

Historical Realities of C-17 Program Pose Challenge for Future Acquisitions

Learning From the Past Before Initiating Major Aircraft Buys

BETTY RAAB KENNEDY

This article advocates incorporating more historical realities into the management and execution decisions of aircraft acquisition programs. Ideally, acquisition improvements should encompass the corporate whole: the Congress, DoD, the Air Force, and the contractor. A formidable task, so reformers take heart.

Not discounting the many good acquisition initiatives, more study and debate about acquisition processes and procedures is needed in light of the C-17's tumultuous history. In concluding this article, I offer future acquisition students, action officers, program managers, and decision makers five maxims that evolved from my study of the C-17 program. If others differ, the acquisition community will reap the benefits of the exchange in viewpoints.

Not a Straightforward Process

The acquisition of the Air Force's newest military transport, the C-17 Globemaster III, was not a straightforward process. The C-17 program encountered political opposition and limited funding, plus technical development and program management difficulties, which affected the program's cost, production, and delivery schedule. From the beginning, no consensus existed within DoD or the Air Force on what type of airlift aircraft was



Photo courtesy The Boeing Company

THE C-17 AS A HIGH-WING, FOUR-ENGINE, T-TAILED AIRCRAFT WITH A REAR LOADING RAMP. IT IS 174 FEET LONG AND 55.08 FEET HIGH, WITH A WINGSPAN OF 169.75 FEET. MAXIMUM TAKEOFF GROSS WEIGHT AT PROGRAM START-UP (AUGUST 1981) WAS 570,000 LBS. MAXIMUM PAYLOAD WAS 172,200 LBS. WITH A PAYLOAD OF 160,000 POUNDS, THE C-17 CAN TAKE OFF FROM A 7,600-FOOT AIRFIELD, FLY 2,400 NAUTICAL MILES, AND LAND ON A SMALL, AUSTERE AIRFIELD IN 3,000 FEET OR LESS. THE C-17 CAN BE REFUELED IN FLIGHT.

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The U.S. military needed the ability to project a rapid deployment force anywhere in the world, and responsive, global-reaching airlift became an essential element of that strategy.



Advanced Medium Short-Takeoff-and-Landing Transport (AMST). Besides concerns over costs, developing the AMST engendered little support as it only offered tactical airlift capabilities. As a result, the C-X (Cargo Transport Aircraft-Experimental) – the future C-17 – evolved from discussions between Office of the Secretary of Defense (OSD) and Air Staff officials on expanding the role of the AMST to include strategic capabilities.

From the beginning, the intent was for the C-X to perform both strategic and tactical missions, but OSD and Air Force put the tactical, or intratheater missions in a secondary role. The national security strategy required more long-range airlift. Events in the Persian Gulf as well as the 1979 Soviet invasion of Afghanistan, underscored the need for the Carter Administration to look beyond the preoccupation with planning for a European-based NATO-Warsaw Pact conflict that relied heavily on prepositioned materiel and equipment. The U.S. military now needed the ability to project a rapid deployment force (RDF) anywhere in the world, and responsive, global-reaching airlift became an essential element of that strategy.

Defining, Agreeing, Selecting

The Air Force, joined by the Army and Marine Corps, formed a C-X Task Force in November 1979 to define requirements for a new type of transport. Led by Air Force Maj. Gen. Emil Block, the task force recommended development of an air refuelable aircraft with an outsize capability that could deliver large payloads over intercontinental distances into either main airfields or small, austere airfields. The joint task force reasoned that the ability to fly into small, austere airfields improved force deployment and employment, enhanced the flow of aircraft by decreasing ground lines of communication, and closed the combat force or cargo on time, at the right place. Such a capability also meant less competition for space in theater and made interdiction by the enemy more difficult. The C-X Preliminary System Operational Concept (PSOC) called for

