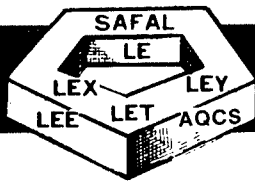
We, as military logisticians of the United States, can be no less flexible in our thinking on the edge of this new era. We must think the unthinkable and come up with a means to accomplish it. Air and sealift capability, material support, and the right mixture of people are the key logistics requirements for success in the world of tomorrow.

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Second Destination Transportation Movement

Because of a continuing budget crunch, the Air Force Transportation community anticipates funding for only 90% of the actual Second Destination Transportation Movement requirement for the coming year. To accommodate this shortfall, many Transportation Priority (TP) 2 shipments will, again this fiscal year, be diverted to surface movement, and LOGAIR will be restricted to six days a week service. Also, Transportation personnel could impose other restrictions on specific commodities. At this writing, they are developing specific rules and conducting a midyear program review to determine the future course of action. They could also ease or further restrict controls, or continue current practices/controls. (Major Dennis Altendorf, LETX, AUTOVON 227-7332)

Performance Oriented Packaging

The United Nations agreed on, and will implement, the Performance Oriented Packaging (POP) for hazardous items on 1 January 1991. Required package performance is intended to contain the hazardous item within the package and protect the item during shipment. Air Force shippers will be required to comply with POP for international shipments. Requirements under the agreement will differ from those presently required by Title 49, Code of Federal Regulations (CFR). These differences and other issues relating to package testing and certification, repackaging, and training are being addressed through Air Force, Department of Defense, and Department of Transportation channels. (HQ AFLC/DST is the AF OPR for POP. Carl Sullivan, HQ USAF/LETT, AUTOVON 227-4742, is the Air Staff POC for this issue.)

Harvest Eagle Bare Base Sets

Harvest Eagle bare base sets have been tasked extensively for contingencies and operation plans. However, there have been instances in operation plans where the site of intended use has not been fully developed. If a base is responsible for a location where a Harvest Eagle set will be used during execution of an operation plan, site preparation should be addressed in the appropriate base reception plan. Primary and alternate sites should be identified to include dispersal of the Harvest Eagle set. Units which will use these facilities should also be identified. When writing the reception plan, ensure the logistics support (fuel for generators, rations to be prepared in the kitchen, etc.) is addressed and adequate for the day-to-day operation of a Harvest

Eagle set. Prior planning is crucial to the successful use of our critical Harvest Eagle resources. (Lt Col Lutz, LEXX, AUTOVON 225-1790)

Logistics Regulations

Two new and three revised regulations affecting the logistics community have been coordinated and are pending publication at Bolling AFB. The new regulations are AFR 20-7, *Logistics Board of Advisors (BOA)*, and AFR 80-33, *Air Force Combat Support Research and Development Requirements (Logistics Needs) Program*. AFR 20-7 prescribes the mission, organization, and responsibilities of the Logistics Board of Advisors (BOA). The purpose of the BOA is to provide senior logistics leadership oversight to the USAF logistics community and advice and counsel to the chairman, the DCS/Logistics and Engineering, on matters concerning Air Force logistics. AFR 80-33 formally establishes the Air Force Logistics Needs (LN) program. It explains the purpose, defines the objectives and scope, and identifies the agencies responsible for identifying, validating, coordinating, disseminating, and responding to the requirements of the LN program. These new regulations should be announced in the Publishing Bulletin within the next 60 days. Please submit all requirements accordingly.

The three revised regulations are: AFR 23-35, *Air Force Logistics Management Center (AFLMC)/Air Force Office for Logistics Technology Applications (AFOLTA)*, AFR 400-13, *Strategic Planning*, and AFR 400-51, *The Logistics Studies Program*. AFR 23-35 has been revised to incorporate AFOLTA (formerly AFCOLR), to place both AFLMC and AFOLTA under the Logistics BOA review process, to clarify that Air Force Logistics Command (AFLC) and Air Logistics Division (ALD) provide administrative support for AFLMC and AFOLTA respectfully, and that both organizations have Air Force-wide missions. AFR 400-13 has been revised to describe changes to the basic USAF Logistics Strategic Plan, to prescribe the development of the plan and MAJCOM responsibilities to develop Theater Logistics Strategic Plans, to direct implementing plan actions, and to describe the strategic plans relationship to the Logistics BOA. AFR 400-51 has been revised to change the title from *Operation of the Logistics Research Program* to *The Logistics Studies Program*. Office symbols have been updated and the review process of the Logistics BOA has been incorporated into the logistics studies procedures. Further, AFLMC is designated as the central point of input for all logistics study requests. (Lt Col Simpson, AF/LEXX, AUTOVON 225-6791)

Contracting for Military Fuels: An Analysis of Peacetime Supply Disruptions

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Introduction

This paper applies a tool developed in game theory to the issue of contracting for military fuels. In particular, it applies a prisoner's dilemma model to the problems of contracting for military jet fuels during peacetime supply disruptions.¹

In addition, this article discusses a simple two-party trade model and illustrates the motive for trade as well as the existence of tendencies to destroy trade relationships. It also explains the basis for institutions that seek to ensure that parties to trade actually honor their trade commitments; provides a general description of the types of institutions used to ensure trade commitments are met; provides an example of how the trade model can be used to explain aspects of government contracting such as the problems likely to be faced by Department of Defense (DOD) during supply disruptions; and considers possible strategies to handle potential problems and then suggests which are most viable.

The principal conclusion of this paper is that DOD cannot depend upon its normal commercial supply mechanisms during disruptions and, accordingly, must develop or preserve alternative supply mechanisms.

A Two-Party Trade Game: Construction and Analysis²

Hypothetical gains from trade as well as possible incentives to cheat that might destroy the trading relationship can be illustrated in a simple two-party trade model with payoffs (Figure 1).

		UNSTABLE TWO-PARTY TRADE GAME [NO PENALTIES FOR CHEATING]			
		TRADER A		TRADER B	
		DON'T CHEAT	CHEAT	DON'T CHEAT	CHEAT
TRADER A	DON'T CHEAT	II A 30 B 30	III-A A 45 B 5		
	CHEAT	III-B A 5 B 45	I A 10 B 10		

Figure 1.

The values can be equivalently viewed as capital values expressed in dollar terms or as utility indicators.

Quadrant I represents a world in which no trade takes place because neither party will honor commitments. Quadrant II is the socially preferred quadrant in the sense that it is the only

quadrant where both parties are made better off, or wealthier, as compared with their initial wealth position represented by Quadrant I. Quadrant III-A represents the payouts if A cheats while B honors his commitments. Quadrant III-B represents the payouts if B cheats while A honors his commitments.

Even though Quadrant II is the socially preferred position, it is not the equilibrium or "solution" position as each party has an incentive to cheat. To better understand why this is so, consider the trade game from trader A's perspective. Trader A knows that trader B has only two options: honor the agreement or cheat. If B honors the contract, then A can increase his wealth from 30 to 45 by cheating relative to his strategy of honoring the contract. If B cheats, on the other hand, A is still better off to cheat as opposed to honoring the contract as he can then increase his wealth from 5 to 10. Because the matrix is symmetrical, what is true for A is also true for B. Hence, the optimal strategy for both is to cheat.

The players have an incentive to alter the structure of the game to ensure that the cooperative outcome will tend to emerge or become the dominant strategy. They may recognize that even a dishonest trader cheats only when it is profitable. If it is possible, then, to alter the payouts in the game such that cheating does not "pay," then both traders would cooperate and receive the benefits of trade. How is it possible to do this?

The cooperative solution would result if the game were restructured to include penalty points for cheating. If the penalty is large enough, cheating will be unprofitable and the cooperative solution will tend to emerge. Consider the possibility that the players develop, in theory, the revised game (Figure 2).

		STABLE TWO-PARTY TRADE GAME [PENALTIES INCLUDED FOR CHEATING]			
		TRADER A		TRADER B	
		DON'T CHEAT	CHEAT	DON'T CHEAT	CHEAT
TRADER A	DON'T CHEAT	II A 30 B 30	III-A A 45 B 5		
	CHEAT	III-B A 5 B 45	I A 10 B 10		

Figure 2.

The revised game has a penalty of 20 for cheating. Any penalty exceeding a gain of 15 makes cheating unprofitable. With a penalty of 20, the cheater is worse off than when he cooperates since his net wealth falls to 25 from 30.

Both players would rationally agree to accept the revised game and the inclusion of penalties because the revision ensures the cooperative solution will emerge. Note that a cheater would have no cause to complain if penalties were assessed against him if he has agreed to the revised game.

The players now attempt to move beyond this theoretical solution and ask an important practical question: What is the source of the penalty points and who ensures they are assessed? The answer is the subject of the next section.

Trade Enhancing Institutions: The Creation of Governance Structures

Structures and institutions that help preserve trade relationships are called **governance structures**. The costs of creating and maintaining such structures are **transactions costs**.³

The purpose of governance structures is to introduce penalty points into the trade game such that cheating is not profitable. This requires the penalty consequences of cheating to exceed its potential benefits. The following outlines some of the more important governance structures:

(1) Formal Contracts:⁴

This is the traditional governance structure in which the proposed trade is reduced to a formal contractual document. Penalty provisions described in Figure 2 are embedded in the contract and enforced within the court system.

A principal cost is the specification of all possible contingencies and the appropriate responses with sufficient clarity that the court "referee" can recognize an infraction and apply the appropriate penalties. An associated cost is the risk that unanticipated contingencies will occur and result in the agreement becoming increasingly suboptimal over time.

(2) Loss of Future Sales:⁵

This is an informal, private governance structure. A structure is informal if it does not use a formal written contract. It is private if it does not use the state's police powers to enforce the agreement.

Trading parties tend to use informal private governance structures in lieu of formal governance structures when the cost per efficiency unit is lower. Informal governance structures avoid the costs of drafting and enforcing formal agreements.

Using this governance structure, the customer can refrain from future purchases if a supplier does not meet its expectations. Similarly, one can shift business to those companies that provide relatively superior services and away from those suppliers who provide relatively inferior services. The potential loss of sales is a source of the penalty points (Figure 2).

The major cost of this governance structure is that one initially runs the risk of using a product that does not meet expectations.

(3) Get a Hostage:⁶

This is another important informal private governance structure used in commercial transactions. The penalty, then, is the potential loss of the hostage. Since we are a civilized society, firms cannot legally use people as hostages. Fortunately, substitutes are available. Suppliers can, for example, provide a hostage in the form of a nontransferable firm specific asset.

One example of a nontransferable asset is goodwill capital. Goodwill capital is useful only to a specific firm. If a firm cheats and loses sales and goes out of business, it may be able to sell

some of its assets at their value to the firm. In other words, some assets are transferable since their disposal value and the value to the firm are the same. Other assets, however, such as goodwill, are not transferable without a concurrent loss of capital value. The possibility that cheating will lead to a loss of capital value of the firm's goodwill represents another source of penalty points (Figure 2).

