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**THE PROCESS OF EXCELLENCE:
A HISTORY OF QUALITY IN THE
AIR FORCE LOGISTICS COMMAND**

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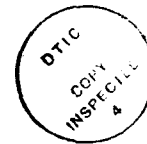
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THE PROCESS OF EXCELLENCE:
A HISTORY OF QUALITY
IN THE AIR FORCE LOGISTICS COMMAND



By

John C. Brownlee, Jr.

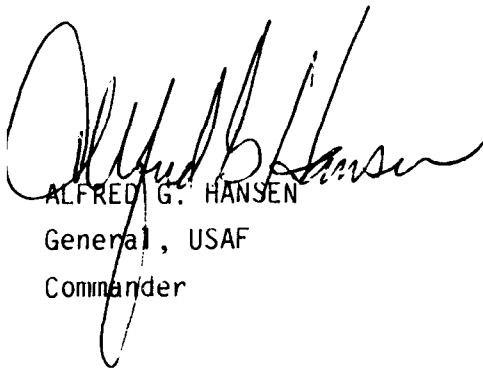
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Foreword

Quality is basic to the business of logistics. It is the discipline and consistency in both industrial and management processes that allows AFLC to deliver goods and services that equal or exceed the requirements of combat commanders. To achieve that level of logistical support, this Command has adopted a new approach to quality, an approach that depends on our ability to determine requirements, provide engineering support, and procure assets needed by the Air Force. Success also depends on our capacity to identify weaknesses in our logistics system and address those problems with quality initiatives. And with a shrinking defense budget, the challenge for AFLC to supply combat capability in the years ahead will increase. Consequently, the Command must seek more effective ways to inject the latest technology into our processes, and to drive the quality mind-set to the lowest level of logistics operations.

This effort has been long in the making and represents the work of many people, military and civilian. As a result, the history of AFLC's endeavor to streamline and improve its processes over time is a window to the past through which modern quality managers and all employees may come to better understand their heritage and gain new directions for the future.



ALFRED G. HANSEN
General, USAF
Commander

Continuous Process Improvement:

A History of Quality in the

Air Force Logistics Command

Background

By the end of World War Two, the United States had become the most prolific industrial power on earth. Although many reasons explained America's unrivaled productivity, one in particular had given the country an advantage over its beleaguered allies and broken adversaries. During the war, the U.S. had attained its enviable reputation for production by fortuitously remaining beyond the pale of enemy bombers. The nation had eluded the ruinous aerial assaults that customarily silenced the gears and wheels of a combatant's industrial machinery. Geographic accident and the natural buffer zones of the Atlantic and Pacific Oceans had protected Americans from attack and the subsequent loss of production caused by bombed-out factories and incinerated refineries. Unlike Russia, Germany, or Japan, the U.S. in 1945 had stepped unscathed from nearly four years of conflict with its industrial base not only intact, but remarkably improved. In fact, America's unfettered production of wartime goods boded well for its future industrial potential. Enabled by the war, the U.S. had marshaled its physical bounty to evolve a production apparatus historically unique. Abundant natural resources, blossoming technologies, ample labor, and an around-the-clock work ethic had converged to virtually assure Americans of their material prosperity in the foreseeable years ahead. Where the factories of other leading capitalist countries had crumbled beneath the barrage of wartime offensives, those of the United States' had escaped to flourish. In the end, U.S. industrialists would encounter comparatively few barriers and meet little foreign competition in their post-war quest of the 1950s and 1960s to preserve, develop, and defend distant markets.

By the 1970s, however, global economic conditions had changed. So, too, had the manufacturing orientations of American industry toward

building consumer goods. Productivity and quality assurance efforts in the workplace had withered dramatically, a decline resulting in a lower standard of living. From 1945 through the 1960s, U.S. manufacturers had grown accustomed to an annual three percent rise in the rate of production. But in the 1970s, that figure had dropped to just over one percent to rank among the lowest of major industrialized countries. As a consequence, creeping inflation, increased unemployment, the diminished value of the U.S. dollar, signs of an impending trade deficit, lower profits, and a weakened ability to compete internationally soon flooded the void left by the productivity gap. And worldwide competition for precious international markets had stiffened. Germany and Japan, hungry to reenter the marketplace after the war, had with unflinching discipline rebuilt their factories and assembly lines and had recovered sufficiently to become fierce competitors for U.S. manufacturers, who until then had taken for granted their dominance over such consumer durables as radios, televisions, synthetics, and automobiles.¹

To be sure, many complex and little understood factors had led to the drop in productivity for American industry, and many economists could not agree as to the primary causes. But a loose consensus did form among some financial experts. Insufficient capital investment, smaller research and development budgets, heightened federal regulation, an alienated workforce, and the intensified power of labor unions had gradually eroded factory production. Further, they pointed to one other factor: an important aspect of the downturn was an ominous decline in the quality of products rolling off American assembly lines.²

The Changing Notion of Quality

Before rapidly expanding market demands had forced industrial managers of the early 1900s to refine business practices to better challenge domestic foes, most American corporations of the previous century, unfazed by the elaborate technologies and complex organizational structures yet to come, had functioned on a simpler level than their modern-day counterparts. Businessmen, who had in many cases personally designed, marketed, and even

delivered their own products, measured quality by straightforward, pragmatic yardsticks. If, for example, one manufactured buggies, the wheels either spun freely and true, or they did not. Leather harness was either finely or poorly stitched. When applied, latter-day efforts toward quality entered the product during manufacturing rather than at the end of a production line as an afterthought. Indeed, though, the detailed legal requirements, logistical snags, and technical pitfalls that badger manufacturers today were undoubtedly less formidable before the turn of the century because of their relative simplicity.³

But as industry matured, from sole proprietorships of family-managed cottage industries to the gigantic and often impersonal conglomerates, specialization split manufacturing functions into smaller components. The different number of tasks to be governed skyrocketed and soon led to the profusion of "control groups" responsible for certain phases in a production line. These groups sought order in an otherwise tangled labyrinth of increasingly fragmented manufacturing processes. Yet, ironically, this growing host of controls in some instances had the unintentional effect of hampering rather than helping productivity. Between 1910 and 1980, the responsibility for quality in U.S. industrial production shifted from those workers charged with building integrity into the product step-by-step, to those control groups who monitored quality at the end of the line. Simply, "quality control" inspectors, not the individuals who actually made the goods, now evaluated product quality. Conclusive results over time have revealed that this shift fostered certain undesirable conditions which threatened the manufacture of high-quality merchandise. Adversary relationships arose between workers and inspectors, and between quality and production departments. Employees also became more and more casual about the quality of their labor, and some lost sight of the ultimate purpose of the product they had made. Accordingly, scrap, rework, and inefficiency became regular features on the assembly line.⁴

Mindful of this heritage, modern industrial planners have pondered over the proper place for quality and over who in the process should control it: the business owner, the board of directors, various managers, a quality

department, or the individual workers throughout the process? By the late 1980s, many within industry felt that responsibility for quality rightly belonged to those who made the product (or performed a service, if a service-oriented corporation) rather than secondary departments. Ultimately, most contemporary analysts have concluded that, if America is to regain a favorable reputation in the world marketplace, responsibility for quality must reside with all persons in the manufacturing process. Such revelations within the private sector have also come to the public sector, particularly at the federal level. One example of the interest government managers have shown toward improving "Quality Assurance Programs" within their organizations occurred at the Air Force Logistics Command (AFLC), with headquarters at Wright-Patterson AFB, near Dayton, Ohio.⁵

The Developing Idea of Quality in Air Force Logistics

Because timely maintenance procedures and a ready supply of dependable spare parts are essential to a strong air defense, the ability of American industry to turn out reliable products and deliver prompt services is today an inseparable component of modern Air Force logistics. The success of the AFLC mission, then, depends on the productivity and quality of its outside contractors and its more than 98,000 military and civilian employees. Also, the state-of-the-art aerospace science central to the manufacture, operation, and repair of complicated weapon systems has clearly taken a quantum leap beyond the machine tool technology commonly used a century ago to fabricate such devices and support systems as, say, Springfield rifles and horse-drawn caissons. That process, of course, has been gradual. Where the modern sorcery of fiber optics and laser guidance is now commonplace, a pilot's eyes and his machine gun sights were the standard for avionics seventy years ago. Indeed, as technology has become more sophisticated, so too has the need for better-devised quality assurance programs. To understand its role and significance in daily AFLC operations, a brief history of quality assurance in Air Force logistics is helpful.

The Early Days to World War II

On 23 December 1907, four years after the Wright Brothers had completed their first successful flight at Kitty Hawk, North Carolina, the U.S. Army Signal Corps (later renamed the Army Air Service)--responsible for pioneering developments in U.S. military aviation--published specifications for a "heavier-than-air flying machine." Signal Corps officials, apparently undecided on the specifics of the aircraft's future uses, required simply of the manufacturer (the Wrights) that the machine fly successfully. As there had never before been a U.S. warplane, the Corps lacked the guidepost of preestablished benchmarks for military aircraft structural standards. Thus the quality of the craft could only be determined during its maiden flight, a seemingly inauspicious moment in which to test for excellence. Although Signal Corps planners did not explicitly specify their expectations for quality control, an unthinkable omission today, their desires were nevertheless implied: the airplane, at its very least, had to fly.⁶

By October 1926, after the U.S. Army Air Corps (redesignated from the Army Air Service on 2 July 1926 for reasons of prestige during a period of expansion) had accumulated more flying experience and had amassed additional pilots, planes, and a first annual budget of \$14 million, the growing formalities of quality control and inspection became progressively more demanding. Recognizing the future implications for logistics, the service had also activated the Materiel Division (a forerunner of AFLC) on 15 October that same year to administer the rapidly expanding functions of supply and repair. As a result, Air Corps policymakers ultimately relegated those tasks to the Division's section in charge of procurements. Thirteen years later, on 1 March 1939, the Air Corps, substantially larger now than in the days of the frail biwing, and with swelling logistical needs, inaugurated a special Inspection Section within its Materiel Command to monitor quality and reliability in materiel, contractors, and contractor plants. With the September 1939 German invasion of Poland and the likelihood of future United States involvement, foresightful defense planners ready for war worried that American air power was inadequate.