AFTER MORE THAN 15 YEARS IN STORAGE IN THE ARIZONA DESERT, THE McDONNELL DOUGLAS YC-15 WAS BROUGHT OUT OF MOTHBALLS TO CONTINUE ITS MISSION AS AN ADVANCED TECHNOLOGY DEMONSTRATOR. IT WAS THE FIRST AIR FORCE DEVELOPMENTAL AIRCRAFT LEASED BACK TO A CONTRACTOR UNDER A COOPERATIVE RESEARCH AND DEVELOPMENT AGREEMENT. THE PRIMARY REASON FOR THE AGREEMENT WAS TO PROVIDE A PROTOTYPE TO EXPLORE NEW TECHNOLOGY APPLICATIONS FOR THE C-17 AND OTHER AIRLIFT AIRCRAFT.

needed. In addition, how much airlift was required for war plans was largely undefined. Securing necessary funding for the C-17 was simply an ordeal. That the program's funding fell victim to the budget axes wielded by Congress, DoD, and Air Force undermined the ultimate goal – timely operational delivery of the C-17.

The C-17's birthing also took place amidst heated competition and the excesses of political influence. Individual personalities also affected the program's direction through four presidential administrations. One other macro ingredient to the program's history was the

performance of the manufacturer and the many subcontractors.

Despite these difficulties, the C-17 entered operational service with the Air Mobility Command June 14, 1993, and in the intervening years, proved its worth as a very reliable and capable airlift aircraft.

Historical Realities

When Secretary of Defense Harold Brown made the decision to pursue a new strategic transport in November 1979, President Jimmy Carter's emphasis on reducing military expenditures had just brought about the end of the

FIGURE 1. **C-17 Preliminary System Operational Concept**

Cargo Load	130,000 lbs. (2.25Gs)
Runway	3,000 ft.
Range Unrefueled	2,400 miles
Backing Up	1.5-% grade w/130,000 lbs.
Turning	180° turn on 90-ft. runway
Airdrop	Yes
Service Life	30,000 hrs.
Utilization Rate Peace-/Wartime	2.5-3.5/12.5 hrs.

the development of schedules for a total aircraft buy of 150 and 200 aircraft (Figure 1).

Deputy Secretary of Defense W. Graham Clayton Jr., approved the C-X Mission Element Need Statement (MENS) in November 1980, formally documenting the requirement and granting the Air Force authority to identify and evaluate potential solutions. Clayton, however, stipulated that the Secretary of Defense would have final approval over the choice of a new C-X aircraft or a derivative of an existing transport (including commercial) or a mix thereof. Another OSD change made the requirement for small, austere airfield capability dependent on whether penalties would apply for executing the primary mission – strategic airlift. Still another OSD change deleted recognition of the studies documenting the intratheater airlift shortfall from the MENS.

That the requirement for small, austere airfield operations remained, albeit in a secondary role, was due in part to the advocacy of the commander of the Military Airlift Command, Air Force Gen. Robert Huyser, who wrote directly to Secretary of the Air Force Hans Mark asking for his support. In October 1980, the Air Force Systems Command released the final request for proposal to industry. As written, the proposal contained an ambitious initial operational capability (IOC) date of 16 operational aircraft by FY87.

In succeeding years, competing interests, sparse funding, and program man-

agement and developmental problems forced the program into an “on again, off again” mode, affecting unit costs, production, delivery, and the IOC date. One major delay was the need to await the results of a new requirements review, the Congressionally Mandated Mobility Study (CMMS), as its recommendations would provide the basis for determining the U.S. force structure required for contingencies. Issued in May 1981, CMMS recommended a fiscally constrained goal of 66 million ton-miles per day (MTM/D) in strategic airlift capability. The projected FY86 baseline capability was only 46 MTM/D, and Congress stipulated half of the additional 20 MTM/D would be in outsize cargo capability.

The CMMS was based upon the analysis of four scenarios: a regional conflict in the Persian Gulf; a Soviet invasion of Iran; a NATO-Warsaw Pact conflict; and/or a contingency in the Persian Gulf, with a precautionary reinforcement of Europe. The study did not address tactical airlift requirements. With the CMMS also disclosing a requirement to improve sealift capability, competition for DoD mobility dollars existed. Congressional support for the new program was far from assured. Representative Richard Ichord (D-Mo.), Chairman of the House Research and Development Subcommittee, which recommended denying the C-X funding request of \$81.3 million for FY81, laid out the subcommittee’s position in a letter to Defense Secretary Brown. “The C-X – a future system – simply could not be supported in the absence of funds for the procurement of sealift assets that are

needed to satisfy our near and intermediate requirements. Beyond the matter of priorities, the case for the C-X per se has not been made to our satisfaction.”