The hostage could also take the form of a firm specific nontransferable productive asset. A supplier might specialize its productive equipment so it only meets the needs of a specific customer. Then if the customer is dissatisfied and refuses to continue business, the firm loses the capital value of that asset.

By creating such hostages or "cash traps," the supplier is saying, in effect, "I know you will like my product; in fact, I am willing to wager the value of these nontransferable assets which I offer up as hostages that you will like my product sufficiently well to permit me to stay in business."

(4) Trade With Your Friends:

This is another important informal private governance structure. It is especially important when the respective duties require a high degree of trust or confidence. The tendency for criminal activities to involve relationships between close associates such as gangs is well known. Also, trades in which the services cannot easily be defined or are very valuable tend to rely on friendships or family relationships. Finally, the tendency of trading partners to encourage shared social settings may be explained as an effort to create friendship bonds.

This governance structure uses the threat of damage to one's social esteem as a penalty source. If society were sufficiently close-knit, formal contracts would not be required at all; for example, in agreements between the Amish.

(5) Vertical Integration:⁷

Firms may vertically integrate when they cannot find any economical means of creating governance structures such as those already mentioned. As a result, they do it themselves.⁸ In this case, the "trade" is internalized as opposed to being between separate players.

An example is easily found in the petroleum industry. Refineries may be designed to run optimally on a particular type of crude. If this were to place the refiner in the position that it would lose capital value if it had to switch crude sources, then the refiner would have a financial incentive to integrate backward to control its crude source.

(6) Regulation:⁹

Victor Goldberg is a leading proponent of the regulatory solution to the trade game. He argues that formal contracts are not a solution to the trade game because future contingencies cannot be anticipated sufficiently well to permit adequate resolution in a formal contract. But he recognizes that trading parties may become dependent on each other in ways that possibly permit opportunistic exploitation.

Goldberg concludes that a process analogous to a contractual "constitution" needs to be developed which fairly protects the interests of all parties to the trade. He considers informal private governance structures inadequate for the task; accordingly, he favors government regulation for those industries in which such dependency relationships are important.

Whatever the theoretical merits of Goldberg's position (his recommendations have detractors), there is no such regulatory superstructure currently in place. Additionally, such a proposal

runs counter to the free market philosophy of the current administration. As a result, no such regulatory structure is likely to be proposed in the near future.

But even if such a superstructure were implemented, it is a risky conjecture to predict the political process will treat DOD more favorably than would the market in the event of a peacetime supply disruption. It is not clear that allocating limited supplies to the military during a period of shortage would be the politically wise thing to do.

Government: A One-Armed Combatant in the Shortage War

If one considers the six principal types of governance structures outlined, it is apparent the government is more limited in its choice of governance structures than are commercial traders. In particular, the government cannot make as effective use of structures 2, 3, 4 and 5.

Consider number 2. If two firms equally meet some minimum level of performance although one is superior to the other, the government often evaluates them as though they are equal. Consider number 3. The government does not ordinarily take the existence of hostages into account in bid evaluations. Firms with no goodwill capital on the line are typically evaluated the equal of firms that risk considerable amounts of goodwill capital. Consider number 4. Obviously, the government cannot limit trade relationships to friends and relatives. Finally, consider number 5. Decisions of the government to integrate are not normally the result of any such analysis as discussed in this paper.

So what governance structures does this leave for the government to use? Only numbers 1 and 6. In short, government contracting is constrained to either place greater reliance on formal contractual documents as compared to commercial contracts for a similar purpose or, if that is not adequate, to attempt to obtain regulatory relief.

What are the implications of this analysis for DOD supply during peacetime disruptions? Simply this. One can reasonably expect many suppliers to drop out of the bidding for DOD military fuels during times of supply disruption. Suppliers will drop out simply because the benefits of so doing exceed the costs.

Commercial accounts, in contrast, will fair somewhat better during disruptions. This, in turn, is a direct consequence of the fact that commercial customers can choose from a more extensive menu of governance structures as compared to DOD. They can, as a result, more efficiently punish cheaters.

It is well known within DOD that, even though commercial jet fuel suppliers and customers favor long-term trading relationships, they rely heavily on informal private governance structures to secure them in lieu of formal contracts. Evidence supporting this position is contained in two unpublished studies by the Defense Fuel Supply Center of commercial airline contracting practices. (The Defense Fuel Supply Center is the contracting agency for nearly all DOD military fuels.)

The first study was conducted during 1975 by two senior procurement officials. That report, hereinafter called the Ward/Biddle Report, was based on actual interviews with key airline procurement officials. The report indicates airlines considered long-term supply arrangements to be important. The

report also notes airlines tended to stay with the same suppliers no matter what the language of the formal contract.¹⁰

The second study was conducted during the early part of 1989. I personally directed the survey which also attempted to determine some of the important differences between the contracting practices between the airlines and DOD. This survey will hereinafter be called the Lee Report.

The Lee Report consists of responses to questions posed by DFSC. Eight refiners and five airlines responded to the survey. The refiners collectively supply more than 50% of the commercial jet fuel sold in the United States. The airlines collectively buy over 33% of all the commercial jet fuel. The collective purchases of the responding airlines more than double DFSC's domestic jet fuel purchases although no single airline buys as much domestically as does DFSC.

An interesting finding of the Lee Report is that all the respondents, whether airlines or refiners, indicate they favor and foster long-term supply relationships even though they typically write only one-year contracts. This finding appears, at first, to be internally inconsistent.¹¹

One can resolve this apparent conflict in one of two possible ways. First, one could conclude that the fact that the companies only write formal contracts for one year is convincing evidence that the companies do not really favor long-term supply relationships despite claims to the contrary. I do not favor this approach; instead, I favor a second line of reasoning. I interpret the evidence as supporting the view that companies use informal governance structures rather than formal contracts to ensure continuity of supply.

Petroleum markets are extremely volatile. Therefore, it is, exceedingly difficult to write formal contracts which correctly anticipate future contingencies and provide appropriate remedies. As a result, a formal written contract would tend, over time, to become increasingly suboptimal. Because of this difficulty in writing formal contracts, firms might tend to place greater reliance on informal governance structures.

Consider, now, the situation where all parties to an agreement consider continuity of the supply relationship to be desirable. The customer wants to protect himself against opportunistic behavior by a supplier during a supply disruption. The customer wants to be sure he is treated "fairly."

Fairness is a concept which defies easy formalization; otherwise, it might be handled in a formal contractual document. Fairness might involve price restraint during a temporary supply disruption.

More relevant to the issue considered herein, "fairness" often involves continuity of supply beyond the period covered by the formal contract even if that means the refiner-supplier has to forego other more profitable short-run sales opportunities. For this case, formal contracts are, by assumption, precluded from use as a governance structure. As a result, greater reliance must be placed on informal governance structures.

This case can be analyzed using the two-party trade game. Designate the commercial jet fuel customer as Trader A and the refiner-supplier as Trader B. Define "cheating" as renegeing on the implicit promise to continue to supply even in periods beyond the term of the formal contract and to price these supplies with restraint. Figure 2 shows the trade model applicable to relationships between refiners and commercial accounts.

Since the issue we wish to consider is whether or not the refiner, Trader B, will cheat, we assume that Trader A, the customer, is honest. The refiner, then, is faced with the choice outlined in the left-hand column of Figure 2 which is shown as Figure 3.

		TRADER A						
		DON'T CHEAT	CHEAT					
TRADER B	DON'T CHEAT	<p style="text-align: center;">II</p> <table border="1"> <tr> <td>A</td> <td>B</td> </tr> <tr> <td>30</td> <td>30</td> </tr> </table>	A	B	30	30		
	A	B						
30	30							
CHEAT	<p style="text-align: center;">III-B</p> <table border="1"> <tr> <td>A</td> <td>B</td> </tr> <tr> <td>0</td> <td>-20</td> </tr> <tr> <td>5</td> <td>25</td> </tr> </table>	A	B	0	-20	5	25	
A	B							
0	-20							
5	25							

Figure 3.

As the game is constructed, the refiner-supplier will not cheat because it is not profitable. With a penalty of 20 as shown, cheating would reduce the refiner's wealth from 30, if honest, and to 25, if dishonest. The refiner-supplier, accordingly, does not cheat but continues to supply as implicitly promised or, alternatively, rations limited supplies on a "fair" basis.

The analysis to this point is very theoretical. Skeptical readers might ask how commercial airlines manage to insert the penalty points, I have so conveniently assumed into this one, into a real world trade game. They may well ask why is the model represented by Figure 2, the one with penalties, used instead of the model represented by Figure 1, the one without penalties?

By way of response, consider some of the ways an airline customer could include penalty points into the game even when there is no formal contractual coverage. First, airlines can withhold or reduce future trade with suppliers who are unfair. Second, they could inflict damage to the valuable goodwill capital of the refiner-suppliers by branding them "unreliable" (see hostage discussion.) Refiner-suppliers who suffered a loss to their goodwill capital might have to lower the price of their products to compete successfully with those suppliers who acted in a manner perceived to be more fair. Finally, refiner-suppliers frequently invest in assets such as distribution facilities which are economically useful only to supply a specific customer. This, too, serves the purpose of a hostage. Collectively, these sources of penalty points might be sufficient to ensure that cheating is unprofitable.

Now consider the same problem with the government being Trader A and the refiner-supplier, being Trader B. In this case, however, the appropriate model for comparison is that shown as Figure 1. Again, assume both parties favor long-term contracts and consider, implicitly at least, "fair play" during a disruption to mean price restraint and continuity of supply in accordance to some "reasonable" allocation formula. Cheating is, as already mentioned, defined as renegeing on this implied promise.

Since the issue under consideration is whether the refiner-supplier will cheat (given honest behavior on the part of the government), the relevant portion of the matrix is the left-hand column of Figure 1 which is reproduced as Figure 4.

		TRADER A						
		DON'T CHEAT	CHEAT					
TRADER B	DON'T CHEAT	<p style="text-align: center;">II</p> <table border="1"> <tr> <td>A</td> <td>B</td> </tr> <tr> <td>30</td> <td>30</td> </tr> </table>	A	B	30	30		
	A	B						
30	30							
CHEAT	<p style="text-align: center;">III-B</p> <table border="1"> <tr> <td>A</td> <td>B</td> </tr> <tr> <td>5</td> <td>45</td> </tr> <tr> <td>5</td> <td>25</td> </tr> </table>	A	B	5	45	5	25	
A	B							
5	45							
5	25							

Figure 4.

As the game is constructed, it pays the refiner-supplier to cheat since its profits increase from 30, if honest, to 45 when cheating. The increase in profits may result, for example, from refusing to offer against DOD contracts and diverting that product into more profitable spot sales.

Skeptical readers might ask why there are no penalty points in this model like those assumed to exist in the commercial game outlined. Why, in other words, is the model represented by Figure 1, which has no penalty points, used instead of the model represented by Figure 2, which does have penalty points?