Consequently, procurement requirements expanded as did the Materiel Command's Inspection Section. More parts and repairs for planes now made of metal instead of wood and cloth meant a stricter, more elaborate inspection curriculum. By 19 October 1949, sufficiently experienced and battle-hardened by World War II, and having undergone several organizational changes calculated to improve management and efficiency, the Inspection Division evolved into the Quality Control Division and was overseen by the recently formed (March 1946) Air Materiel Command (AMC). Surveillance inspections (those end-of-the-line "control group" reviews discussed earlier) of missiles, engines, rocket propellants, packaging techniques, and statistical methods for the control of production quality became its primary responsibilities.⁷

The Cold War Era

In the early 1950s, as U.S.-Soviet relations hardened in the tense atmosphere of the Cold War, and while the capabilities of aircraft and missile technology promised more "bang for the buck," quality control for Air Force logistics donned an increasingly greater role. On 1 December 1952, to create a comprehensively integrated Quality Assurance Program throughout AMC (redesignated AFLC in 1961), a staff-level Quality Control Office was established under the leadership of a Brigadier General. An important precedent, this reorganization also extended for the first time quality assurance responsibilities beyond procurements and into the areas of supply and maintenance. Over the next decade, a flurry of reorganizations grappled with questions over who should administer quality assurance for the Command and exactly how that task would be accomplished. Significantly, the quandry over responsibility for quality had by 1963 also come to involve private industry, particularly spare part contractors on whom AFLC now relied for much of its inventory. After a particularly frustrating period riddled with faulty parts had brought the Command and industry to loggerheads, each holding the other responsible for poor quality control measures, a compromise between the two eventually forced both parties to reevaluate their respective quality control programs and strive for improvements.⁸

Between 1963 and 1973, persistent AFLC efforts to attain an efficient Quality Assurance Program had spawned a bleary welter of administrative and organizational changes, all of them attempts to affix proper responsibility for the manufacture of quality parts and the timely conduct of repair services (for an organizational lineage of those various Air Force logistical entities periodically responsible over the years for quality assurance, see Appendix A). Many of the changes stemmed from a successive chain of sincere commanders who wondered whether the Command administrative structure for quality assurance should be centralized or decentralized? The fluctuating shifts in administrative style would be for future AFLC Commanders a recurring feature in the ongoing debate for control over quality assurance.

A Renewed Effort to Centralize: Office of the Assistant to the Commander for Quality Assurance

On 1 July 1974, Brig General Charles E. Buckingham, Chairman of the AFLC Quality Assurance Committee (empaneled earlier to define quality-related problems), urged the approval of a new organization within AFLC headquarters and at each of the Air Logistics Centers (ALCs). Responsible for impartial, detailed studies to identify and improve weak quality assurance programs throughout the Command, the Office of the Assistant to the Commander for Quality Assurance (synonomously referred to as the Quality Assurance Office) opened on 20 August 1974. With Colonel Harry C. Long at the helm, staff members set out to develop sharper ways to measure quality effectiveness and its related costs. For the first time, AFLC would have a single advisory body to treat quality-oriented issues. At least for the present, responsibility for these concerns would no longer be scattered helter-skelter among the Command's Maintenance, Materiel Management, and Procurement functions. With a newly centralized structure administered beneath one roof, officials expected that AFLC could review the agendum of its assorted quality assurance components to eradicate duplications of effort.⁹

Quality Cost Program

Colonel Long and his staff immediately tackled the problem of organizing a Quality Cost Program to identify those expenses suffered by the Command due to defective materiel. General Jack J. Catton, AFLC Commander, 1972-1974, felt that the stratagem might also pinpoint trends in those defects, define their causes, and further, present solutions. Quality assurance analysts divided the previously discerned quality-related expenses into three cost categories: prevention, appraisal, and failure (which itself consisted of internal and external expenses). Prevention outlays were those costs connected to the design, implementation, and maintenance of the quality program, such as money spent to train personnel for quality assurance measures. A typical example of appraisal costs included the money spent to audit contracts to confirm their proper administration and conformance with prescribed standards for project quality. Failure costs related to materiel defects that required rework labor and materiel, or that resulted in spoilage, scrappage, or transportation expenses. More specifically, internal failure expenses often stemmed from those processes or products that could not meet quality standards and resulted in manufacturing or operational losses. Costs from external failure arose from shipping substandard goods to AFLC customers.¹⁰

Using these classifications, the Quality Assurance Office launched a landmark study in December 1974 and January 1975 to determine exactly how much annually, in dollars and cents, the Command lost through inferior products. An early discovery revealed that to draw reliable correlations between available cost data from the several ALCs would be difficult because of their operational differences. But a second finding pointed out that Command-wide failure costs were too high and that not enough had been spent for prevention and appraisal. Lastly, the study concluded that product rework expenses had been improperly reported.¹¹

At the end of the inquiry, although the researchers admitted to approximations, they had nevertheless found that annual quality costs for the Command would exceed \$49 million for the calender year (CY) 1975. The

office went on to state that even though no accurate figures existed to reflect the actual savings to be gained by using the Quality Cost program, estimates calculated that if the plan reduced AFLC costs by only two percent annually, more than \$991,000 could be saved each year.¹²

Apart from isolating deficiencies to assess fiscal impact, the Quality Cost Program dangled other incentives. For instance, the plan prompted managers to monitor more closely quality assurance measures and their results. The program also helped management select, after a perusal of the cost data, the most prudent alternative for remediation. For example, high failure costs could bring managers to spend more for quality testing and inspection and eliminate the causes born by defective products. Planners could also rely on quality cost statistics when designing their budgets for quality assurance programs. However the Cost Program were to be used in the future, it nonetheless remained for the first time that AFLC had fashioned a scientific tool to assess the annual monetary losses caused by product flaws.¹³

Consolidation of Quality Assurance Regulations

By April 1975, the Quality Assurance Office had begun to consolidate all AFLC regulations related to quality, had begun to better control its various quality programs and organizations, had improved the caliber of materiel supplied by the Command, and had started to reduce the number and cost of equipment failures. Managers had reasoned that increased centralization would mean better quality assurance. Converting beliefs to action, they wrote a new regulation: AFLCR 74-1. The document required the Quality Assurance Office to plan, among other things, effective and economic quality assurance programs; to ensure that all products and services complied with project directives, contract specifications, and other technical requirements; to clearly define the authority and responsibility of all personnel testing and inspecting products and services; and to review purchase request requirements, project directives, and work specifications during the earliest possible phase of a new project. On 21 January 1976, General F. Michael Rogers, AFLC Commander, 1975-1978, centralized these new

quality assurance efforts by approving the regulation. Each of the ALCs also underwent similar but less detailed consolidations.¹⁴

Quality Assurance Matures

Led by Colonel Lawrence J. Johnson, and after 1 July 1976, Colonel Edward J. Campbell, the office of the Assistant to the Commander for Quality Assurance began in 1976 to refine its daily operations in several areas. Office organization, data reliability, collection and analysis, and customer relations comprised but a few of the important functions slated for renewal.

Office Organization and Data Reliability

By the end of January 1976, the Quality Assurance Office consisted of nineteen people, some of whom had transferred from DCS/Materiel Management, Distribution, Maintenance, and Procurement and Production as part of the previous year's reorganizational push for centralization. Once reasonably assured of a stable office, Colonel Johnson's staff in February authored a special study to determine how well ALC personnel identified and categorized materiel defects. The study required the ALC Offices of Quality Assurance, on a rotating basis, to submit to AFLC each month a report covering twenty-five major defects on different product items. For its part in the inquiry, the AFLC office then reviewed each ALC report to discover if it had properly identified each defect, determined its cause, chosen the right remedy, and implemented all the necessary steps to prevent the mistake from recurring.¹⁵

To the chagrin of eager AFLC quality assurance staffers, results of the study had disclosed disheartening news. The ALCs had not been properly identifying materiel defects and lacked the appropriate technical vocabulary to do so. Of the 125 deficiency reports examined, only one had correctly assessed a defect in quality. Workers needed, inspectors concluded, specialized training to categorize defects, to assess their origins, and to recommend remedies. A disappointed Colonel Johnson lamented that quality assurance personnel throughout the Command had been treating

the symptoms of defects rather than their causes. Much like those alienated assembly line workers earlier in the twentieth century who had lost touch with their products, ALC employees, according to Colonel Johnson, lacked "a common understanding of the nature and purpose of the quality work force and its relationship to the products, services and other ALC functions." Consequently, planners in the Quality Assurance Office began to agree on uniform definitions ALC workers could use to report defects in materiel so that the origin of the flaws, once identified systematically, could be corrected.¹⁶