In the end, Congress appropriated \$35 million for the C-X program in FY81 and required the new Reagan Administration’s Secretary of Defense, Caspar Weinberger, to certify the program met congressionally stipulated requirements before funds could be obligated.

Meanwhile, the Air Force Systems Command/Aeronautical Systems Division conducted a source selection competition. Boeing, McDonnell Douglas, and Lockheed all submitted proposals. In August 1981, the Air Force announced McDonnell Douglas’ C-17 as the winning design. The C-17 was a larger, heavier version of McDonnell Douglas’ AMST YC-15. McDonnell Douglas offered an aircraft capable of a maximum gross take-off weight of 570,000 pounds and a design payload of 172,200 pounds (at 2.25Gs) for 2,400 miles. It would land on a small, austere airfield of less than 3,000 feet with its design payload. The C-17 would accommodate 102 paratroopers and up to 40 A-22 containers for airdrop missions, with a total airdrop payload of 110,000 pounds.

Alternatives, Debate, Delays

The second year of funding for the C-17 was even worse. Congress denied Research and Development C-X funding for FY82; instead, it provided \$50 million in procurement funds for wide-bodied aircraft, and another \$15 million for studies on airlift enhancement and C-X alternatives. Within weeks of the source selection decision, Lockheed submitted an unsolicited proposal to provide 50 C-5Ns (later designated C-5Bs). As feared by the Air Staff, Lockheed’s offer and subsequent visits by Lockheed and Boeing officials with Dr. Richard DeLauer, Deputy Secretary of Defense for Research and Engineering, caused uncertainty for several months. DeLauer was a key figure in providing Congress the requested certification and DoD endorsement, and he was not satisfied the C-17 was the right decision, considering the available options. For months, DeLauer held up

the certification, asking the Air Staff to analyze and re-analyze the C-5N and the C-17. In an Oct. 30, 1981, meeting with Air Staff representatives, DeLauer recommended purchasing C-5Ns and KC-10s. Thus, while the Air Force had decided on the C-X and McDonnell Douglas as the contractor for the program, DoD apparently disagreed.

This was confirmed in December 1981, as Secretary Weinberger closed his certification to Congress with a cautionary note stating, "The Department has not yet reached a final decision on which of the various alternative aircraft programs to pursue." Later that month, Deputy Secretary of Defense Frank Carlucci directed the Air Force to prepare a system analysis study of the C-17 and alternative proposals, ranking each candidate (Figure 2). Air Force analysis endorsed the C-17 and an expanded Civil Reserve Air Fleet (CRAF) enhancement program.

Finally, at the end of January 1982, Carlucci decided in favor of the C-5N, and Secretary Weinberger agreed. Shortly thereafter, Secretary of the Air Force Verne Orr announced a near-term airlift enhancement program of 44 KC-10 tanker/cargo and 50 C-5B aircraft. Orr explained that the C-5B could be operational three years sooner than the C-17, providing an immediate 3.8 MTM/D capability. He was willing to buy existing, less-advanced systems, believing the need to address the airlift shortfall warranted such measures. Orr was also mindful that Congress had eliminated Research, Development, Test and Evaluation funds for FY82 but would provide funding for a near-term program. The new Reagan Administration was also willing to spend money on addressing the airlift shortfall. Orr indicated in his memorandum to Army Gen. David Jones, Chairman of

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the Joint Chiefs, that he was no longer fully committing the Air Force to the long-term solution.

Following the controversial announcement, Boeing submitted another unsolicited proposal, offering 50 747s. Boeing considered the re-winged C-5s capable of handling the outsize CMMS requirements, so the proposed procurement of C-5Bs and KC-10s would meet any deficiencies in bulk and over-size cargo, the same role 50 747 freighters could fulfill. From March until mid-summer 1982, DoD, Air Force, and Lockheed lobbied hard to prevent Congress from overturning the near-term solution. So hard in fact, that the General Accounting Office disclosed, and Congress took action on, allegations of collusion between the government and Lockheed.