In response, compare the airlines' ability to introduce penalty points into the game with DOD's ability. First, they credibly threaten the refiner-supplier with a loss of future sales. The Department of Defense cannot do that. Failure to offer products in response to a government request for offers to supply is an unacceptable basis for refusing award if the supplier decides to offer against a subsequent requirement. The refiner-supplier can, accordingly, drop out of the bidding during a disruption and then reenter at a later date without fear of evaluation penalty.

Since this is so, commercial accounts do not treat the actions of the refiner-supplier as a signal of unreliability. They recognize that refiner-suppliers are rationally responding to the incentives (payouts) of the government trade game. As a result, there is no loss of goodwill capital.

Finally, refiner-suppliers generally do not make customer specific investments for the government unless they get total cost recovery during the initial contract period because they recognize that DOD cannot deliver on an informal commitment to be a long-term customer. Accordingly, they do not have any "cash-traps" for the government to hold hostage.

In short, the government is extremely limited in its ability to introduce penalty points into the trade game. It is, consequently, a one-armed combatant in the shortage war.

Remedies for Readiness

If the trade game depicted in Figure 1 fairly represents the situation facing the government, then the remedies must either include ways to live with the spectre of disruption or include

ways to alter the payout matrix such that the cooperative solution will tend to emerge (Figure 2).

The following possible remedies are suggested. Remedies 1 through 4 are best described as methods of coping with supplier defections during disruptions while remedy number 5 considers the possibility of altering the payout matrix such that the refiner-supplier has incentives to continue to supply.

(1) Hedge on Futures Exchange.

If this remedy were employed, the government would ensure against a supply disruption by taking a position on a futures exchange such as the New York Mercantile Exchange. In the event of a disruption, the government could then either take physical delivery of the products which it could exchange for military fuels or it could take paper profits and use the proceeds to buy military fuels presumably at higher than market price.

Two limitations to this remedy are obvious. First, statutory authority would have to be provided to permit the government to hedge. Second, the government would be subject to possible political criticism if it were to take profits from hedging and use them to buy products at "spot" prices above the prices charged to companies with more secure informal contractual relations such as those depicted in Figure 2. Third, hedging has transactions costs.

(2) Pay the (Possibly) Higher Price.

There is disagreement whether future disruptions will result in spot prices rising above average prices as has been the case during past disruptions. On strictly theoretical grounds as outlined, I consider it likely that spot prices will be higher than the average prices. However, not everyone shares that opinion. But for sake of argument, at least, consider the situation where spot prices are considerably above the average market prices.

One might argue that the government should just pay that price. One might also argue that the government benefits from lower prices during normal times because refiner-suppliers lower their prices in recognition of the fact that they are not "buying-in" to a long-term, albeit implicit, supply arrangement. Having obtained the benefits of the lower prices during normal times, the government would have no cause to complain when it has to pay above average prices during periods of disruption.

Despite the merits of this line of reasoning in terms of its theoretical economic validity, the remedy totally ignores the political reality of the situation. Contracting officials are unlikely to pay prices for products which are clearly above the average price, appropriately adjusted for differences in quality, paid by commercial customers. If DOD were to do so, it could reasonably anticipate a storm of political protest. It might even be blamed for bidding up market prices. The anticipated criticism is real whether or not it is based on sound economic logic.

(3) Acquire Additional Inventory.

When market conditions are expected to adversely affect, or have adversely affected, DOD's ability to acquire petroleum products, DOD may request the Department of Energy to provide them access to any portion of the US Government's share of the Naval Petroleum Reserves. DOD would reimburse the Treasury at the fair market price for crude. Federal divestiture of these reserves, as envisioned in proposed legislation which the Bush Administration forwarded to the 101st Congress, would enhance this option by dedicating a fixed amount of crude oil,

stored in salt domes and collocated with the Strategic Petroleum Reserve, for defense use.

Additionally, DOD could increase its inventory to permit it to "ride out" a supply disruption. This need for additional operating storage was discussed during hearings before the Investigations Subcommittee of the Committee on Armed Services (HASC No. 96-33), called because of fuel acquisition difficulties experienced by DOD during the late 1970s. The following exchange between General Seamon, then Commander of the Defense Fuel Supply Center (DFSC), and Samuel S. Stratton, the Subcommittee Chairman, is instructive:

Mr. Stratton. You say here on your final page that we are going to have to take a hard look at our current and projected storage capability; and you would like to have enough to ride out future shortages of temporarily high prices.... But you're saying, in other words, that you really believe we need more storage capability and you'd like to see that constructed. Is that right?

General Seamon. That is correct, sir.

Mr. Stratton. Then I take it what you're saying is that over and above the day-to-day operational requirements, plus your wartime requirements which you've described as being about 70 percent of your total, you would like to have a little extra leeway to be able to avoid purchases in times of especially high prices.

General Seamon. That is correct, sir.

(Source: H.A.S.C. No. 96-33, p. 56)

Historical data indicates that, from 1973 through 1985, DOD did increase its fuel inventories. The DFSC, which procures fuel for the military services, increased its maximum authorized level of petroleum stocks from 56 million barrels in 1973 to 99 million barrels in 1985. A significant portion of this increase was dedicated to support specific war plan requirements; however, those stocks acquired to support peacetime operating requirements nearly doubled. The increase in peacetime operating stocks occurred despite DOD's relatively stable consumption history. Since the middle 70s, consumption for all products, mainly jet fuels, has remained relatively stable at about 200 million barrels per year. Significantly, however, peacetime stocks have decreased since 1985 as the result of budgetary pressures. Current stocks for peacetime operations are approximately the same as the 1980 levels.

(4) Seek Product Priority Assistance.

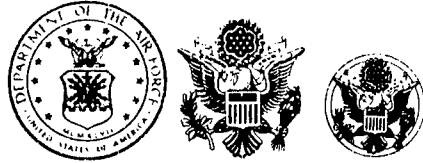
DOD can request the Department of Energy to use its regulatory powers under the Defense Production Act to assign DOD fuel contracts priority ratings, thus enabling DOD to receive products ahead of non-DOD customers. This option may have both economic and political consequences. When all is said and done, I believe DOD will either have to live off its existing inventory or seek priority assistance to receive the product.

If this reasoning has merit, the procedures for using regulatory powers, such as those under Title I of the Defense Production Act, should be well understood by DOD contracting personnel. It would, perhaps, be wise to practice these procedures during military exercises.

(5) Change the Payout Matrix.

There are current initiatives, such as those being discussed in government contracting circles under the rubric "contracting for value," that have the potential of altering the payout matrix to

Continued on page 40 →



CAREER AND PERSONNEL INFORMATION

Civilian Career Management

The Twenty-First Century Logistician

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(The following article was developed by members of the LCCEP Panels and the LCCEP PALACE team.)

Logistics is a dynamic field that continues to evolve in response to the changing needs of our defense posture and advances in technology. This represents a demanding challenge for long-range planning to build up and maintain a logistically strong and technically capable work force. The Logistics Civilian Career Enhancement Program (LCCEP) and the LCCEP Career Development Panel are committed to the recruitment, retention, and development of our logistics work force to meet that challenge.

Today's environment of transition and change has accelerated this evolution. The environment of the 1990s and beyond, which will include new and updated weapon systems, new technologies, complex embedded software systems, major information systems, organizational structures, and management styles, will dictate the knowledge, skills, and abilities required of the twenty-first century logistician. These translate into a need to reassess the recruitment, retention, education, training, and career development requirements for logisticians of the future.

Environment

The majority of the weapon systems currently in the inventory will remain beyond the year 2000; however, modifications to existing weapon systems will incorporate new technologies to upgrade and extend service life. A myriad of state-of-the-art weapon systems and a variety of new electronic communications and space systems are poised on the horizon awaiting transition into the inventory. To gain more mission capability and reduce logistics support costs, the new technologies and processes must incorporate high maintainability, reliability, sustainability, and survivability to effectively support the mission within budgetary limits. Emphasis on Reliability & Maintainability (R&M) 2000 will continue into the next decade. The concept of Total Quality Management will be applied toward improving the way the Air Force manages its support of the fleet.

Recruitment and retention of a quality work force will require managers to sharpen and enhance their own management abilities to present challenging and satisfying work environments. Managing a technologically astute logistics work force, whose skills and job requirements are constantly evolving,

presents a tremendous opportunity for LCCEP to create a framework that will meet the needs of these logistics managers.

Technology

Technologies such as "smart skins" that replace bulky antennae, sensors, and communication devices, fiber optics that replace bulky metallic wiring, and photonics which substitute light energy for electric energy (photons for electrons) will change the mix of skills required for maintenance and repair processes. Additionally, new materials being used such as composites and ceramics will challenge engineering expertise to modify and develop new manufacturing and repair processes.

Infusion of new technical developments and the required skills upgrade in both hardware and software will force reassessments of depot and field organizational structures and operations. This will require the logistics infrastructure to adapt to the new technology hardware that must be manufactured and repaired (composites, very high speed integrated circuits (VHSIC)) to meet the challenges. High technology industrial equipment such as robotics and more cost effective repair and manufacturing procedures will also be integrated into logistics processes.

Increased reliability and quality will reshape the levels maintenance concept as a result of modular repair. Modular avionics and VHSIC components will also drive changes in system test, diagnosis, and repair.

Our newer systems are software intensive and require highly skilled technical personnel. The shift to software intensive systems, the upgrade and integration of information systems, and the evolution of artificial intelligence will make our systems less people intensive and require a new mix of technical skills. These and other emerging technologies will continue to increase the complexity of the workload and require our managers to gain a better understanding of how to manage scientific, engineering, and technical personnel who will accommodate the influx of new processes, materials, and technologies.

In addition to the insertion of new technology, a changing logistics infrastructure, and sophisticated information systems, the acquisition community is streamlining the way it does business. The complexities of buying and managing "high tech" acquisitions will force our acquisition logisticians to acquire a better understanding of how to interact with engineering and program managers as well as information and software engineering personnel.

Information Systems

In the near future, a computer terminal will be at almost every desk. With easy access to computer terminals, much more data will be available for the analysis and decision-making processes. All personnel must increase their proficiency as computer users to make the best use of available data and to array the data into meaningful formats. Analytical skills become more critical with the need to assess and manage vital data accurately.

The improvements in information systems are erasing lines between wholesale and retail processes and bringing with it integrated management with less need for human intervention. This linkage among systems is ushering in new opportunities for sharing data. Logistics managers must be able to manage information systems and understand the problems encountered in this integrated environment.

Training

Management training is necessary to create broad-gauged professional logisticians who have the expertise to manage people across a wide range of skills. Training must be available for those who show the aptitude and desire to become senior managers. A larger segment of the budget must be geared toward management applications, new ideas, and future technologies. Training remains the responsibility of management and must receive the proper emphasis in the work place. Logisticians need to be able to incorporate various training opportunities as an integral part of their duties.