As AFLC initiatives for quality assurance gained momentum, particularly after the commander had listed them among his special interests, a vague description emerged of what management generally expected of Command personnel to raise the standards of excellence. A successful quality effort plan, its authors noted, would incorporate a total commitment by commanders, managers, and workers to produce goods free of defects; to fashion measurement systems designed to gauge quality in terms of cost and customer acceptance; and, importantly, to collect and analyze accurate data to isolate weak and costly operations so that corrections might be made. Exactly how personnel would be inspired to achieve this heretofore elusive goal, however, remained unclear.¹⁷

Near the end of 1976, members of the Quality Assurance Office believed they had for the first time compiled fairly accurate figures on the costs of reworking defective parts at the ALCs, specifically aircraft engines. The Command had been losing money everytime a rebuilt engine faltered prematurely and had to be returned to the contractor or an ALC for reconditioning. At the time, quality assurance analysts had labeled this inefficient condition as a blue ribbon example of the price paid for shoddy workmanship. In their concern for accuracy, the report's writers, who had reviewed two AFLC Organic Engine Maintenance Facilities--Oklahoma City ALC and San Antonio ALC--concluded that because a relationship existed between monthly rework expenses and the monthly rate of acceptance for engines after their initial trial on the test stand, the reported figures from both ALCs on the amount spent for engine rework were probably reliable. During

the first six months of 1976, for example, the study pointed out that the cost for engine rework at San Antonio amounted to \$78,000, and at Oklahoma City, \$1,488,663.¹⁸

Automated Data Collection

Devoted to stockpiling credible data to assess the extent of defects and resulting costs to the Command, quality assurance staff members since 1975 had relied on computers to quantify information on matters related to quality. But because the automated systems had not been programmed for quality assessment purposes, the resulting statistics often lacked sufficient detail to develop a Command-wide snapshot of product defects. By July 1976, though, a new computer, the G021 Customer Deficiency System, had begun to process those figures retrieved from the ALCs. Amassing, sorting, analyzing, and displaying numeric incidents of customer dissatisfaction about the quality of freshly purchased, repaired, or reworked items, the machine charted the flawed item by National Stock Number and origin of complaint. At the close of 1976, the new system, perhaps primitive next to 1989 technology, hummed busily along at all of the ALCs (except San Antonio, which was scheduled for on line operations by February 1977) collecting data that would give some shape to the previously fluid world of quality assurance.¹⁹

Customer Relations

With a computer-based dragnet stretched across the Command to better trap information on the nature and extent of defective workmanship, quality assurance workers could now turn to other tasks. One involved AFLC customer relations. A chief dissatisfaction voiced by some customers had targeted AFLC's rather sketchy replies to those deficiency reports filed by customers unhappy with the condition of an AFLC product. For instance, between July and December 1975, displeased AFLC customers had submitted claims on forty-seven product defects. Of these, quality assurance adjusters had acknowledged only twenty-one as the responsibility of AFLC or a related contractor. The remaining twenty-six customer demands had apparently received only perfunctory replies from the Quality Assurance

Office, ones which denied Command culpability. Colonel Johnson, no doubt in earnest that his office itself set a better example for quality service, intervened to advise his staff members that they should have instead checked the complaints more carefully, confirmed that proper remedial channels had been followed, and finally, saw that complaining customers had been fully apprised of all actions taken by AFLC. By becoming more closely allied with customer interests and their needs, officials hoped employees would create better products and service.²⁰

Quality Assurance Expands and Specializes

In February 1977, the Quality Assurance Office expanded from nineteen to thirty personnel after Command decision makers, in another reorganizational shuffle, had given it the responsibility for Materiel Safety, a task formerly administered by DCS/Logistics Operations. The duties incumbent on Materiel Safety encompassed those emergency conditions which threatened harm to personnel or equipment that resulted from materiel or operator failure. Additional responsibilities included other lesser materiel-oriented hazards such as defects in design and workmanship. The Office's chief purpose when reviewing serious incidents centered on examining data, identifying trends, and disseminating advisory information regarding the event throughout the Command so as to constitute some form of preventative awareness program.²¹

To better fulfill its role as Command guardian for product excellence, the Quality Assurance Office on 1 April 1977 formed three subunits: Quality Analysis, responsible for preparing management indicators and spotting trends; Quality Programs and Systems, directed to design long-range plans and to write regulations and technical orders; and Quality Operations, assigned to develop a modern customer relations program. Each unit would shoulder specific work assignments as part of a growing tendency toward specialization, yet would still be centrally supervised by the Quality Assurance Office. As the year progressed, more and more specialists joined the Office. Experts in materials, processes, metrology (weights and measures), and calibration filled its swelling technical

ranks. The rising allocations of manpower and money were tacit indicators that the Command's steadfast commitment to quality was sincere.²²

Quality Systems Evaluation Program (QSEP)

Quality assurance measures gained new dimensions in 1977 when AFLC unveiled the Quality Systems Evaluation Program (QSEP). Designed to maximize the quest for product excellence, QSEP examined the holes in the Command's managerial infrastructure that had permitted, though inadvertently, product defects to continue. A persistent weakness faced by AFLC's frustrated quality assurance staff had been the inclination throughout the Command to rework product failures without rigorously seeking their elemental causes. The laxity of this method, unfortunately, better abetted than prevented the recurrence of similar deficiencies. Farther reaching than previous tactics, QSEP goals addressed the entire quality assurance system, particularly the worth of those management-authored regulations and instructions that governed daily quality-related operations. Officials believed that the pursuit of quality, timeliness, and economy relied on an efficient and well-designed management plan, one which the many functional organizations within the Command could incorporate into their daily routines. Simply, QSEP sought a process, constantly reevaluated, from the drafting of a regulation to the final packaging of an item, by which truly fine products could be obtained. The key to success, planners believed, called upon managers to expand their role and to ensure that the process worked as designed. As an effective quality program depended on the individual responsibility of everyone involved in the production or service role, it also assumed that executive managers were ultimately responsible for the quality of those goods and services. Officials hoped further that urgent quality-related matters could be handled expeditiously with QSEP because the Quality Assurance Office at each ALC was a staff function in the hierarchy immediately beneath the ALC Commander, an arrangement believed likely to streamline decision-making and eliminate sluggish, administrative delays.²³

The authority for QSEP, AFLCR 74-1, "AFLC Quality Program," described the tactics necessary for the Command to improve its repair processes. The

regulation drew life from specific policies and procedures already in play and additionally directed management to assure that adequate written instructions relevant to quality were available to and followed by workers on the line. Quality assurance tasks were also to be separated from production schedules to deemphasize quotas at the expense of quality. One special feature of QSEP distinguished it from other reviews, like IG inspections, in that regular evaluations would theoretically detect deficiencies as they occurred and provide for their correction.²⁴

Before QSEP could be evaluated, stacks of technical orders, operating instructions, policies, and procedures would have to be reviewed. It would take time before any cogent conclusions could be reached. Any change in the "process" would be slow at first and difficult to measure. Only after QSEP had been in place for a while would a detailed picture be possible for evaluators to make an assessment.²⁵

ALC Maintenance Quality Function's Complete Consolidation

There were few significant administrative changes within the Quality Assurance Office during 1978. But the first consolidation of the maintenance quality functions at the ALCs, begun in 1976 at San Antonio and Oklahoma City, had finally concluded. Now, instead of quality assurance personnel scattered across the many AFLC product divisions, they would be housed together within each ALC Directorate of Maintenance. Two reasons justified the merger. For one, centralization for quality theoretically made for greater efficiency and more flexibility than did the arrangement of an individual quality branch in each product division. For another, the act would diminish the endangerment to quality posed by the pressures inherent to production schedules. As previous AFLC studies had indicated, these benefits surpassed those of having a separate quality unit inside every product division. But as with QSEP, only time could begin to assess the value of this new plank in the refinement platform of AFLC quality assurance programs.²⁶

Quality Systems Evaluation Program (QSEP)-A Progress Report

To design a far-reaching program like QSEP is one challenge; to cast it smoothly across an entrenched military bureaucracy such as AFLC without hitting a snag is another. Perhaps not surprisingly, latent resistance did lurk beneath the surface of the ALC aircraft maintenance and supply divisions. QSEP progress during 1978, especially among the ALCs, eventually encountered the resistance of those employees forced to learn something which at first seemed a senseless and later an unwelcome burden. Quality assurance workers had to absorb the previously unfamiliar operational details of those ALC maintenance organizations that used technical orders and regulations associated with QSEP to assess the documents and their applicability. And because few precedents existed, much of the learning was by trial and error, an often frustrating experience with few immediate rewards.²⁷