Replying to Boeing in May, Carlucci stated that commercial freighters "...

more appropriately belong in the CRAF Program rather than the Air Force organic airlift force." A Presidential letter from Ronald Reagan to key members of Congress in July 1982 reiterated these views, effectively ending Boeing's run at the near-term airlift solution. Modest funding by Congress in FY83 and FY84 – \$60 and \$27.6 million, respectively – kept the long-term solution of the C-17 alive, but resulted in a slippage of

the IOC date to the 1st Qtr., FY92.

Two documents in this period substantiated the requirement and solidified support for the C-17. In September 1983, the Air Force published the *US Air Force Airlift Master Plan*, which outlined the Air Force's commitment to modernizing its military airlift force structure and fulfilling the CMMS' 66 MTM/D goal. The master plan regarded the C-17 as an inter- and intratheater airlifter with a direct delivery role. Further, the Air Force announced a requirement for 210 C-17s (total aircraft inventory) destined to replace the aging C-130 and C-141 systems in the late 1990s.

In February 1984, Secretary Weinberger, with the unanimous endorsement of the Joint Chiefs of Staff, forwarded the *Validation of the Requirements Concept and Design for the C-17* as required to Congress. This report provided another ex-

FIGURE 2. 1981 Air Force Ranking of Airlift Candidates

Aircraft	Program Risks	Outsize Cargo	MHE	Ground Maneuverability	Intratheater	Maintainability	Manpower	Military Utility
C-17	4	2	1*	1	1	1	1	1
C-5N	3	1	2	2	2	4	4	2
B-747	2	3	4	4	4	3	3	4
KC-10	1	4	3	3	3	2	2	3

*1 equals excellent.

tensive review and substantiated the number of C-17s. The Services were fully behind the C-17.

While the master plan and validation report displayed consensus, program completion was far from guaranteed. Lockheed challenged the C-17 in February 1984 with yet another unsolicited proposal, which sought to complete testing of the C-5's direct delivery capabilities into austere airfields. (Testing was suspended in 1970 because of problems with the C-5's wings.) Lockheed's proposal sparked intense congressional and media debate over performance characteristics and costs of the two weapon systems for several years.

In February 1985, the program was reaching a major milestone decision – full-scale engineering development (FSED); at the same time, congressional and Air Force Program Objective Memorandum reductions for FY86 slipped the IOC date to the end of 1992. These funding reductions also delayed 14 of the first 36 aircraft and impacted technical data, support equipment, and training. At this point, the C-17's production costs had increased from \$33.7 billion to \$35.1 billion, primarily because of inflation and limited funding.

More limited funding with more restrictive language followed the next year. Yet, a measure of hope appeared in May 1987 as Congress overwhelmingly defeated Representative George Darden's (D-Ga.) amendment to delete all funding for the C-17 program. At the OSD level, Weinberger concurred with Secretary of the Air Force Edward Aldridge's designation of the C-17 program as a Defense Enterprise Program that, among other things, indicated their commitment to the program's success and funding priority. Despite this designation, the OSD staff had concerns. Originally Robert Costello, Under Secretary of Defense for Acquisition, had advised Weinberger against including the C-17, citing "high technical risks."

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1
Weapon system programs cannot succeed without consensus and astute, visionary leaders.



By this time, avionics development and integration had fallen considerably behind schedule. The C-17 was McDonnell Douglas' first effort at developing and integrating complex avionics systems, and the corporation's decision to modify the Sperry hybrid fly-by-wire and hydro-mechanical flight control system to a primary quad-redundant digital flight control system with a hydro-mechanical back-up only complicated the matter. Additionally, concerns emerged over increases in the aircraft's weight growth and cost estimate increases for logistics resources and military construction.

Inevitably, the years of delays and funding difficulties had adversely impacted the contractor's ability to perform. By the mid-1980s, McDonnell Douglas no longer had the C-17 workforce that it had started with, forcing the corporation to rebuild its base of expertise. In November 1987, when the first part for the first C-17 was manufactured, six years had lapsed since source selection. Nearly a year later, in August 1988, assembly of the first C-17 components began, and

another two years passed before the first C-17 was completed and ready for pre-flight testing in December 1990. Clearly, this was no way to build an airplane, especially one critical to national defense.