Broad logistics experience will help develop the twenty-first century logistician. Logistics experience at retail, wholesale, command, and Air Staff levels will prepare a more well-rounded logistics manager. The experience of working different command levels and various issues offers the broadening desired for logisticians to reach the highest levels of management.

Management needs to take a more deliberate role in training of the work force by identifying individuals who show potential and set their direction of training opportunities. LCCEP must take the initiative to plan and offer opportunities by implementing the training and developmental activities necessary to meet these upcoming challenges.

Work Force

The age of our LCCEP population today for GS-11 and above is as follows (data was extracted from the Personnel Data System - Civilian (PDS-C) as of 30 September 1989):

AGE	PERCENT OF POPULATION
UNDER 31	5
31-40	20
41-50	40
51-60	31
OVER 60	4

Seventy-five percent of the current LCCEP population are over the age of 40. This provides the Air Force with a wealth of experience in the Air Force but accentuates the need for continuing training and upgrade of logistical and technological skills to meet changing demands. To ensure an efficient work force, mandatory training or education may become necessary as well as revision to current personnel standards (X-118) for the logistics field. Presently, 80% of the LCCEP population have at least some college education, while 43% have completed a bachelor's degree program. The influx of PALACE ACQUIRE interns, in GS-5 to 9 positions, all with bachelor's degrees, will bolster these figures in the future.

Conclusion

The challenges of the future will center on the logistics manager's readiness to keep abreast of the many technological transitions and changes in the work place infrastructure and to

plan efficiently to support mission requirements. LCCEP must continue its commitment to recruit, retain, and develop our logistics work force to meet the challenge of providing a technologically sound and logistically capable work force.

Logistics Professional Development

Air Force Systems Command Broadening Experience Tour (BEST) Program

The BEST program was established in 1982 to combat the decline in operational experience within Air Force Systems Command's Scientific and Developmental Engineering force (26XX-28XX) by providing selected company grade officers with an operational tour. This program gives engineers the opportunity to gain experience while performing duties in operational Air Force units by broadening to other Air Force career fields. The program objective is to provide these officers with a better understanding of how their engineering/acquisition duties tie in with operations.

There are 57 quotas for BEST officers in nine Air Force specialty codes (AFSCs) for BEST 1990. These are Air Weapons Directors (17XX), Missile Operations (18XX), Air Base Operability (19XX), Space Operations (20XX), Weather (25XX), Missile Maintenance (31XX), Aircraft Maintenance and Munitions (40XX), Intelligence (80XX), and Security Police (81XX). In the logistics field, the aircraft maintenance and munitions career field will receive 12 BEST officers this year, and the missile maintenance career field will receive one BEST officer.

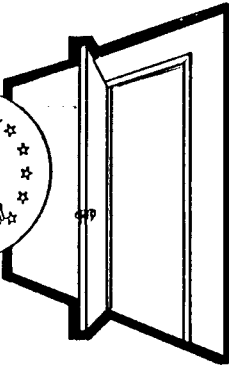
The BEST program is highly selective. Officers must have a history of superior performance. The officers are selected as volunteers by a Systems Command BEST selection board for duty in specified AFSCs. After HQ AFMPC confirmation of availability and completion of the Commander's Involvement Process, the officers are then given to various assignment teams. Assignments are then determined according to criteria such as background applicability, MAJCOM needs, and geographic preferences as identified on the Air Force Form 90. The officers are assigned to the MAJCOMs for permanent change of station assignments with the necessary training scheduled en route (TDY). For maintenance officers, the school is the combined aircraft maintenance/munitions officers course, 17 weeks in duration at Chanute AFB, Illinois; for missile maintenance officers, the school is five weeks in duration, also at Chanute AFB.

After training, the BEST officer spends three years in maintenance organizations, learning flight-line operations or missile launch facility maintenance, and in-shop maintenance management. After tour completion, the BEST officer returns to the Air Force Systems Command.

If you would like more information concerning BEST officer opportunities in the aircraft maintenance/munitions career field, call Capt Glenn Scott, HQ AFMPC/DPMRSL1, AUTOVON 487-3556/4553, or call Capt Denny Briggs, HQ AFMPC/DPMRSL5, AUTOVON 487-5207, for information concerning BEST officers in the missile maintenance career field.

(Capt Glenn Scott, HQ AFMPC/DPMRSL1/AUTOVON 487-3556)

AFIT



The Doorway to Logistics Success

The following are summaries of the theses which won awards for the class of 89S, School of Systems and Logistics, AFIT. The class had 70 graduates in logistics management, 18 in engineering management, 45 in systems management, 45 in contracting management, and 9 in cost analysis.

TITLE: *An Analysis of the Advantages and Disadvantages of the Air Force Standard Control Panel*

AUTHOR: Captain Kevin E. Rumsey

This study conducted research into the field of heating, ventilating, and air-conditioning (HVAC) controls to determine if the Air Force Standard Control Panel would aid in solving the Air Force's problems with complicated and unreliable HVAC controls.

The researcher conducted an experiment and a Delphi survey of experts. The experiment compared the Standard Panel with a pneumatic built-up system. The analysis included a comparative investigation of the installation, calibration, and operations of each system, and a statistical analysis and comparison of the drift of each system's mixed air and supply air controllers.

The researcher concluded from the results of the qualitative portion of the experiment and the consensus of the Delphi experts that the Standard Panel was not superior to other control systems in terms of design and installability (to include calibration) but was superior in terms of ability to maintain setpoint (to include overall operability) and diagnostics capability.

TITLE: *Reducing C130E Hercules Operating Costs in the Royal Australian Air Force and the United States Air Force by Increasing Cruise Speeds*

AUTHOR: Squadron Leader Dennis G. Green

The purpose of this research study was to examine a proposal to reduce C130E Hercules operating costs in the Royal Australian Air Force (RAAF) and the United States Air Force (USAF) by increasing cruise speeds. The current fuel conservation policies in the RAAF and USAF do not consider the effect of the policy on aircraft operating costs.

RAAF C130E cost data was found to be invalid. The study qualified major differences in the depot servicing, contract servicing, and in-house servicing for RAAF C130E and C130H Hercules aircraft. The study suggests that the RAAF should improve the accuracy of C130E cost data to allow a valid assessment of the operating costs over the aircraft life cycle.

USAF C130E cost data was readily divided into fixed and variable costs. The variable maintenance costs were found to be more than double the hourly fuel costs. Flight manual data and mission profile data were used to show the USAF could save \$94,613 to \$1,979,227 (US) in 1989 by flying selected missions at 290 knots instead of 280 knots true airspeed (TAS).

The Lockheed MACPLAN computer flight plan system was used to verify the theoretical calculations. Savings of \$5.17 (US) to \$15.18 (US) per flying hour were demonstrated using 290 knots TAS over short- and long-range missions with varying payloads. The sensitivity of the calculated savings to changes in fuel and maintenance prices was also examined.

TITLE: *An Analysis of In-Transit Lead Time for Asset Delivery at Ogden Air Logistics Center*

AUTHOR: Captain Philip J. Price

AFLC has directed that the amount of material stocked in maintenance inventory centers (MICs) be reduced. The in-transit

delivery time for replenishment issues to MICs from Depot Supply has significant impact on material support. This study examined MIC stock replenishment in-transit time. In-transit times experienced during a six-month period in six MICs at Hill AFB, Utah (Ogden ALC), were analyzed to establish performance parameters for simulation analyses.

Empirical in-transit time performance statistics implied the AFLC 1.5 working day delivery time standard for MIC replenishment issues was not being achieved for all MICs.

Simulation experiments indicated that the 95% line item fill rate objective outlined in certain MA data automation reports is achievable only for items characterized by high frequency of demand. The mean, variance, and probability distribution of in-transit delivery time, coupled with the current 15/7 day (stock level/reorder point) inventory policy were the main factors influencing inventory performance. Reducing the mean in-transit time improved material availability in the MIC characterized by beta-distributed in-transit delivery times.

TITLE: *The Development of an Expert System for F-16 Aircraft Battle Damage Repair*

AUTHOR: Captain James G. Fulton

This thesis constructed an aircraft battle damage repair (ABDR) expert system and determined whether this system could meet the rapid repair requirements established by the ABDR program and could help solve the Air Force's shortage of ABDR expertise.

The system was validated by conducting a field test to assess the effectiveness and efficiency of the completed prototype. This experiment was performed by having ABDR engineers and technicians solve ABDR scenarios with and without the expert system and then comparing the resulting solutions. The 16 engineers and 36 technicians produced 104 solutions using the expert system and 104 solutions by hand. These solutions were compared and showed that the ABDR expert system prototype effectively reduced the overall time required to solve the battle damage scenarios by 50.42% for the engineers and by 39.19% for the technicians. Furthermore, the solutions generated by the expert system were selected over the solutions generated by hand as the preferred solution 94.23% of the time.

TITLE: *An Investigation of the Distribution of Power and Leader Effectiveness in Matrix Organizations*

AUTHOR: Captain Richard L. Wojcik, Jr.

This research developed and validated new measures of power. Previous field studies suffer from several methodological limitations—no power base measures currently exist with adequate reliability and validity. A list of desirable psychometric properties was assembled and a well-planned, detailed program of item development and scale testing was carried out to assure that the newly developed measures would possess the desired properties.

Five theoretical construct definitions were developed for reward, coercive, legitimate, expert, and reference powers. Next, items were generated for each power base that were consistent with the theoretical power definitions. The resultant items were then subjected to a three-phase pilot study to determine those most suitable for further examination. The retained items were next administered, along with various dependent variables, to a sample of project personnel working in matrix organizations.

Continued on page 41 →

Assessing Supportability Through Innovative Dyna-METRIC Spares Assessments

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Introduction

The purpose of this article is to provide the practitioners (daily users of the Dyna-METRIC¹ computer model), research students, and analysts with a view into innovative methods used to perform spares assessments.

The basis for performing spares assessments with the Dyna-METRIC model was addressed in the Spring 1983 *Air Force Journal of Logistics* in an article written by Dr Raymond Pyles, The Rand Corporation, and Lieutenant Colonel Robert S. Tripp, USAF. Their article, "Measuring and Managing Readiness: An Old Problem - A New Approach,"² provided an explanation for the development and needed capability to perform supportability analyses of various weapon systems.

Their article centered on a specific example: F-16 aircraft quarterly spares assessments, an innovative and serious effort to assess the supportability of the F-16 aircraft. The following sections will identify and detail problems that were overcome and the enhancements designed to support the F-16 system program managers' (SPM) efforts in assessing the readiness of the F-16 weapon system.