To breach the subconscious learning barriers raised by reluctant employees, QSEP indoctrinators set out to persuade production managers, dependent on quality assurance measures for their products, to accept the new program. But, in the end, such attempts fizzled. Although supervisors would correct production line defects as they occurred, they nevertheless ignored the repair process, procedures, and related policies when doing so, and failed to uncover the weaknesses ultimately responsible for inferior goods. Consequently, production flaws continued. Division managers apparently thought of themselves as outside the quality assurance network. They believed that the quality assurance offices within each of their ALC divisions, and not themselves, had responsibility to lead the Command's "search for excellence." Echoing a popular maxim circulated in management circles, "If you are not part of the solution, you are part of the problem," recent quality assurance experience at the ALCs had validated the pithy adage. In extreme cases, such as those workers in private industry historically averse to "quality control" personnel, quality assurance representatives at the ALCs soon came to be seen by line workers as enemies rather than as allies. In one example at Oklahoma City ALC, a January 1978 Management Effectiveness Inspection discovered seventeen quality-related

deficiencies. Twelve of them had been instances of conditions similar to earlier defects previously reported by QSEP. Although functional supervisors had repaired the flaws, they had not alleviated the primary causes, omissions which, of course, predictably led to recurrences. The Quality Assurance Office blamed this condition on the inclination of some managers to see the quality assurance organization as an adversary, deserving little cooperation.²⁸

By the end of 1978, the Assistant to the Commander for Quality Assurance, Colonel Edward J. Campbell, revealed to General Bryce Poe II, AFLC Commander, 1978-1981, that QSEP had been received unevenly by Command employees. A study soon showed that a parade of obstacles had derailed QSEP spirit and intent. A lack of enthusiasm in some ALC quality assurance offices, managers who had ignored QSEP discoveries, and inadequate program emphasis by higher-echelon supervisors were a few of the problems. Despite these disappointments, QSEP staffers announced some positive results as well. Indeed, the program had isolated inconsistencies among AFLC regulations, had located insufficient ALC operating instructions and directives, and had also found examples of noncompliance with operational directives.²⁹

Automated Data Systems Revisited

After periodic QSEP reviews had helped AFLC planners fine tune their quality assurance programs, data collection apparatus reassessments followed. In addition to the G021 system, on line since 1976 and serving as a data bank for production deficiencies, the Quality Assurance Office in 1978 added another computer, the G056, to measure the quality of ALC maintenance and to collect figures on production problems. Before long, however, operators complained that the new device was slow, inaccurate, and complicated--in short, user "unfriendly." Shunning the modern convention, some ALC workers consequently returned to the antiquated collection of information by hand. Although the G056 had "bugs," a few skeptical quality assurance personnel concluded that operators had used it improperly, particularly during the initial stages of data entry. Hence, concerned technicians produced an audiovisual training program geared to the needs of the

new G056 operators. Despite remedial training, the system by the end of 1978 had not risen to user expectations.³⁰

Streamlining Customer Relations-"Operation Listening Post"

Product quality and related management systems had, by 1978, become a permanent fixture at AFLC, and some of the older pilot programs launched in previous years warranted reviews. The second look also probed the level of AFLC customer service, and in some instances, desirable relations were found in short supply. Shortly thereafter, in summer 1978, the Quality Assurance Office inaugurated Operation Listening Post. Engineered to enhance communications between AFLC and its customer commands, the plan proposed to lay more clearly defined channels of information and sharper lines of responsibility in the logistical support of weapons systems. In the past, other commands and their field units sometimes had had difficulty when they attempted to get information from AFLC on specific support and maintenance problems. Typically, when a question developed, frequently at the local level, finding a responsible and sufficiently informed AFLC authority was sometimes difficult. Such breaks in communications caused personal frustration, promoted the belief that AFLC ignored the needs of other commands, and, in the worst scenarios, potentially damaged the readiness status of weapon systems. And occasionally, unresolved deficiencies needlessly became the province of higher authorities solely because they had not been resolved earlier at a proper, lower echelon. Such events disrupted administrative authority and were inefficient.³¹

To solicit suggestions for improvements, a team of "Listening Post" representatives from the Quality Assurance Office met with members of the directorates of maintenance to fashion a better communications network and to hear complaints. Together, they designated a telephone number at the AFLC Quality Assurance Office that could be used by other commands to get help directly or by referral. For instance, the caller could be placed in touch with the "regular crew chief" (that person in charge of an area or project, such as an item or system manager), who was properly knowledgeable in the area of concern.³²

Materials and the Manufacturing Process

Between 1974 and 1978, command workers trotted out an assortment of human and electronic scales to assess ALC levels of production and service. By 1979, however, some of their attention had shifted to the processes and physical properties basic to the repair of aircraft, missiles, and their components. Quality assurance evaluators expected AFLC's manufacturing procedures to yield high-standard goods that met both safety requirements and customer expectations. Moreover, the same inspectors required that the materials and methods used to achieve those goals meet certain standards. The manner in which parts were welded, plated, painted, and heat-treated, for example, preoccupied quality assurance staff inspectors. To evaluate those techniques during their in-initial application better assured consumer satisfaction than "quality control" inspections conducted subsequent to assembly. It also was cheaper to build an item "right" the first time than to later mitigate defects through scrap and rework.³³

AFLC learned of high-grade repair processes by monitoring the ever-improving industrial accomplishments practiced by the many private contractors linked to the defense complex. Because Air Force components often required unusual materiel specifications, the Quality Assurance Office assigned a representative to an Industrial Process Review Program team that tracked private sector development technology. Other quality programs such as QSEP and Operation Listening Post supplied additional information on new achievements in material and processing procedures.³⁴

On 28 September 1979, eager to streamline Command-wide quality assurance measures, the Quality Assurance Office published AFLCR 74-7, a regulation that reduced the number of routine inspections required for processes already proven reliable in the repair of deficiency-free items. ALC assessors could now exempt a process from inspection by invoking the following criteria: few customer complaints; the employment of certified workers; and the presentation of six months of inspection data that supported minimal deficiency ratings, providing that no defects had impaired components critical to the operation of the subject mechanism. In this

way, limited quality assurance resources could be diverted to more deserving functions because methods known to be reliable needed little attention. But, not all processes were foolproof.³⁵

A Case Study in Material Defects: Reynolds Aluminum Plate

As 1979 drew to a close, AFLC workers learned of a possibly disastrous condition involving defective aluminum plate. Used wholesale in many industrial applications and in aircraft components, the suspect plate, rolled by the Reynolds Aluminum Company at its McCook, Illinois facility, had been sold to a broad variety of Department of Defense customers, including the Air Force. Threatening flight safety, the improperly manufactured aluminum had lost much of its strength and temper. The task for AFLC investigators directed them to identify how much plate the Command had purchased and determine which aircraft might have received replacement parts made from the defective metal.³⁶

Much of the faulty material had been used to fabricate new Air Force fighters, such as the F-15 and F-16. Fortunately, in its search for the "soft metal," the Air Force Systems Command (AFSC), responsible for the early development of weapon systems, had located the "contaminated" planes with relative ease. But the job for AFLC sleuths soon proved more difficult, even though their investigation encompassed a much smaller amount of the dubious material. While the raw aluminum stock stored at the ALCs would be examined, perhaps some of the flawed material had already been tooled into parts and been installed on operational aircraft. Identifying which replacement parts had been manufactured from the faulty aluminum, how important that piece might be to flight safety, and whether a part did, in fact, have any weakened metal at all presented a complex problem for AFLC logisticians. After considerable time and effort, ALCs had by April 1980, identified most of the suspected material, and previous arrangements with the Reynolds Corporation had promised a thorough testing. The incident, though apparently never a contributor to the loss of life or property, nevertheless illustrated the potentially hazardous results when quality assurance measures are not properly taken during elementary repair processes.³⁷

The Japanese Way: New Definitions of Quality Assurance

By the late 1970s, aggressive industrial competition from abroad, particularly Japan, (its manufacturing base long since repaired from the battering taken in World War II), had threatened to pitch some of America's top manufactures into bankruptcy. Names such as Toyota, Sony, and Fuji had captured much of the high-tech market previously controlled by American heavyweights like General Motors, RCA, and Kodak. What had once been scorned the world over as a label synonymous with frivolous trinkets and glossy lacquer, "Made in Japan" had become the hallmark of quality at its stellar best. How this had happened and what U.S. manufacturers could do to recover their fair market share were hotly debated questions on both the minds of American producers and consumers. Although many factors underpinned the intricacies of international economics and trade, one issue did eventually rise to the top and suggest an answer: America had to improve the quality of its products, which in many instances were inferior to those produced in Japan. And one of the many lessons U.S. manufacturers learned upon close inspection of Japanese processes was that domestic factories needed to draft long-range plans and set production goals that incorporated quality assurance incentives. As the popular slogan at a top U.S. auto maker now celebrates, "Quality Goes in Before the Name Goes On," Americans had to abandon their pursuit of "quick and dirty" profits for longer-term reinvestment for modernization and research and development if they expected to survive the onslaught of overseas imports. Hence forward, products had to roll off the assembly line in near-perfect condition. No longer would industry-wide recalls be acceptable to correct the manufacturing defects rampant at many U.S. factories. Never again would the American consumer tolerate gas tanks that exploded or cars that failed to run, not when foreign manufacturers could produce quality merchandise free of dangerous or pesky defects.

Though the private sector accent on quality had excited media interest in the early 1980s, the notion had not been a new one for the Air Force. As discussed already, AFLC had faced the issue squarely for nearly a decade

since its 1974 establishment of the Quality Assurance Office. But, much like the industry upon which many of its operations depended, AFLC and subordinate ALCs had from habit come to rely on end-of-the-line inspections for quality control rather than "applying" quality at each stage of the repair or servicing process. In a 1 December 1980 letter, the DCS/Maintenance at HQ AFLC, Maj General Earl T. O'Loughlin (later to be AFLC Commander, 1984-1987) summed up a new direction for AFLC quality assurance: "Producing more is not the single solution. We must strive to place continuous emphasis on the quality of products we produce and learn to view the process of building in quality as a means of improving productivity...i.e., do it right the first time."³⁸

The Concept of Responsibility for Quality Broadens

AFLC soon unfurled several new programs aimed to improve combat readiness. Part of that initiative included that workers take personal responsibility for quality on the production lines to "build in" excellence along the way. But, much like the auto maker faced with volcanic fuel tanks, the Air Force also wanted to prevent quality-related accidents, especially when their origins could be traced to logistics.