Crisis Looms

In 1989, the pattern of funding cuts with corresponding adjustments to procurement profiles continued. President George Bush's decision to trim the FY90 budget, proposed by his predecessor, stretched out the C-17 program just as the Defense Acquisition Board (DAB) approved start-up of low-rate initial production. The new Secretary of Defense, Richard Cheney, supported the program more than Air Force leaders, who were prepared to accept large cuts.

By April 1989, McDonnell Douglas acknowledged the C-17 program was over-budget by \$400-500 million. Cost overruns of \$150 million were attributed to problems devel-

oping the mission computer and the electronic flight control system. Both systems had sizeable software requirements to grapple with.

In August 1989, McDonnell Douglas initiated a C-17 recovery plan, but the corporation's less than successful implementation of quality management principles hampered these efforts. Citing delays in the integration of the electronic flight control system and the mission computer software, and the reorganization of McDonnell Douglas, Congress cut funding for FY90. As an aftereffect, IOC slipped to June 1993. Consequently, the Air Force advised the first flight probably would not occur until June 1991. The November 1989 Defense Acquisition Decision Memorandum attempted to reorder the program; however, succeeding events would disrupt the C-17 procurement profile, which sought to retain multi-year unit cost savings.

In April 1990, Cheney held a Major Aircraft Review (MAR) of the Navy's A-12 and the Air Force's B-2, C-17, and Ad-

vanced Tactical Fighter. The MAR reduced the number of C-17s from 210 to 120. Accordingly, the production peaks were adjusted to 24 aircraft vs. 29. The plan now called for C-17s to replace only the retiring strategic C-141s and on a one-for-one basis.

A major influence on Cheney's decision was the subsiding Cold War threat. At this time, the airlift mobility requirement was revised from a capability of 66 to 48 MTM/D. Decisions at the MAR resulted in a C-17 cost increase of 25 percent, \$260 million per unit. The Air Force placed the total cost of the 120-aircraft program at \$31.2 billion and anticipated an IOC of July 1994. As a result of the MAR, Congress cut C-17 funding for FY91. This, in turn, further revised the C-17 procurement profile, moving the first flight from August 1990 to June 1991, and the IOC date to August 1994. The Air Force cited McDonnell Douglas in May 1990 for various problems in managing the C-17 program, and in July of that year, the Air Force withheld progress payments.

C-17 program difficulties persisted. When Cheney abruptly canceled the Navy's A-12 program in January 1991, after learning somewhat "overnight" that the program was a billion dollars over budget, 8,000 pounds overweight, and 18 months behind schedule, the OSD immediately undertook a C-17 review.

Visits to McDonnell Douglas disclosed little oversight by top management, as well as the lack of an effective risk management program. Defense officials also criticized the corporation's manufacturing procedures, noting a lack of integration and coordination had resulted in redundant work and increased costs. Concluding the review process, Dr. David Chu, the Assistant Secretary of Defense for Program Analysis and Evaluation, believed the C-17 was still cost-effective and still the best option. Navy Rear Adm. Dave Robinson, who chaired the Joint Requirements Oversight Council, stated nothing had

changed since the April 1990 MAR that would alter the need for the C-17. Donald Yockey, the Under Secretary of Defense for Acquisition, did not recommend terminating the C-17 at this juncture. Yet, while support from OSD and Joint Staff continued, the question remained, "How strong?" As one of the primary contractors on the A-12 program, McDonnell Douglas heeded the criticisms of the C-17 program, and more oversight continued in the following months.

Concerned about the C-17 program, Congress cut funding for aircraft purchases and enacted restrictive measures — downright "hold DoD's feet to the fire" — in the National Defense Authorization Act for FY92 and FY93. Congressional staffers made it perfectly clear to Air Force liaison officers, that while no one disputed the mobility requirement, McDonnell Douglas simply needed to get the program in order over the next year or else face the consequences. Staffers also made a point of remarking that, "It would have been easier for us to fight the fight [for the C-17] if your Chief [Gen. Merrill McPeak] and Secretary [Donald Rice] had been more

vocal." Despite the program's woes, the C-17 showed promise with its successful first flight on Sept. 15, 1991.