Background

Several factors led to the F-16 quarterly spares assessments. Both technology (Dyna-METRIC) and senior management interest had developed which related logistics postures to combat capability. Several important changes in planned F-16 logistics support had occurred that were significant enough to have senior military leaders seriously question the spares supportability of the F-16.³ In 1980, defense logistics budgets were cut by as much as one-half. In 1982, the requirements process was simultaneously shocked by cumulative double-digit inflation; "catch-up" from 1980 budget cuts; induction of some of the most extensive weapon system modifications in history; and a host of imponderables ranging from national policy and economic recession to methodological changes in computational models. The result was an unexpected peak in most logistics budgets, one of the most visible being the rapid growth of the aircraft replenishment spares budget (BP15) from approximately 2 billion to 3 billion dollars. With national attention beginning to concentrate on the growing national debt, high-level attention focused on improving Air Force requirements forecasting accuracy—Air Force credibility.⁴

Given these major issues and the climate to gear Air Force Logistics Command (AFLC) support to combat readiness, the F-16 SPM, with the active participation of the tactical air forces, led a serious effort at Ogden to assess the supportability of the F-16.

Designed Solution

The first goals of the spares assessment were to determine:

- (1) How well did available peacetime operating stock (POS) and war reserve materiel (WRM) support flying objectives in peacetime and wartime?
- (2) What items limited attainment of flying objectives?
- (3) What could be done to alleviate these problems?⁵

To obtain quantitative answers to these questions, a three-year supportability period was designed into the Dyna-METRIC assessment.

Unique aspects of the F-16 assessment were to, first, analyze and examine total worldwide F-16 performance across all commands and relate how all levels of the logistics systems concerned with recoverable spares interact and impact weapon system support. The analysis linked together the impacts of stockage, base and depot repair capability, and transportation capability between the base and depot systems. Another unique feature was the extended time horizon. This aspect of the analysis provided the capability to evaluate peacetime supportability in terms of not fully mission capable (NFMC) aircraft at quarterly intervals. This capability is extremely important because it enabled the SPM to examine long-term changes in stockage, reliability enhancements, and other corrective actions already underway at the proper lead time. The extended supportability assessment also allowed the SPM to evaluate wartime supportability during any particular quarter requested during the three-year time period.

For the first time, the analysis provided the F-16 SPM with a data bank of all recoverable items used on the F-16. This required obtaining input data on these items from each of the five air logistics centers (ALCs) which are involved with managing items used on the F-16. Thus, on the output side, the assessment and analysis provided the F-16 SPM with information on all recoverable items—no matter where they were managed—that impact NFMC rates.

Implementation Issue Strengths

There were several strengths to the F-16 quarterly spares assessments. The assessments relate logistics system performance and resourcing decisions to combat capability measured in terms of available aircraft and achievable sortie rates. The technique also deals with base and item level data, or in the case of war reserve spare kits (WRSK), squadron level. Therefore, problems can be isolated down to the item, and squadron or base level. The approach also deals with interactions between the base and depot level transportation, maintenance, and supply systems.

Another strength was that the assessments looked at the total force of F-16s worldwide and not just at squadrons or theatres.

Finally, the assessments explicitly dealt with the dynamics of a changing world over a relatively long span (three years).

Assessment Shortfall

The initial F-16 quarterly spares assessment provided the SPM with a means of measuring the readiness of the F-16 aircraft. However, only the F-16A mission design series (MDS) was assessed. The shortfall was similar to taking a fleet of automobiles, but only looking at one specific model, a Ford Thunderbird for example, all identical to one another. All that was being assessed was Tactical Air Command (TAC) F-16A, block 5 aircraft with the assessment limited in benefits to both the F-16 SPM and the TAC headquarters staff. But what about the F-16B, the training two-seater version of the F-16 fleet? And what do we do when we change configuration of the aircraft by improving the radar and components that only work on specific blocks of aircraft? Do we limit the assessments, perform separate assessments, or block assessments? Or do we say the model (Dyna-METRIC) worked fine for a small sample data base (the F-16A), but it is not practical or capable of modeling a whole fleet of aircraft dispersed throughout the world? Indeed, this problem of a multiple MDS seemed almost insurmountable at first; but, through a search of available resources, a solution was found.

Finding the Solution

Finding a source of aircraft data that would provide a uniqueness to every national stock number (NSN) seemed impossible in everyday United States Air Force data bases. D041 contained national stock numbers, technical data relating to reliability, and not repairable this station (NRTS) rates and stockage. However, it did not appear to distinguish to which specific MDS block configuration a national stock number was peculiar. The starting point was hidden in a data base peculiar to the F-16 aircraft, the integrated logistics data file (ILDF) D194C. ILDF contains the production effectivity of each NSN to the tail number at the time it was installed during production. By using the 61 (F-16A) and 62 (F-16B) designators within the ILDF program, a matrix was established to make each NSN unique or common to an MDS. For a stock number common to both the F-16A and B, a two position numeric field was created within the ILDF data base (Reske, 1983). Therefore, an NSN such as 1280-01-045-3976, which is common to both MDS, would be followed by an 11. If a stock number was unique to an F-16A, it was followed by a numeric designator 10. If unique to an F-16B, its numeric designator would appear as 01. Adding two other F-16 MDS aircraft, we create the following matrix of possibilities,

F-16A	1000
F-16A & B	1100
F-16A, B, & C	1110
F-16A, B, & D	1101
F-16A, B, C, & D	1111
F-16A & C	1010
F-16A, C, & D	1011
F-16A & D	1001
F-16B	0100
F-16B & C	0110
F-16B & D	0101
F-16B, C, & D	0111
F-16C	0010
F-16C & D	0011
F-16D	0001

Table 1: F-16 MDS Aircraft Matrix.

and so forth, until a matrix of 15 different combinations would be formed. What is the significance of such numeric designators? Look at aircraft disbursement for an interesting approach and one of the keys to modeling multiple MDS aircraft at a single location.

Aircraft Disbursement

Finding the shortfall of having only modeled the F-16A in the F-16 quarterly assessment provided the first step of defining readiness through the Readiness Capability Assessment Preprocessor (Birch, Blair, Hales, Reske, 1983-84).⁶ The mix of aircraft for the four mission design series has 15 possibilities as determined by the matrix in the preceding section. Since the goal is to determine if purchased stock for our future flying hour programs is adequate, a matrix to evaluate the mix of aircraft at each operating location is created. If, for example, 100 aircraft are assigned to an operational wing, any combination of aircraft assigned may occur especially if the unit is engaged in in-flight training operations. For example, a Tactical Training Wing may be configured as follows,

24	F-16A Aircraft	24%
16	F-16B Aircraft	16%
36	F-16C Aircraft	36%
24	F-16D Aircraft	24%

Table 2: Percentage of Assigned Aircraft.

or matrixed as:

	1	1	1	1	
F-16	A	B	C	D	TOTAL
	24	16	36	24	100
	24%	16%	36%	24%	

Table 3: F-16 MDS Aircraft Application.

A national stock number such as our example 1280-01-045-3976 for F-16A and B assigned aircraft would comprise 40% of the assigned fleet. This percentage is then assigned to the application portion of the input data base so the national stock number would be assessed as 40% of the flying hour program computed for the operating base. The enhancement provided the capability of modeling the various types of F-16 aircraft, operating from disbursed operating locations. This assumes the flight information input into the Dyna-METRIC model applies equally to all MDS. Logic for the assumption is validated in Option 1.

Preface to the Menu

The Dyna-METRIC Readiness Capability Assessment Preprocessor (consists of 18 steps) develops a matrix output file loaded onto a VAX-11/780 computer and processed by the 4.4 version of the Dyna-METRIC model. The output of the model is then analyzed and a formal assessment of the data is performed.

**DYNA-METRIC READINESS CAPABILITY ASSESSMENT PREPROCESSOR
MAIN MENU**

1. F/M THE SCENARIO
2. F/M FOR SRANs TO BE USED FOR THIS ASSESSMENT
3. F/M MDS (PADS) TABLE TO BE USED FOR THIS RUN
4. MAKE INITIAL RUN AGAINST D041
5. VALIDATE NSN AND DETERMINE WUC —BY ILDF OR VAMOSC—
6. F/M TO CORRECT, ADD OR DELETE TO THE FINAL MATCHED MASTER FILE
7. ALIGN SRUs WITH LRUs (CHANGE SRUs TO LRUs)
8. F/M FOR INPUT OF AIRCRAFT BY MISSION DESIGN SERIES (MDS) LOCATED AT EACH STOCK RECORD ACCOUNT NUMBER. PROGRAM BUILDS APPLICATION TABLE AND CREATES APPLICATION FILE.
9. RUN D041 DATA AGAINST ALC D104 MASTER FILES
10. RUN D041 DATA AGAINST ALC D104 SORT FILES
11. F/M SRAN ISSL ACFT NR
12. F/M ISSL NR
13. DETERMINE ISSL QUANTITIES
14. F/M SERIAL NUMBER FOR WRSK/BLSS KIT TABLE
15. DETERMINE D029 QUANTITIES
16. COMPUTE D104 VS D040 QTYS + D029 QTY FOR STOCKAGE
17. LRU/SRU DESCRIPTIONS
18. FINAL OUTPUT
19. THIS OPTION RESERVED
20. EXIT

ENTER OPTION NO. [D R:1.-20. D:20.]:

**OPTION 1
FILE MAINTAIN THE SCENARIO**

File maintaining the scenario for the quarterly assessment of recoverables is accomplished by determining current operating locations as well as those activating over the next three-year period. From the Aerospace Vehicles and Flying Hour Document designated, i.e., PA85-3(c), the base activation schedule can be extracted from the document as well as the number of aircraft at each location, MDS, sortie utilization of assigned aircraft at each location, and the average sortie duration. Sortie utilization can be determined by dividing the average sortie duration into the total flying hours for the assigned aircraft at a location to determine the total sorties to be flown; the sorties total is then divided by the total number of aircraft assigned to calculate the sortie utilization of assigned aircraft. The number of aircraft and MDS will also be used to build matrix tables at various times during processing of data within the Dyna-METRIC Preprocessor Main Menu.

A sample SRAN TABLE (first 6 positions) with priority codes (last positions) is illustrated for your review as it would appear following the file maintenance routine:

FB202711	FB561203
FB480309	FB562001
FB481407	FB562104
FB482913	FB602218
FB483012	FB609115
FB485210	FB615120
FB488708	FB626119
FB520506	FB640114
FB528405	FB643216
FB557302	FB645117

Table 4: SRAN Priority Code.

**OPTION 2
FILE MAINTENANCE FOR INPUT OF STOCK RECORD
ACCOUNT NUMBERS (SRANs)
USED DURING THE ASSESSMENT**

The bases converted to stock record account numbers (SRANs) should be those currently activated, and activating, over the next three-year period. The base information from the Aerospace Vehicles and Flying Hour Document can be converted from bases to SRANs through the use of the DODAAD Master File. This is a D124 microfiche product; PCN: A-DI24-A1A-WK-GA7.

Up to 20 (this can be expanded) SRANs can be entered along with a precedence rating priority. When assigning priorities, overseas (OS) units have the highest priority over Continental United States (CONUS) units for safety stock. When CONUS and OS have equal force activity designators (FADs) based on their precedence ratings, the highest priority should go to the OS unit.