The "Broad Look" Program-Aircraft Mishaps

Military aircraft accidents are entitled "mishaps." Class A mishap rates (events which result in a fatality, total permanent disability, more than \$500,000 damage, or the complete destruction of an airplane) for the period 1 January 1970-31 December 1981 had consumed nearly three aircraft for every 100,000 flying hours. Nearly one-third of these incidents, according to investigators, could be connected in some way to logistics. Although mishap rates had been stable, they had not decreased in a decade, a distressing condition that alarmed key defense officials. Deputy Secretary of Defense, Frank Carlucci, in addition to his concern over the loss of life and the staggering drain on military assets, predicted in an 18 September 1981 memorandum that "Even at constant accident rates, annual costs will reach \$1,000M by next year." Accordingly, Deputy Carlucci ordered the military branches to explore the problem.³⁹

Investigators soon learned that the Air Force, to its credit, had suffered fewer mishaps than other branches of the U.S. Armed Services. But, because the Air Force flew more aircraft than the other services, tacit protocol dictated that it spearhead the drive to shrink the number of mishaps. Interestingly, AFLC had previously advised ALC commanders, months before the Carlucci directive had passed among the services, to review their accident records. To assess the proper action needed to mitigate aircraft losses, General James Mullins, AFLC Commander, 1981-1984, asked that such recommendations be sent to the HQ AFLC Quality Assurance Office for study. Shortly after General Mullins' request, HQ USAF Inspector General, Lt General Howard W. Leaf, in a message to all major commands, announced the inauguration of program "Broad Look," a plan created by the Air Force Inspection and Safety Center (AFISC) to review all class A mishaps that had occurred since 1979.⁴⁰

AFLC and AFISC representatives, bent on eliminating logistics as a factor in aircraft mishaps, toured the ALCs, and by the end of June 1982, had finished their review of the many procedures linking maintenance to aviation safety. Among their findings, the team listed simply that there was the need for "Improvement of procedures for quality control/assurance" at the ALCs. But in a 16 August 1982 Broad Look update, General Leaf described the logistical sources that had the worst impact upon aviation safety. Four in particular related to the ALCs: 1) a shortage of skilled maintenance technicians; 2) poor management visibility of the aircraft safety modification process; 3) loss of skilled maintenance workers; and 4) the negative consequences of mission pressures on limited maintenance resources. By year's end, after a focused Air Force effort to devise general solutions to improve flight safety through better quality assurance methods, statistics revealed that 1982 had produced the lowest USAF class A mishap rate in the history of the service-2.3 per 100,000 hours flown. Although it would be suspect to suggest that Broad Look could claim much responsibility for the new record, especially since the program had been of such short duration, the overall awareness toward quality-related safety issues at the ALCs had, nonetheless, been elevated sufficiently and thereby contributed somewhat to the improvements in Air Force aviation safety.⁴¹

Project Overlook

Broad Look's rather stark assessments might lead the casual observer to wonder about the quality of work provided by the ALCs. Given the gravity of aircraft mishaps, inspectors felt, a penetrating review critical of maintenance procedures was in order. In fact, months before Broad Look began, a February 1981 AFLC maintenance conference held at Warner Robins ALC had with foresight suggested that such a group be convened to rate quality in maintenance. Thus, by 30 March 1981, an Industrial Maintenance Study Group had formed and soon acquired the name Project Overlook. It would not be long, however, before some friction occurred between Project Overlook staff and that of the AFLC Quality Assurance Office over their respective roles. The director of quality in DCS/Maintenance, who had made significant contributions to Project Overlook, was by virtue of his position, expected to construct independent quality programs within the several DCSs. Conversely, the HQ AFLC Quality Assurance Office intended to preserve centralization within the Command as it related to quality. A controversy over authority was brewing that would simmer for years.⁴²

Other than the emphasis placed on quality assurance, Project Overlook interests served mainly those of the Directorate of Industrial Maintenance Process Control, part of HQ AFLC's DCS/Maintenance. Adding fuel to the fires surrounding the uncertainty of who would oversee quality assurance issues within the Command, MAQ's organizational designation changed on 3 March 1982 to the Directorate of Maintenance Quality Assurance, an act which confused the question of who now spoke for the AFLC quality program: the AFLC Quality Assurance Office, or the newly titled Directorate of Maintenance Quality Assurance? Aware of the tension, General Mullins emphasized that he wanted "one voice" to speak for quality at the command headquarters, and that was in the AFLC Quality Assurance Office. At an ALC, the General went on, the ALC Quality Assurance Office would be in charge of designing quality programs. Although far from dead, the issue was momentarily settled.⁴³

Once absolved from the weight of an organizational dispute, Project Overlook reviewed the various ALCs in search of where quality-related

improvements could be made. Recruitment, training, and the evaluation of new personnel; production certification; and career enhancement were some of the topics deemed worthy of improvement in the standards of AFLC maintenance.⁴⁴

Production Certification

An innovative feature of Project Overlook required employees to take personal responsibility for the quality of maintenance that they performed at the ALCs. A pilot program to facilitate the goal, Production Acceptance Certification (PAC), would hand the responsibility for quality back to production line personnel. Journeymen mechanics, certified to approve the quality of their own work and that of their non-certified peers, would oversee the arrangement. AFLC officials scheduled the San Antonio ALC, selected as the command's initial test site, to begin PAC experimentation in May 1982. If successful, the program would make each person individually accountable for the quality of his or her own work.⁴⁵

First targeting San Antonio's B-52 Armament Function, F100 Core Repair, and Test Equipment Section, PAC emulated the Navy's "Artisan Certification" program then underway at the Naval Air Rework Facility (NARF) in Jacksonville, Florida. Hopeful technicians expected that the implementation of PAC would sustain high levels of productivity, better quality, self-reliance, worker pride, improved combat readiness, and, propitiously, reduce aircraft mishaps. Although the impressions gained during a preliminary visit to the Naval facility led AFLC representatives to conclude that the ALCs could easily adapt the Naval program to Air Force needs, the proposed venture sparked unanticipated labor resistance from factions of the American Federation of Government Employees (AFGE). Uncertainty as to how union members would be affected by proposed changes in their working conditions had ignited the discord. HQ AFLC's Directorate of Civilian Personnel, responding to union concerns, outlined the tenets of PAC intentions and granted labor leaders fifteen days in which to review the slated requirements. Some of the new stipulations required journeymen to be task-certified within their specialties; that certification itself would be

limited to qualified journeymen; decertification was possible if the quality of a worker's efforts declined; and those technicians facing decertification would undergo retraining before recertification was possible. The union failed to reply within the prescribed period and, as a result, AFLC instituted the program unilaterally. Though disgruntled labor officials grouched that the new conditions were negotiable, adamant civilian personnel specialists denied their subsequent appeals.⁴⁶

By early fiscal year (FY) 1983, PAC had spread from the original three experimental areas at the San Antonio ALC to encompass fourteen, an expansion which involved over 1000 employees. And plans had already charted the course for additional pilot programs at the other ALCs. Even though a preliminary assessment of the San Antonio PAC had rejoiced that "The Product Acceptance Certification Program looks like a winner," wary cynics muttered doubts. A drop from 1.86 percent to .01 percent in the rate of defects for the reporting period of 1 July-30 September 1982, remarkable for such a brief period, prompted PAC evaluators to explore other possibilities. Two factors seemed to explain the decline: the hesitation of production line verifiers to "write-up" individual workers who had fallen short of their goal; and better workmanship in an environment which had stressed quality to perhaps the point of personal saturation. Both seemed plausible explanations for the drop in defects at the San Antonio ALC.⁴⁷

Materiel Defects Threaten Flight Safety

The early 1980s had indeed witnessed the ripening of newly sprouted AFLC quality assurance efforts as well as the maturation of programs first seeded in the 1970s. And, logistically-caused aircraft mishaps had continued to wither. In fact, overall, the Air Force enjoyed its lowest number of mishaps since 1921. But in 1983, quality assurance investigators discovered what at first seemed to be a relatively minor defect yet would eventually have service-wide implications: the CM313 "Peanut Bulb."