In 1992, the C-17 program needed to accommodate a further revision of national security mobility requirements, in light of the post-Cold War environment. After two years, the Mobility Requirements Study was completed, favorably documenting a requirement for 120 C-17s and establishing a new goal of 57 MTM/D in strategic airlift capability. The most demanding scenario required the delivery of nearly five Army divisions to the Persian Gulf area, assuming "moderate" risk.

That June, Rice personally communicated to John McDonnell the need to demonstrate sustained improvements in the C-17's production performance. The Air Force knew the program could no longer continue in its current state; obviously, it required extraordinary management effort. The Air Force also realized that it had to ensure congressional funding of adequate production rates before McDonnell Douglas could improve the status quo. Regrettably, the Air Force was not successful in this effort.



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Maxim No.

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Expect and prepare for world order/national security changes.

Pointing to delays in the delivery and test schedules, Congress cut funds. The reductions added three more years to the production run, increased program costs by approximately \$210 million, and threatened the IOC date. Additionally, Congress restricted the obligation of funds until the Secretary of Defense submitted another extensive certification report. Adding to program concerns, the wings of a static display C-17 buckled in October

1992 when stress testing reached 128 percent, requiring a retest in 1993 to achieve the designed 150 percent. Not all was grim, for by year's end, the C-17 owned several world records. The plane did fly!

Probation

On several fronts, 1993 was a watershed year for the C-17 program. Right off, in

President Bill Clinton's Budget submission for FY94, the C-17 program acknowledged an IOC slip from September 1994 to January 1995. Early in 1993, Air Force Gen. Ronald Fogleman, then the commander of Air Mobility Command, publicly expressed interest in alternatives to the C-17, if McDonnell Douglas' production problems continued. Fogleman considered the state of the program, as well as concerns voiced by OSD and Air Force, congressional pressure, and the new Clinton Administration with its emphasis on cutting costs. He regarded it as his responsibility to plan an alternative course, thus precluding the command from losing its funding for critically needed airlift modernization.

Fogleman's statements renewed interest in previous options, namely the Boeing 747 and the Lockheed C-5D as Non-Developmental Airlift Aircraft (NDAA). Problems with wing cracks in the C-141 fleet also heightened the search for other options. The commercial derivative NDAA, however, did not set well with civil carriers in the CRAF program. The carriers and their associations regarded the commercial NDAA as a breach of the National Airlift Policy directive, signed by President Ronald Reagan in 1987, which recognized the importance and need for both civil and military airlift. Congressional support was forthcoming for all views – the business interests of the civil carriers as well as for the C-5D, C-17, and B-747. Heady debate ensued.

Continued controversy and uncertainty riddled the program. At the end of April 1993, Defense Secretary Les Aspin disciplined four senior Air Force officials for their handling of the program. This included improperly channeling \$442 million to McDonnell Douglas when the company was having financial difficulties in late 1990. The following month, just as the first C-17 entered operational service, Under Secretary of Defense Dr. John Deutch advised John McDonnell, "Unless there is a strong resolve on the

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 What can be managed
 should be;
 otherwise, bear the
 consequences.



“probation.” It also presented a comprehensive settlement of all outstanding contract issues to McDonnell Douglas and launched a new study – Strategic Airlift Force Mix Analysis (SAFMA) – to determine the optimum strategy for a mixed force of C-17s and NDAAAs. Congress was supportive, and the FY95 Defense Bill formally approved the claims settlement.

Turnaround

Despite the moratorium, the C-17 met another major program milestone with the declaration of IOC Jan. 17, 1995. To many, operational missions throughout 1994 and 1995, which took the C-17 around the world, indicated that despite problems with the program, the plane was very reliable and capable of living up to its strategic and tactical roles. However, meeting Army requirements for formation airdrops and dirt strip landings were especially long in resolution.

part of McDonnell Douglas corporate management to meet contract requirements, particularly schedule, specifications, and testing requirements, the C-17 program cannot be continued.”

Deutch requested that McDonnell Douglas, the Air Force, and the Defense Plant Representative Onsite take corrective actions with regard to the operation of the program and its financial management.