**OPTION 3
FILE MAINTENANCE OF MISSION DESIGN
SERIES (MDS)
PROGRAM APPLICATION DESIGNATORS (PADS) TABLE
TO BE USED FOR THIS ASSESSMENT**

This program establishes the cutoff date for the data under analysis and creates the application program designator table required to pull specific data from the D041 PROGRAMMING DATA FILE record type "01" formats. The cutoff date is required to properly determine starting points for current factors and the number of interpolations required for each quarter between current and first forecasted factors. The date needs to correspond to the tape's cutoff date; i.e., month of quarter and year.

The other half of this program creates a file containing a table of the mission design series the user selectively loaded.

The reference for obtaining the required information is AFLCR 57-4, *Recoverable Consumption Item Requirements System (D041)*, Section 3-3, "Maintaining Application Data."

Additionally, AFLCR 57-1, *Material Programs for Recoverable Consumption Type Item Computations for Replenishment Requirements*, contains authorized application designators for standard MDS items.

F016A
F016B
F016C
F016D

Additional information can be obtained from examination of the following two tables:

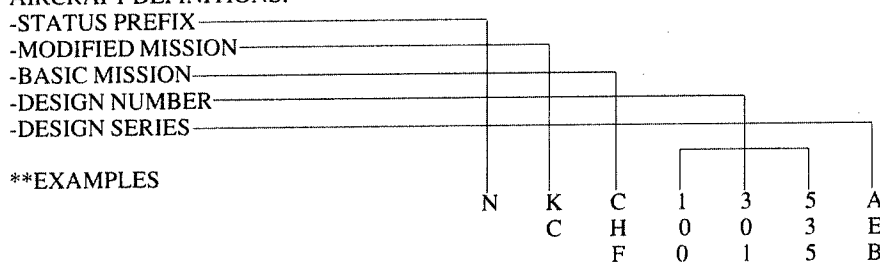
The following format is used for the F-16:

Type Record 01 = Application Data

COLUMN =	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
ACFT MDS			B	0	5	2	E								
ACFT MDS		K	C	1	3	5	A								
ACFT MDS	N	K	C	1	3	5	A								
ACFT MDS		C	H	0	0	3	E								
ACFT MDS	F	X	F	0	0	5	A								
ACFT MDS		C	1	3	0	K							U	K	
ENG TMS			J	0	0	5	7	0	5	5	A				
ENG TMS		G	R	0	0	8	5	1	8	0					
ENG TMS	F	X	J	0	0	7	9	0	1	1	A				
ENG TMS	G	S	0	0	4	8	0	B	1	0	A	6			
MISSILE MDS	A	I	M	0	2	6	B								
DRONE MDS		Q	F	1	0	2	A								
TRAINER	1	A	D	0	0	0	A								
NATL. STLK. NR.	1	6	5	0	0	1	2	3	4	5	6	7	8	L	H
PROGRAM ELEMENT CODE	5	6	0	1											
PROGRAM ELEMENT CODE	1	0	0	3	2										
AUTHORIZED DATA															
A=ALPHA	A	A	A				A	A			A			A	A
N=NUMERIC	N	N	N	N	N	N	N	N	N	N	N	N	N		
X=ALPHA (IN SOME CASES)				X	X										

Table 5: Application Program Designator Format.

AIRCRAFT DEFINITIONS:



MISSILE DEFINITIONS:

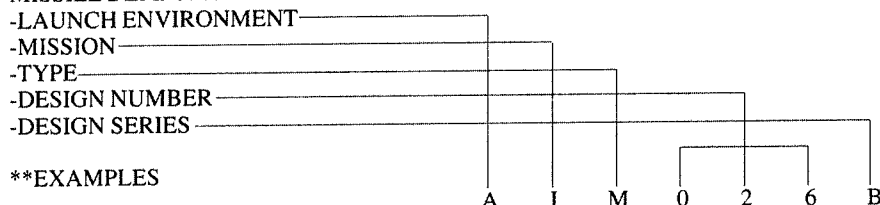


Table 6: Aircraft and Missile Model - Design - Series.

The program application selected must meet the criteria of format to correspond to the D041 PROGRAMMING DATA FILE before a selection of data can be withdrawn from the D041 file. As the two tables portray, a wide variety of systems can be assessed.

**OPTION 4
MAKE INITIAL RUN AGAINST D041**

At this point, the initial run is made against the D041 PROGRAMMING DATA FILE. When a match of the application program designator is made with the D041 PROGRAMMING DATA FILE record type "01," the national stock number is extracted and, using the cutoff date, item application percent, and quantity per application, the future program is determined for each of eight future quarters for each of the application program designators. The total future program for each national stock number is also determined and compared to the subtotal of the future programs for each of the application program designators, as defined in Option 3. This ratio is then applied to the various asset levels and these levels are then allocated to the national stock number/application program designator pairs. This output is passed to programs in later options.

**OPTION 5
VALIDATE NSN AND DETERMINE WUC
— BY ILDF OR VAMOSC —**

One of the requirements for Dyna-METRIC to model correctly is in the relationship of indentureship of shop replaceable units (SRU) to line replaceable units (LRU). A "source" for this information is required in order to proceed with preprocessor development. In early development, the ILDF D194C has been used as the primary F-16 data base for recoverable assets. The ILDF is peculiar to the F-16; however, some other weapon systems do have a form of ILDF for similar use by their weapon system analysts. Currently, we are aware of two other such sources for recoverable items that can be used for all weapon systems. One source is the D041, but the programming to obtain this information is not very direct. The second source is the Visibility and Management Operations Support Costs (VAMOSC). At Ogden, we hope that VAMOSC is the best way of obtaining the relationships necessary to access recoverable assets. The appropriate description will identify in detail the data available from each source.

This option allows the user to choose the F-16 ILDF data source or the VAMOSC data source for establishing the initial LRU/SRU relationships through work unit codes (WUCs). As an analyst, it will allow one the capability to file maintain for duplicate NSNs and WUCs, and to differentiate by specific block number of aircraft to block peculiar NSNs.

ILDF

The ILDF D-194C, program extraction provides a source selection for the F-16 weapon system. Data is extracted for the recoverable items source maintenance recoverability (SMR) codes PAO/PAF and economic recovery codes (ERC) coded C/T describing items reparable at organizational or intermediate repair levels designated XD1 or XD2.

VAMOSC

The VAMOSC information may be obtained from:
HQ AFLC/MM: (VAMOSC)

Special requests for data: Air Force Regulation 400-31, Volume IV, *Visibility and Management of Operating and Support Cost Program (VAMOSC) Component Support Cost System (CSCS)*, D160B, Chapter 4, Para 4-5
Microfiche: RCS HAF-LEY (AR) 8109
NSN/MDS/WUC
RCS HAF-LEY (AR) 8110
MDS/WUC/NSN

Establishing Relationships

Following the questions from the main menu, the analyst establishes the LRU-SRU files necessary to perform the assessment. Beginning with a relational program, the user creates a file from the ILDF tape properly establishing an LRU to SRU relationship. This is accomplished through work unit code relationships.

The program validates the file for duplicate NSNs, and the output is sorted to be file maintained for duplicate WUCs and NSNs to specific block numbers.

The ILDF file is unique in that a production effectivity can be applied to each MDS NSN. Additionally, by the addition of three additional fields behind the WUC, peculiar duplicate end item LRU WUC'd items can be factored by identifying their recurrence.

Additionally, duplicate WUCs which are block peculiar can be changed to reflect their peculiarity (Blair, Reske, 1984).

A brief explanation at this point will clarify the analyst's role in establishing relationships of the matched data between D041 and ILDF for the F-16 or D041 and VAMOSC for other weapon systems.

The ILDF Master file contains in its first 13 positions the national stock number followed by a two position materiel management aggregation code:

1270011022962WF
1270011022963WF
1270011022965WF
1270011022966WF
1270012330011WF

The next four position field provides for identifying the quantity per assembly amount of the item on the aircraft for an LRU:

1270011022962WF 0001
1270011022963WF 0001
1270011022965WF 0001
1270011022966WF 0001
1270012330011WF 0001

The next five position field provides the work unit code as we know it from a standard -06 code manual, such as 74AB0 for F-16A/B aircraft and 74AN0 for F-16C/D aircraft:

1270011022963WF 0001 74AB0
1270011022963WF 0001 74AB0
1270011022965WF 0001 74AB0
1270011022966WF 0001 74AB0
1270012330011WF 0001 74AN0

Since the 74AB0 WUC appears four times (four different stock numbers with the same WUC with each aircraft off the assembly line receiving a different stock number through each four aircraft produced), we have allowed a three position field following the WUC (Hales, Reske, 1983) to establish the number of occurrences for WUCs ending in 0, such as 74AB0. The new identity would appear as:

1270011022962WF 0001 74AB0 001
 1270011022963WF 0001 74AB0 002
 1270011022965WF 0001 74AB0 003
 1270011022966WF 0001 74AB0 004
 1270012330011WF 0001 74AN0 001

A factor statement will appear during the program execution in Option 8, asking users what factor to apply to WUC 74AB0001 through 74AB0004. In that instance, they would apply a factor of 4, so the application percentage at each base can be adjusted for the installed production probability that might exist at each SRAN (Birch, Reske, 1983).

To further identify a block peculiar WUC to a specific model and block of aircraft, the next four position field can be used:

1270101022963WF 0001 74AB0 001 0010
 1270011022963WF 0001 74AB0 002 0010
 1270011022965WF 0001 74AB0 003 0010
 1270011022966WF 0001 74AB0 004 0010
 1270012330011WF 0001 74AN0 001 0030

In the example, the first four NSNs would be peculiar to block 10 aircraft and the last peculiar to block 30 aircraft; application percentages will only be written to specific block identified SRANs.

The unique ILDF file for the F-16 and a program to identify the NSN to each MDS allow for the next four positions to identify A, B, C, and D versions of the F-16 aircraft as previously described.

1270101022963WF 0001 74AB0 001 0010 1100
 1270011022963WF 0001 74AB0 002 0010 1100
 1270011022965WF 0001 74AB0 003 0010 1100
 1270011022966WF 0001 74AB0 004 0010 1100
 1270012330011WF 0001 74AN0 001 0030 0011

The example now lists NSNs for items managed by the OO-ALC with a quantity of one identified as an LRU with multiple occurrences of WUC which will be factored peculiar to block 10 aircraft within the A and B F-16 MDS. The other NSN is peculiar to block 30 C and D aircraft. However, both WUCs are for low power radar frequency LRUs. Option 8 allows for a file maintenance program to assign aircraft to a specific MDS at each SRAN.

VAMOSOC

This step matches D041 data with VAMOSOC, creating a second ILDF master file for other than the F-16 weapon system. This file is actually only structured after the image of an ILDF file.

An additional source for determining block peculiarities and MDS designators is the -4 technical order for each weapon system.

Option 6 is a file maintenance program designed for non F-16 weapon systems to insert or correct data to establish the master NSN file to be used during the assessment.