The small incandescent bulbs, used daily by the Air Force in handfuls to illuminate airplane instrument panels, electronic equipment, and testing devices, and manufactured abroad, by late 1982 had earned a reputation as

being unreliable. Apparently, the poorly-made glass envelope protecting the filament prevented the bulb from seating fully into its electrical socket, an aggravating condition that produced intermittent lighting. Though a minor flaw, it nevertheless threatened many Air Force operations, some of them critical. For example, often mounted in "press-to-test" indicator assemblies used to check electrical circuits, the defective version of the bulb could not light up to indicate whether or not a test had been performed properly. Further, and more ominously, investigators warned users that the light bulb, in some applications, might glow as intended during a test sequence, but fail to light during an operational mode. One such case occurred in January 1983. A T-33A aircraft attached to the 325th Fighter Weapons Wing at Tyndall AFB, Florida, aborted take-off when the rear cockpit fuel quantity low level light flashed on but the light in the front cockpit, in contradiction, did not. Although the lamp worked well in certain test modes, it had failed to alert the pilot to a critically low fuel level.⁴⁸

Learning that the flawed bulbs threatened weapon systems and imperiled Air Force lives, ALC technicians hurried to strip all suspected offenders from their shelves. A prime example of a widespread materiel deficiency, the seemingly minor lamps, costing about 25 cents apiece and common as table salt, had endangered Air Force combat readiness. The fickle bulbs could have accelerated aerial mishaps. Colonel Paul Brown, HQ AFLC's Assistant to the Commander for Quality Assurance, summarized the significance of the Peanut Bulb affair succinctly when he said:

The lesson to be learned is that it is essential that item and materiel managers...conduct periodic reviews of the specifications and standards that apply to their items. Otherwise, USAF weapons systems may very well be confronted with severe problems of readiness and reliability, as indicated by the adage 'Loss of a nail, loss of a shoe.'⁴⁹

If the simple technology sparking the glow of a basic light bulb, when improperly applied, had jeopardized aircraft and crews, then little imagination is required to visualize the proportional hazards menacing flight safety in those instances where truly advanced technology goes awry. Despite the wizardry computers bring to national air defense, elaborate

microcircuits invite disaster when quality assurance procedures during their manufacture are poorly followed. Such an incident occurred in 1984.

Faulty Microcircuits from Texas Instruments

On 6 September 1984 Texas Instruments Corporation (TI), a prestigious builder of the sophisticated semiconductors used in computers, notified the federal government that as many as 4,700 different kinds of microchips (ultra-miniature electronic circuits) made for the defense industry might be faulty. Although TI soon recalled the flawed "chips," investigators were unable to establish how many had already been "plugged" into existing weapons systems. Similar to the 1979 defective Reynolds aluminum plate incident, the malfunctioning TI microchips presented AFLC technicians with the problem of finding small items already operational in the aircraft and missile network.⁵⁰

Although there had been no reports of microchip-oriented mishaps, the inconvenience to the armed services generated a host of complaints throughout the defense complex. Beyond expenses to the Air Force due to the delays, investigations, additional testing, and corrective work, a nagging uncertainty remained as to those suspect chips in service that at any time might fail prematurely and that should have been detected by proper testing during TI's manufacturing process. Having few other practical alternatives, the Air Force made the decision to do nothing further to locate TI chips. Because no pattern of failures or serious malfunctions had noticeably emerged to suggest that circuits already in place were a hazard, conventional wisdom assumed an acceptable reliability factor. Further presuming that safety was no longer a threat, officials decided it would be cheaper to wait for the chips to fail during the early hours of operation rather than finding and retesting them, all at great expense. A lingering question, however, of serious consequences remained. Given that TI had been making, and the Armed Forces had been using, perhaps other improperly tested electronic circuits for many months before the defects were discovered, additional technological "time bombs" might be ticking away without warning. Although disasters were not forthcoming, the circumstances had nonetheless made for an unsettling environment.⁵¹

PACER IMPACT

By the mid-1980s, an age of "Do More with Less" had fallen upon the federal government, especially in the defense department. Since 1981, the administration of President Ronald Reagan had routinely approved yearly increases in the national defense budget to strengthen an armed forces stunted by decisions made in the previous Carter administration. But by 1985, amid rising public fears over a ballooning federal deficit, a fiscal twilight had darkened the days of easy spending. Congress, passing the Balanced Budget and Emergency Deficit Control Act of 1985, better known as the Gramm-Rudman-Hollings (GRH) Amendment, acknowledged that escalated defense outlays had exacerbated the national debt and that only strict controls could stem the ebbing tide of taxpayer dollars. In effect, the amendment cut annual defense allowances significantly. As a consequence, in an era of declining resources, military planners would have to stretch their assets to meet those defense commitments deemed essential to national security.

On 31 July 1985, President Reagan, moving with the spirit of the times, unveiled a plan to improve productivity in the federal government by twenty percent over the next seven years. To meet this challenge, AFLC planners, for their part, turned to PACER IMPACT, a program created two years earlier to increase Command efficiency and economy in its production and maintenance evolutions. The program emphasized three issues: People needed to be motivated and properly trained; the manufacturing or servicing process had to be controlled and use the newest technology; and the product should grow in quality and quantity. PACER IMPACT (an acronym meaning Industrial Maintenance Productivity through Accountability, Creativity, and Technology), slated for ten years duration, had been designed to perfect maintenance techniques at the ALCs by using five different development groups that managed programs by developing fresh initiatives. The groups were successful because their members had come from the "shop floors" of the five ALCs and possessed first-hand experience and ideas where improvements might realistically be made. Technicians who routinely performed

depot maintenance would now decide how that workload could be more efficiently accomplished. Listed below are the five PACER IMPACT development groups and examples of their relative contributions during FY 1985:⁵²

1. Technology Enhancement. Group members looked for ways to apply the latest technology to their daily ALC operations. Plastic Bead Blast Paint Stripping, Robotic Laser Paint Stripping, Laser Machining, and Cryogenic Spin Testing (of engine parts) were a few new maintenance procedures added in FY 1985 that incorporated the latest technology.

2. Financial Management Integrity. Participants in this group encouraged the use of audits and management training to govern the prudent execution of AFLC's maintenance budget. New innovations for FY 1985 included the preparation of a financial data automation catalog, the design of a material sales pricing procedure, and a complete analysis of work already in progress.

3. Workforce Development and Motivation. A sensitive endeavor, this plan made efforts to keep lines of communication open between workers and management. Managers also attempted to motivate their employees through direct involvement in projects like the Production Acceptance Certification (PAC), where workers had some direct influence over the quality of their work. Awards for minimal sick leave usage, training in sign language for supervisors of the hearing impaired, and an emphasis on physical fitness all were plans to motivate and develop employees so that they would work more productively, thus more economically.

4. Material/Asset Management. Here, groupmembers reduced the inventories of spare parts by constantly watching over the volume of incoming workloads. Vigilance to reclaim reusable parts, industrial fluids, and precious metals also comprised their interests.

5. Methods/Process Development. Employees sought ways to simplify depot maintenance methods and processes so as to reduce expenses. One accomplishment involved the C-135. Previously, the less productive method for C-135 overhaul kept the airplane in one place while moving maintenance

crews and their equipment from plane to plane. The new, more efficient plan shuttled the C-135 between fixed repair sites, an act more cost-effective and time saving.

Decentralization of AFLC Quality Assurance Responsibilities

Caught in the government-wide maelstrom to further economize, an AFLC "Tiger Team" assembled in summer 1985 to consolidate Command manpower allotments and eliminate unnecessary duplications of personnel. One of their more controversial and historic targets was the AFLC Quality Assurance Office and its ALC subordinates. In the Tiger Team's final report, and of its forty-eight different recommendations, one urged the abolition of all ALC Quality Assurance Offices and fewer staffers working in the HQ AFLC Quality Assurance Office. Reminiscent of pre-1974 organization, when quality assurance functions were both decentralized and in early stages of development, the new plan pictured that the Directorates of Materiel Management and Contracting and Manufacturing would fill the void left by the now-defunct and decade-old Quality Assurance Offices. Although the report could not quantify the alleged redundancy of responsibilities or tabulate in columnar form any actual savings the potential reductions might yield, the Team nevertheless voted in June 1986 to eliminate the Quality Assurance Offices at all ALCs and at Headquarters AFLC.⁵³

Defending themselves against the looming reduction of their responsibilities, quality assurance representatives countered that if their offices closed, an independent, unbiased voice in the process of quality assurance would be lost. In its absence, they went on, quality functions would henceforth be overseen by the very organizations they were to monitor, much like the fabled fox in charge of hen house security. Further, they urged, an element of organizational freedom would slip away with the inability to audit operations that crossed directorate lines of authority.⁵⁴

Ironically, the organizational framework of the Quality Assurance Office itself had provoked the assault on its autonomy. The Assistant to the Commander for Quality Assurance, a full colonel, sometimes lost ground

when up against AFLC Deputy Chiefs of Staff, usually general officers. And one necessary ingredient in a flourishing quality assurance program entailed complete backing from those deputy chiefs of staff. Lacking such support, the centralized quality assurance effort could not long survive and would lose its area of responsibility to the more powerful entities disinclined to permit the outside intrusions of well-intended though interloping advisors. The other chink in the armor of AFLC's Quality Assurance Office, was that, despite its 1975 consolidation by General Rogers, the office had seldom exercised absolute control over the Command's quality assurance programs. To a large degree, quality assurance at AFLC and the ALCs depended on the performance of workers from the DCSs of Materiel Management, Logistics Operations, or Maintenance. Not surprisingly, these organizations eventually assumed the functional control of their own quality measures, further estranging the Quality Assurance Office. Through a series of gradual reorganizations over the years, DCS/Maintenance had chipped away at the exclusivity enjoyed by the Quality Assurance Office in matters related to quality. By August 1980, the Directorate of Industrial Maintenance Process Control (MAQ) had been installed to raise the product quality at AFLC's various depots. And particularly, as mentioned previously, in July 1982, Quality Assurance Office authority dimmed when MAQ stepped from its former skin to become the Directorate of Maintenance Quality Assurance. Worse for Quality Assurance Offices, in November 1983, a new Logistics Operations Center and a renewal of the DCS for Materiel Management drained even more power from the Offices because each of the new organizations employed specialists to control matters of quality assurance within their operations. In sum, these organizational realities had in part diminished the vigor of the Quality Assurance Office.⁵⁵