OPTION 6 FILE MAINTENANCE TO CORRECT, ADD OR DELETE TO THE FINAL MATCHED MASTER FILE

This program allows a file maintenance program for non F-16 weapon system data base NSNs to be placed in a final "NSN to WUC" master output file.

OPTION 7 ALIGN SRUs WITH LRUs (CHANGE SRUs TO LRUs)

This program takes the second ILDF master file created in Option 5. The file is then run in the program to establish SRU to LRU WUC identities and pseudo LRU WUCs for non 5th position 0 ending WUCs.

OPTION 8 FILE MAINTENANCE FOR INPUT OF AIRCRAFT BY MISSION DESIGN SERIES LOCATED AT EACH STOCK RECORD ACCOUNT NUMBER

This program allows the analyst to forecast aircraft totals by mission design series for each SRAN being assessed.

The aircraft total is then used to determine application percentages by dividing appropriate MDS totals by the aircraft total and writing out a percentage file.

OPTION 9 RUN D041 DATA FILE AGAINST EACH ALC's MASTER FILE

This option provides access to the command file which will allow the user to execute Option 9. This option matches the 13 position NSN from the final "NSN to WUC" master output file created from running ILDF or VAMOSOC against D041 data. The 13 position NSN from ILDF or VAMOSOC will match with the current NSN in the D104 master tapes. When a match is made a record is created in an output file for every SRAN in the SRAN table using the corresponding subgroup master NSN and the WUC from the ILDF or VAMOSOC file. A separate file containing unmatched records is created, and this will be used as the new master to run against the next ALC for D104 data.

OPTION 10 RUN D041 DATA FILE AGAINST EACH ALC's SORTED FILE

This option uses the subgroup master NSN and matches back against D104 data sorted by subgroup NSN and SRAN. When a match is made, the requisition objective and the WRM level are pulled to later calculate the peacetime operating stock (POS) level.

OPTION 11 FILE MAINTAIN STOCK RECORD ACCOUNT NUMBERS WITH THE NUMBER OF AIRCRAFT THEY WILL BE ASSIGNED EACH QUARTER TO CORRESPOND WITH ISSL AIRCRAFT INCREMENT

In this step, the user tells the computer the number of aircraft to use when selecting the initial spares support list (ISSL) increment code for each quarter and, thus, the ISSL authorization (when authorized).

A sample of a file following file maintenance is portrayed as follows:

SRAN: FB1234 PRIORITY CD: 01

QTY1 QTY2 QTY3 QTY4 QTY5 QTY6 QTY7 QTY8 QTY9 QTY10 QTY11 QTY12
024 024 024 024 024 024 024 024 024 024 024 024

**OPTION 12
FILE MAINTAIN ISSL NUMBERS TO APPROPRIATE
STOCK RECORD ACCOUNT NUMBER**

The Aircraft Requirements and Distribution Branch will provide the correct ISSL number for each SRAN being assessed. The user should note that not all locations will be assigned an ISSL number.

A sample file is portrayed below:

ISSL NUMBER: 05GEAB16

SRAN1 SRAN2 SRAN3 SRAN4 SRAN5 SRAN6 SRAN7

FB2029 FB4852

SRAN8 SRAN9 SRAN10 SRAN11 SRAN12 SRAN13 SRAN14

**OPTION 13
DETERMINE ISSL QUANTITIES**

This option now computes the D040 ISSL quantities (war readiness materiel lists/requirements and ISSL) for each SRAN and aircraft quantity identified.

**OPTION 14
FILE MAINTAIN WRSK/BLSS KIT NUMBERS TO EACH
APPLICABLE STOCK RECORD ACCOUNT NUMBER
WITH APPLICABLE MULTIPLES OF KIT TYPES
OVER THE TWELVE QUARTER ASSESSMENT
PERIOD**

In this step, the user tells the computer the appropriate WRSK/BLSS number to be assigned against each stock record account number. The multiples of like kits will automatically be computed for the user and written to the output file.

A sample file is portrayed as follows:

SERIAL NUMBER: 0F016AOT7270

SRAN 01: FB5620 #KITS
QUARTER 01: 01
QUARTER 02: 01
QUARTER 03: 01
QUARTER 04: 01
QUARTER 05: 01
QUARTER 06: 00
QUARTER 07: 00
QUARTER 08: 00
QUARTER 09: 00
QUARTER 10: 00
QUARTER 11: 00
QUARTER 12: 00

**OPTION 15
DETERMINE D029 QUANTITIES**

This option selects the "6" records from the D029 master file and compares them to the serial numbers of Option 14. If a stock number matches, the total quantity is written to the output file, depending on the quantity and kit number at the respective SRAN. The total quantities for each NSN-SRAN for all kits pulled off the D029 master file will be added to the higher quantities of D104 or D040 in Option 16.

**OPTION 16
COMPUTE D104 VS D040 QUANTITIES, ADD OR
SUBTRACT THE D029 QUANTITY AND ALLOCATE
STOCK TO THE DEPOT, CIRF AND BASES**

This option involves the requirements program which uses the quantities for the 12 quarters of D104; and, if there is a match with the D040 stockage, it takes the larger of the two to be added with the stock from D029 later.

**OPTION 17
LRU/SRU DESCRIPTIONS**

This option pulls the LRU/SRU technical descriptions from the D041 file and formats them to the Dyna-METRIC Model 4.4 required format.

**OPTION 18
FINAL OUTPUT**

This option formats all the files to the Dyna-METRIC Model 4.4 required format. The files include the scenario, LRU description, application, SRU description, indentureship, variance to mean, and stock. Twelve files are formatted for input into The Rand Corporation model of Dyna-METRIC known as 4.4.

**OPTION 19
THIS OPTION RESERVED**

The Analysis

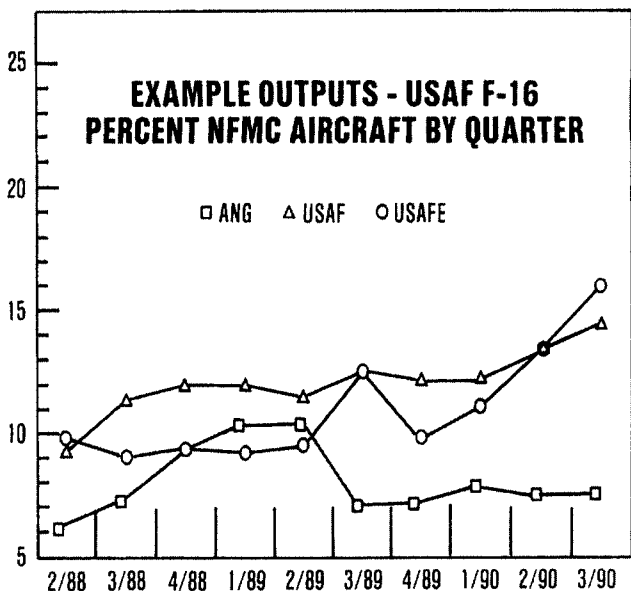
Figures 1 and 2 show some of the major outputs of the F-16 Readiness Capability Assessment Preprocessor. Figure 1 shows

USAF %	9.6	11.8	12.3	12.4	11.9	12.9	12.5	12.6	13.9	15
TAC %	9.9	13.2	13.5	13.5	12.7	13.7	14.2	14.4	14.5	15.6
USAFE %	10.0	9.3	9.6	9.5	9.8	12.9	10.0	11.4	13.8	16.1
PACAF %	6.8	9.4	10.0	10.1	10.0	12.3	12.5	8.7	14.6	12.8
ANG %	6.7	7.7	9.5	10.9	10.9	7.4	7.6	8.3	8.0	8.0
RESERVE %	9.0	11.2	12.9	19.1	18.4	8.2	8.3	8.3	8.5	9.1

Figure 1.

**EXAMPLE OUTPUTS - USAF F-16
PERCENT NFMG AIRCRAFT BY QUARTER**

□ ANG △ USAF ○ USAFE



EXAMPLE OUTPUTS
PEACETIME PROBLEM ITEMS SHORTFALL IN 3 YEARS

WUC	SYSTEM	NOUN	ALC	MIN QTY	MAX QTY
75DJ0	WEAPONS DELIVERY	ADV CIU	OO	7	33
74AB0	FIRE CONTROL SYSTEM	LOW POWER RF UNIT	OO	8	8
14DA0	FLIGHT CONTROL SYSTEM	POWER DRIVE UNIT	OC	7	33
75ACA	WEAPONS DELIVERY	AMMO TRANSFER UNIT	WR	10	44
75DBA	WEAPONS DELIVERY	POWER SUPPLY, RIU	WR	23	31
24AC0	AUXILIARY POWER/JFS	5KVA GENERATOR	SM	6	8
23PAB	TURBO FAN POWER PLNT	EXHAUST NOZZLE CONTROL	SA	9	28
46AF0	FUEL SYSTEM	FUEL FLOW PROPORZIONER	SA	7	7

Figure 2.

projected peacetime NFMC rates over a three-year period. The chart shows the worldwide average NFMC rates and compares each MAJCOM's NFMC rate against that average. These aggregate statistics can be used to compare rates by MAJCOMs and thereby provide management information which could possibly be used as the basis for allocation or redistribution decisions.

Figure 2 is an example of some of the problem items identified by Dyna-METRIC that will probably cause the peacetime NFMC rates to be above the system manager's selected target of NFMC aircraft. The output allows us to see which ALC has the item management responsibility for this item and what the minimum and maximum shortages of the item happen to be over the time horizon. The SM can use this information to track down potential future problems and propose get well actions before those problems become overwhelming.

Summary

The use of the Readiness Capability Assessment Preprocessor provides another means to predict readiness. Its development

Continued from page 29

penalize suppliers that are not reliable. Perhaps such concepts could be expanded to include evaluation penalties for refiner-suppliers who do not supply DOD on terms equal to their other customers during times of disruption.

I am skeptical of the possibility that this approach will solve the problems mentioned. The question simply is this. When the time comes to apply the penalties, will DOD be permitted to do so? Alternatively, will the procedures of "Due Process" be so burdensome that DOD gives up meaningful efforts to apply what are, in fact, subjective penalties which offer considerable opportunity for second guessing.

Conclusion

I conclude, on largely theoretical grounds, that DOD will be unable to acquire military fuels during a disruption using normal commercial acquisition techniques. Refiner-suppliers will favor commercial customers because they use a superior mix of governance structures. Commercial customers can, as a result, better punish cheaters than can DOD. Experience during previous disruptions lends credence to this theoretical proposition.

There is no obvious remedy that is without possible problems. This is clearly a subject that needs further research and consideration. At a minimum, DOD should take steps to prevent further erosion of its petroleum inventory.

produced a breakthrough in modeling multiple aircraft MDI disbursements with subset routines for block differentiation. This automated extraction and formatting of data produced a rapid means for system managers to effect actions to maintain or increase the readiness of the fleet under their management.

Notes


¹Hillestad, R. "Dyna-METRIC: A Mathematical Model for Capability Assessment and Supply Requirements When Demand, Repair, and Resupply are Nonstationary," Santa Monica, CA, The RAND Corporation, R-2785 - AF, 1982

²Pyles, Raymond Dr. and Lt Col Tripp, Robert. "Measuring and Managing Readiness: An Old Problem - A New Approach," *Air Force Journal of Logistics*, Spring 1983, pp. 18-21, 24.

³Ibid., p. 20.

⁴Brannock, James Dr. "POSSEM-ALERT: The Search for a Requirements Forecasting System," *Air Force Journal of Logistics*, Spring 1987, p. 31.

⁵Pyles, p. 20.

⁶Birch, Carol and Blair, Paul; and Hales, Kenneth and Reske, Frederick. "The Readiness Capability Assessment Preprocessor," F-16 Acquisition Division Ogden Air Logistics Center, Hill Air Force Base, Utah, 1983-1984. 

Notes

¹Baumol, William J. *Economic Theory and Operations Analysis* (Englewood Cliffs: Prentice-Hall, 1977), Chapter 18.

²This article represents an application of a more theoretical article. See Christopher N. Lee, "Government Contracting: A Game-Theoretic Analysis," *The Public Contract Law Journal* (January 1990), forthcoming. That article contains an expanded version of the material contained on pages 25-27 of this paper. It may be beneficial to readers who are unfamiliar with prisoner dilemma models.

³Williamson, Oliver E. *The Economic Institutions of Capitalism* (New York: The Free Press, 1985).

⁴MacAulay, Stewart. "Non-Contractual Relations in Business: A Preliminary Study," *American Soc. Review*, 28 (Feb 1963), pp. 55-67.

⁵Klein, Benjamin and Leffler, Keith B. "The Role of Market Forces in Assuring Contractual Performance," *Journal of Political Economy*, Vol. 89 (Jan 1981), pp. 615-641.


⁶Williamson, Oliver E. "Credible Commitments: Using Hostages to Support Exchange," *American Economic Review*, Vol. 73, No. 4 (Sep 1973), pp. 519-540.

⁷Klein, Benjamin, Crawford, R. A., and Alchian, A. A. "Vertical Integration, Appropriate Rents, and the Competitive Contracting Process," *Journal of Law and Economics*, 22 (October 1978), pp. 297-326.

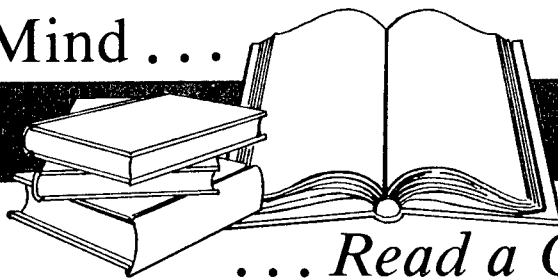
⁸Coase, Ronald H. "The Nature of the Firm," *Economica*, 9:1937, reprinted in Stigler and Boulding, they are unwilling to trade within such an environment eds, *AEA readings in Price Theory* (Homewood: Richard D. Irwin).

⁹Goldberg, Victor. "Regulation and Administered Contracts," *Bell Journal of Economics* (Autumn 1976) 7, pp. 426-448.

¹⁰Ward/Biddle Report.

¹¹Lee Report. 

Enrich Your Mind . . .



. . . Read a Good Book

On Becoming A Leader by Warren Bennis. Santa Monica, California: Addison-Wesley Publishing Company, Inc., Second Printing, August 1989, 226 pages, \$19.95.

What we have here is not just your basic definition of *Leadership*, but the nuts and bolts of how to and how *not* to be a leader. Warren Bennis has identified the common characteristics of several successful leaders and mapped the route that each took to achieve prosperity. Unlike publications that emphasize theory, his book concentrates on real-world experiences and demonstrates how some have failed and some have succeeded.

Bennis isn't the first well-known author to believe that leaders are made, not born. But unlike some, he admits that certain natural traits must be recognized by each before they can be successful. Just about everyone has the capacity to lead, but each must know his/her own strengths and weaknesses and control them accordingly for the maximum benefit. Whatever type of leader results, does so because of the individual's own actions rather than those of outside influences. Capacity alone is not enough.

The author believes that we are in an age where the number of true leaders is diminishing. He provides several reasons:

First, American businesses have become the guiding element in our society. Although American businesses in general are popular, they are becoming less and less effective. Business heads have aimed their efforts primarily toward the bottom line and, as a result, have become too concerned with near-term objectives. Strategic planning has been sacrificed for the sake of tomorrow's earnings. Everything is now directed toward short-term results. That same climate has forced most executives to become bosses rather than leaders. They have become so company-minded that they have developed tunnel vision and fail to use their intuition for their company's betterment. He points out that it's OK to pledge one's allegiance to the company, but one should not become a slave to it. Despite company policy, there is always a better way to do business.

Second, because we have become so bottom-line minded, our companies have developed managers but have failed to provide an environment to produce leadership. Leadership development programs exist but usually provide theory alone. True leaders, he points out, are made on the battlefields of experience. We must give our executives the flexibility to take risks and make mistakes without fear of political suicide. They shouldn't be afraid to stick their necks out for ideas they know are worthy. Those same development programs he mentions have become specialist-minded which makes them manager-oriented, not leader-minded. This is not a new criticism of organizations but one that must be constantly re-looked. Managerial skills can be taught in the

classroom, but being a leader requires a chance to apply theoretical skills. Experience is the only teacher. He believes that too many schools have become vocational, producing specialists which he calls "unfinished people." We may expect those graduates to do a good job in the trenches but find them unqualified to lead others who are in the same ditch.

It is because of this diminishing pool of leaders that he attributes the fact that America has lost the lead among several industries. Thus, what started out as our century has now become the Japanese century.

So where do we find these much-needed leaders?

Most of *On Becoming A Leader* addresses the steps to success taken by a number of recognized leaders in a variety of careers. Bennis effectively draws from these personal experiences to demonstrate the do's and don'ts in developing those characteristics found in many well-known, successful leaders.

Because the premise is that leaders are made, not born, the bulk of this text is devoted to those practices individuals should perform in order to develop as leaders.

He lists the characteristics he finds in just about all successful leaders: guiding vision, passion, integrity, trust, curiosity, and daring. He says successful leaders will begin by knowing themselves and leading their own lives, not the lives that someone else wants for them. Several of the cases he examines went against what society had decided was the norm. They had the aforementioned traits and the will to apply them where they felt they belonged. Bennis adds true leaders have an unyielding urge to observe everything, recognize the changing environment, and plan accordingly. Leaders must not be afraid to fail and, when failure occurs, must properly assess the lessons learned only after they are able to wait, step back, and look at the situation objectively. He recognizes that a lot of this depends on organizations' willingness to allow individuals to develop and exercise these traits. Organizations must foster an environment where individuals are free to grow and can exercise the autonomy necessary to become leaders. As mentioned earlier, too often that is not the case.

In summary, reading Bennis' work reminded me a lot of the way I felt when I read *Clear and Present Danger* by Tom Clancy. As I fought the war against the drug lords in Central America with Tom, I could easily equate what I was reading to real-world events as they occurred down south. I found the same of *On Becoming a Leader*. It is a dynamic description of what each of us can do on the job now to become the leaders that our country needs as well as ways to help others do the same.

Maj Butch Ford, USAF

Air Force Logistics Management Center
Gunter AFB, Alabama

Continued from page 32

TITLE: *Maintenance Procedures, Intervals and Storage of Prepositioned RED HORSE War Reserve Equipment*

AUTHOR: *Captain David T. Clark*

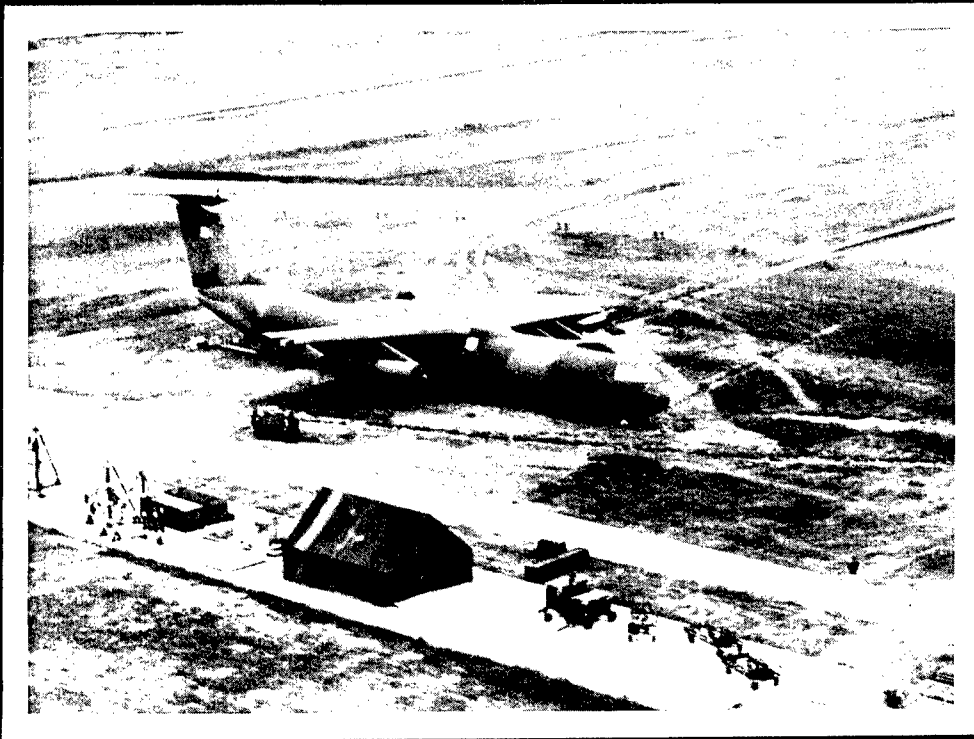
Establishing maintenance, storage, and preservation methods for improving RED HORSE prepositioned war reserve equipment availability was the central focus of this study.

First, the study provided the first known comprehensive review of military and commercial maintenance, storage, and preservation methods for long-term stored equipment. Survey comprehensiveness led to valuable comparisons of storage procedures internal and external to DOD.

Second, the research examined the factors influencing the availability of prepositioned war reserve equipment. Operational data

was collected from six prepositioning programs at 51 sites. This study analyzed the impact of relative humidity, type of storage facility, maintenance intensity, maintenance cost, number of maintenance personnel, maintenance interval, and fleet size on equipment availability. The research discovered significant performance measurement problems among prepositioned units.

This research identified major problems in the performance measurement of prepositioned site effectiveness, which in turn, could impact unit readiness. Among the conclusions were: (1) DOD was reliant on qualitative estimates of equipment availability and (2) the vehicle out-of-commission rate was ill-suited to the application of prepositioning sites because of assumptions implicit in this performance measurement and the cursory nature and frequency of stored vehicle inspections.



...Escaping the Boneyard
(Story on page 12.)