On 8 February 1986, after much discussion among AFLC's affected functions had weighed its merits, the quality assurance organization decentralized. Its various duties would be spread among AFLC DCSs and ALC

Directorates. "Designed to eliminate duplicated effort, save personnel spaces, and emphasize the placement of quality responsibility at the worker-level throughout the command," the dispersion received general approval.⁵⁶

New Directions and Transitions

While the winds of change may often blow hot and cold, they are seldom constant or predictable. Newly appointed AFLC Commander, General Alfred G. Hansen, in August 1987, taking a personal interest in quality assurance, astonished the Command shortly after his arrival by reemphasizing the virtues of centralization. Some members of the AFLC Quality Council (an advisory group established upon the decentralization of the Quality Assurance Office), however, expressed surprise at the General's persuasion. Much of the year's efforts related to quality had just been spent on decentralization!⁵⁷

After a tour of AFLC and ALC facilities had prompted General Hansen to acknowledge the adequacy of the present quality structure, he nevertheless reminded attendees at a 17 December 1987 AFLC Quality Council meeting that "The time has come for us to shift our emphasis away from evaluating the goods and services we provide at the end of the process...and toward the process itself by which goods and services are actually provided." Although the concepts were not new to AFLC quality assurance technicians, and they had been part of the professional literature for years, the General's observations did contain a revitalized emphasis. The new AFLC quality effort would "represent a culture change wherein quality becomes everyone's responsibility." He underscored that the allegiance to quality began in his own office and that it would "cascade" down to every person in the command. The Commander added further that:

This effort encompasses everything we do. It involves manufacturing a part right the first time, and buying smart all the time. It involves effective planning up front, and requirements computations that are accurate from the start. It also involves staff work that's well thought out and on target, and program execution that commits scarce resources effectively and efficiently.⁵⁸

The Third Wave - Dr. W. Edwards Deming

Part of General Hansen's devotion to quality enhancement may well have come from events begun largely outside Air Force perimeters. Packaged for popular consumption and occasionally pitched with the zeal of revival tent evangelism, the idea of quality as the bedrock of better business had been around since the turn of the century and efficiency expert Frederick Taylor's school of "scientific management" (later to be loosely labeled as "time and motion" studies). But the more recent progenitors of the present-day quality movement appeared at the end of World War II. In fact, several individuals would eventually achieve notoriety as free-lance consultants (or "Gurus" in the contemporary parlance of the discipline) by celebrating the benefits of "working smarter" through modernized manufacturing processes. Names such as J. M. Juran and Phillip B. Crosby often dotted the pages of trade journals during the mid-1980s with their ideas of how to improve American industry to better compete with the Japanese and the developing Pacific Rim economies of South Korea, Singapore, Thailand, and Taiwan. But one among many stands out as the movement's patriarch: Dr. W. Edwards Deming. No discussion of quality would be complete without reference to the man who, some believe, fathered the "third wave of the industrial revolution." Whereas the first wave brought the machine-dependant factory, created by Eli Whitney and his cotton gin, and the second wave ushered forth Henry Ford and the age of mass production, the third wave brought the quality assurance revolution of W. Edwards Deming and his statistical controls to improve production.⁵⁹

Deming, a trained scientist, badgered stubborn corporations to use bone-dry statistical analysis to examine their processes and products to verify they were buying from the right supplier, and to see whether their products were as good as they could be. But ironically, American industry had turned a deaf ear to Deming shortly after World War Two. Seeing little need for "quality" per se, many U.S. industrialists, "living the arrogance of affluence," coveted the huge and quick profits generated by markets yet untouched by foreign competition. But the Japanese of the early 1950s, lean and hungry, having few natural resources, clung to Deming's lectures

like magnets. Deming boldly promised that if they followed his methods, they would in five short years not only be able to compete with the West, but even more, that Westerners would hurriedly throw up protective tariffs as shields against the unexpected fusillade of quality Japanese exports.⁶⁰

Today widely considered the elder statesman of the quality movement, Deming and his kind attracted little attention in the United States until 1979, when downturns in heavy industry had pressed many of this country's once-booming midwestern and northeastern manufacturing centers into little more than bankrupt potholes notched along America's metaphorical "Rust Belt." Dr. Deming, then in his seventies, holding a doctorate in physics, and previously nominated in Japan for the Nobel Prize, recaptured the American public eye in June 1980 when he appeared in an NBC documentary comparing Japanese quality with American quality. Establishing Deming as the world's foremost authority on that subject, the film would receive more transcript requests than any other produced by the network. As a result, in just a short time he had signed contracts with Ford Motor Company and General Motors Corporation, two grand masters of the industrial world, to become according to Ford Motor Company, "our consultant, our catalyst, our philosopher, and a burr under our saddle when we're not making enough progress." Once accepted by such pre-eminent luminaries, Deming's enthusiasm for quality soon gained widespread support throughout not only private industry, but the public sector as well.⁶¹

Deming blamed management for most of the problems in the American workplace. Citing his now-famous "14 Point" plan for industrial administration, he claimed that workers, if permitted to do a good job, would. But the system, as it was, prevented them from producing quality items. Production quotas, Deming insisted, induce fear, which in turn cause workers to hurry through a process with little regard for the quality of their work. Further, he lamented that American employees were not given the opportunity to suggest simple solutions to ongoing problems, that managers had closed ranks to keep them outside decision-making circles. Also, cooperation rather than competition should be emphasized in the workplace. "Employee of the Month" awards and similar honors only divided employees,

according to Deming, and frustrated mutual cooperation in the labor force. Moreover, instead of darting from supplier to supplier when dissatisfied or to secure the best price, he suggested that a company was miles ahead to light on one jobber and establish a long-term relationship founded on loyalty and trust.⁶²

Aside from these recommendations, Deming argued that a manufacturer had to produce an item "right" the first time, every time. Quality control inspectors caught defects only after they had already entered the production stream, a condition both too late and too costly. It was cheaper to build a product properly than to recall the deficient ones. Quality had to become "a way of life" among all aspects of industrial and service organizations, and that meant all employees had to be involved through quality awareness and quality training programs.⁶³

General Hansen: Command-wide Quality Assurance Measures and Accountability

Shortly after his arrival at AFLC, General Hansen, a proponent of the Deming school, took a hard look at the Command to judge the breadth and depth of quality assurance as it related to Air Force logistics. In just a short time, the General would move AFLC's quality program beyond the supply and maintenance function to all Command operations, another precedent in the history of the program. At a 13 January 1988 AFLC Council meeting, he eliminated the Quality Council Executive Office. In its place, the Commander created a new position: Assistant to the Commander for Quality Programs (QP), with Colonel John C. Reynolds as its administrator. Broadcasting his intentions across the Command, General Hansen sponsored a variety of reports and news releases on the subject of quality and the new directions AFLC efforts toward quality would take. By 5 February 1988, QP offices had been established at the ALCs that reflected the Headquarters initiative.⁶⁴

Noting that attempts to improve quality had become "nearly an obsession with many U.S. manufacturers," the AFLC Commander explained his vision succinctly: "My intent is to bring AFLC in line with this quality revolution. Its time we substitute an 'ounce of prevention' for 'a pound of

correction.'" Although industry experts had advised the General that his goals would probably require a minimum of seven years before any results would appear, he replied: "I'm here to tell you I plan to change the course of quality in AFLC within the next year."⁶⁵

Key Concepts-Total Quality Management Program

In the early 1980s, embarrassed by the inefficiencies of a sprawling acquisition system that had somehow permitted such dubious purchases as \$300 hammers and \$600 toilet seats, the Department of Defense unleashed a master plan to improve the overall quality of work and procurements made on behalf of the nation's defense. Entitled Total Quality Management (TQM), the program emphasized innovative methods of education and training for the logistics workforce. By 1987, TQM had become a primary interest of the Secretary of Defense, especially as it related to military purchases and the quality of defense workers.⁶⁶

With foresight, AFLC leadership had already begun to institute several key concepts for quality, ones which formed the core of General Hansen's revolution. One turned on the idea of "cascading," where top management personally oversaw quality-related goals at each ALC. Once the goals had been defined, subordinate directors and executives, facilitating education and worker awareness programs, passed information and training down to employees at the lowest levels of the Command. Quality was now not something to be delegated, but instead an endeavor for which each person in the production chain took personal responsibility. The Commander further underscored the importance of moving from product orientation to that of process awareness. Even more, AFLC officials had to become more attentive to customer needs than ever before. Traditionally, U.S. manufacturers had followed the directions given them by design engineers who set limitations on what could and could not be done when building a product. Now, customer requests would be acknowledged and their priorities, if at all possible, would be honored.⁶⁷

A Quality Program for the 1990s: QP4

For the General's Quality Program to succeed, he recognized that workers at every level in the Command would have to rely on their common sense and native intelligence when striving to improve AFLC products and services. That sentiment was embodied in a program entitled QP4 and would become the Command's new quality program. An AFLC news release explained:

The Q stands for quality--not an organization but a condition. The four P's represent people, processes, performance, and products. Quality and the four P's really are inseparable, and the force that binds them together is applied common sense. The applied common sense of all the workers to their jobs becomes a force for the continuous improvement of everything related to their jobs. Common sense is an inexpensive, renewable energy source available at every work place.⁶⁸

Process Action Teams (PATs)

As part of the QP4 initiative, common sense also dictated that workers themselves knew best how to improve the products and processes they faced everyday. Consequently, AFLC officials asked employees to examine their production methods by using Quality Circles and the fledgling Process Action Teams, vehicles which both conformed to Dr. Deming's principles that all processes could be enriched. Basically, production and maintenance workers were in better positions to see problems than those policymakers sitting in distant offices removed from the daily "hands-on" experiences.⁶⁹

PATs would be formed to review a process, seeking ways to improve its overall performance. Trained in analysis techniques that included flow charts, statistical process control, and data collection methods, team members obtained facts on which to base changes in the process under examination. In essence, PATs gradually sought to inject quality into every step of a process, an act which eliminated the need for quality control measures at the end of the line. Unlike Quality Circles, however, which were oriented more toward the worker and their problems within the work site, PATs were management-directed and tracked a certain process. But both groups addressed quality and could see the need for change at their respective levels. In the end, PATs (of which there were over 700 Command-wide

in 1989) and Quality Circles improved lines of communications between supervisors and workers, thereby enhancing the AFLC work atmosphere to encourage the production of first-rate products and services.⁷⁰

A Quality Philosophy and Bill of Rights

Although AFLC could not practically adopt all the philosophies espoused by industry consultants such as Deming or Juran because of the innate and sometimes awkward differences between corporate and military organizations, several issues applicable to AFLC did emerge from the collective wisdom of those experts: 1) management commitment, 2) employee awareness, 3) continuous process improvement, and 4) customer satisfaction. Important to General Hansen's program, the development of a Command philosophy about quality faced certain limitations if it were to be flexible yet still effective. For example, it could be neither a binding regulation nor all-inclusive. The philosophy could not circumscribe other quality efforts or become a "How To ..." guide. The challenge inherent to the quality philosophy design process was to somehow convince workers that "Quality was king" without preparing another set of rules. In other words, AFLC planners sought fresh ways to motivate employees throughout AFLC and the ALCs to embrace the Commander's enthusiasm for quality and to assimilate new work habits.⁷¹

By spring 1989, Colonel Darrell W. Grapes, Assistant to the Commander for Quality, distributed across the Command a Quality Bill of Rights intended to instill among employees a sense that they were an important part of the revolution swirling around their job sites. Supporting the creation of an atmosphere of trust throughout AFLC, the Bill of Rights urged each member to contribute to safety, quality, and productivity. Accordingly, every employee would have the following rights:⁷²

1. The Right to Challenge Business as Usual. Any worker can question the way their operation is managed or operated. Because employees are intimately familiar with their daily work routines, managers should encourage them to challenge processes.

2. The Right to Be Heard. Employees are promised a voice in the operation of their processes and management is obligated to listen. Workers, because of this protection, can express themselves without fear of reprisal. The right relates to written, oral and other proper means of expression.

3. The Right to Expect Commitment to Quality. All workers have the right to expect their supervisors to set work habits consistent with accountability, dedication, and the desire to "be the best" in their profession.

4. The Right to Place Quality Before Production. Product quality will meet or surpass customer expectations. Quality should not be linked to a production quota but instead be indicative of worker commitment to quality. Responsible action should be taken to halt production and remedy defects when processes are substandard. Production quotas will not overshadow quality.

5. The Right to Feel Genuine Pride in AFLC Products and Services. All AFLC employees should know that AFLC processes are being challenged, studied and enriched daily because of the Command commitment to quality.

Conclusions

General Hansen's newly framed Quality Program sought to revolutionize the ways in which Command workers viewed their jobs. Through special training, indoctrinations on the benefits of quality, management acceptance, direct involvement on the part of all employees, and a Quality Bill of Rights and Philosophy, the notion of "quality" has begun to acquire a new personal meaning for all AFLC members, inspiring them to take greater responsibility for the excellence of their work, not only in maintenance or procurement tasks, but in all functions of the Command, whether as a gardener, secretary, or budget director. First, however, the normal human barriers to change had to be undermined. Some sociologists have suggested that to modify the often rigid cultural values by which a society defines

itself, such as bigotry, sexism, or the depth of its work ethic, may take as much as a generation of reeducation or longer before desired patterns of behavior appear. Similarly, given the postwar history of American industrial management and its periodic warfare with a militant labor force, skeptics might suggest that it is premature to expect a spectacular overnight reversal in productivity regardless of the efforts made in quality programs in either the private or public sector. Yet, many corporations are reporting surprising upturns in sales and downturns in defects. And much of that improvement has come from those businesses who have brought their workers into the decision-making process. Employee recognition, increased responsibility, shifting assignments, and better training and education have all motivated many employees in the private sector toward greater quality.⁷³

Although the revised AFLC quality plan is barely two years old, it has nevertheless relied on similar incentives as those in private enterprise to motivate and redirect employees. PATs, Quality Circles, awareness seminars, and a Command-wide Training Development Plan have all been measures to entwine both management and workers in mutual goals to better serve AFLC customers by working smarter and by stretching shrinking resources. In its brief history, the Commander's Quality Program has attracted the attention of such defense contractors as Boeing and General Dynamics, not to mention AFLC's logistical counterparts within the Army and Navy, in their own searches for a model from which to fashion quality programs. In an 11 July 1989 introductory speech before a gathering of AFLC training development planners, General Hansen concluded with confidence and ease that AFLC had the "best Quality Program in DoD." With ongoing cooperation from devoted AFLC workers and with the future support of succeeding commanders, the Quality Program will no doubt go on to improve the level of excellence in AFLC products and services, now and in the years ahead.⁷⁴

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Appendix A

Lineage of Quality Functions within Air Force Logistics Organizations

15 October 1926--Materiel Division of U.S. Army Air Corps activated. Inspection function (quality control) part of Procurement Section.

1 March 1939--Inspection Section under U.S. Army Air Force Materiel Command.

1 July 1943--Inspection function elevated to division status with no major change in organization.

1 September 1944--Air Technical Service Command replaced both the U.S. Army Air Force Materiel Command and the Air Service Command. Under this consolidation, the Inspection Division was redesignated the Quality Control Section within a newly formed Procurement Division. But in March 1945, due to confusion over the meaning of the term "quality control," the organization reverted to its previous designation, "Inspection Section."

19 October 1949--Quality Control Division established within the Directorate of Procurement and Industrial Planning.

1952--Other quality control organizations within the Directorate of Maintenance Engineering and in the Directorate of Supply and Services also dealt with quality control relevant to their own functions.

1 December 1952--Quality Control Office established at staff level under a Brigadier General with responsibility for all quality assurance duties of the U.S. Air Force Air Materiel Command (AMC).

1 February 1962--Quality control functions removed from staff level. A newly established Office of Management Sciences within the U.S. Air Force Logistics Command (formerly AMC) accepted the responsibilities for quality control, management engineering, and operational analysis.

1 November 1962--Office of Management Sciences absorbed by the Directorate of Operations. As a result, all quality control duties were supposed to shift to Operations. But, decision makers were uncertain of what quality control could accomplish within that directorate. As a result, HQ AFLC created a temporary Quality and Reliability Branch within the Contract Operations Division of the Directorate of Procurement and Production. Yet at the same time, both the Supply and the Maintenance Engineering directorates retained some responsibility for quality control within their own organizations.

26 July 1964--Quality control function transferred from the Contract Operations Division (Directorate of Procurement and Production) to the Management Engineering Office (Directorate of Operations). A Quality Assurance Branch was formed within the Management Engineering Office, which would, in a few months, become the Industrial Engineering Office, and later, the Industrial Management Office.

August 1969--Quality control activities split among the new Deputy Chiefs of Staff (DCS) of Maintenance, Materiel Management, and Distribution.

23 November 1971--All residual quality and reliability assurance responsibilities transferred to the new Quality and Reliability Assurance Office (MMXQ) within the DCS/Materiel Management.

28 February 1973--AFLC Regulation 74-A created the AFLC Quality Assurance Program, governed by DCS/Materiel Management and DCS/Maintenance.

20 August 1974--Office of the Assistant to the Commander for Quality Assurance (also referred to as the Quality Assurance Office) established to define and address Command quality assurance problems.

January 1976--The many and varied AFLC Quality Assurance functions spread throughout the command centralized, eliminating the separate and previous quality assurance duties of the Directorate of Mission and Management Support, DCS/Materiel Management; the Directorate of Industrial Systems Engineering, DCS/Maintenance; Directorate of Plans and Programs,

DCS/Distribution; the Directorate of Contract Maintenance and Management, and the Directorate of Contract Placement, DCS/Procurement and Production. All future duties would now be handled by one office: the Office of the Assistant to the Commander for Quality Assurance, located at HQ AFLC and its counterparts at each ALC.

1 October 1979--Directorate of Industrial Maintenance Process Control (MAQ) established within DCS/Maintenance to assure quality in maintenance functions and act as liaison between the Quality Assurance Office at HQ AFLC and the quality functions in the ALC Directorates of Maintenance.

8 February 1987--Quality Assurance decentralizes, sending the responsibility for quality back to the various organizations and functions from which it had come in January 1976. In its place, the AFLC Quality Council Executive Office was created.

13 January 1988--AFLC Quality Council Executive Office abolished and replaced by an Assistant to the Commander for Quality Programs (QP).