Based on extensive reviews, Deutch announced in December 1993 that 40 C-17s would be built, but that DoD would halt the program if McDonnell Douglas did not improve it within two years. Ultimately, a November 1995 Defense Acquisition Board review would decide the program's fate.

Deutch's announcement contained several provisions. It continued the program for two years at a production rate of six aircraft per year and effectively placed the C-17 and McDonnell Douglas on

In addition to the C-17's operational performance, the results of another mobility requirements study and the SAFMA seemed to bode well for the pending DAB decision. In 1995, an Update of the 1992 Mobility Requirements Study, which incorporated the Clinton Administration's "Bottom Up Review" of national defense, validated to Congress a strategic airlift requirement between 49.4 – 51.8 MTM/D to support two nearly simultaneous major regional contingencies. This equated to a need for 120 – 140 C-17 equivalent aircraft. Since the C-5 was not the equivalent, but rather an alternative to the C-17, this study seemed to portend a favorable C-17 decision. A subsequent examination of the Mobility Requirements Study Bottom Up Review Update in 1996 revised the requirement to 49.7 MTM/D. (Fifteen years earlier, the CMMS had settled on a fiscally constrained airlift requirement of 66 MTM/D.)

As for the SAFMA, while a mix of 86 C-17s and 30 C-33s (a modified 747-400)

was the most cost-effective option in achieving the MTM/D goal, it did not provide for strategic brigade airdrop, intratheater airlift operations, or lesser regional contingencies that focused on peace enforcement. The SAFMA study concluded, "There is no existing substitute for the C-17 if that program is cancelled. There are no combinations of C-5Ds and/or C-33s that can provide the equivalent of 120 C-17s (or certainly not 140 C-17 equivalents)."

Convening at the end of 1995, the DAB, under the chairmanship of Dr. Paul Kaminski, Under Secretary of Defense for Acquisition and Technology, considered solutions to the strategic airlift MTM/D requirement. Before the board was the decision to purchase additional C-17s or combinations of C-17s and NDAA aircraft. Deputy Secretary of Defense John White announced Nov. 3, 1995, the DAB's decision to purchase a total of 120 C-17s.

Logic

The DAB regarded the C-17 as best providing the greatest amount of flexibility in meeting the strategic airlift requirements. Maximum [aircraft] on the Ground (MOG), along with austere and outsize capabilities were critical considerations. McDonnell Douglas' program improvement was another key consideration. Since the end of June 1994, all aircraft deliveries were ahead of schedule. Further, it did not make sense to procure the commercial NDAA (C-33), as 18 C-33s would deliver about a fifth of what the CRAF could at a comparable or slightly higher cost. Nor did the C-5 prove to be a cost-effective option.

The Nov. 3, 1995, Defense Acquisition Decision Memorandum directed the Air Force to develop and analyze a multi-year procurement alternative for the C-17 program. With congressional approval, the Air Force signed contracts with McDonnell Douglas Corporation and its subcontractors May 31, 1996, to buy 80 C-17s over seven years. These ac-

tions signified that the major acquisition hurdles of the C-17 had been successfully surmounted. America, at last, had a new transport well suited for the airlift tasks leading into the 21st century.

Five Maxims to Live By

Maxim No. 1: Weapon system programs cannot succeed without consensus and astute, visionary leaders.

Congress, DoD, Air Force, and the Services must come to a consensus and continually support a program or mutually decide to alter/terminate it. In the case of the C-17, the program and the contractor were essentially held in limbo year to year. Only on the brink of cancellation was a consensus reached. Such consensus could serve as the basis for future successful programs, but agreement is necessary at the inception of a program. Moreover, future programs require astute, visionary leadership — lead-

ership that **determines** early on a program's stakeholders, support base, mission roles, and costs; that **expects** and **surmounts** delays, highs and lows in funding, requirement changes, intense lobbying, alternative proposals, cutting criticism, and extensive reviews; and that **fosters** professionalism, honesty, openness, and communication. What leaders certify or validate must be based upon integrity and soundness of judgement. The challenge is great.

Maxim No. 2: Expect and prepare for world order/national security changes.

It took nearly a decade-and-a-half to field the C-17 during four presidential administrations. Each administration had its own agenda. While the program experienced the lean years during the Carter Administration, Reagan's buildup of defense spending made the C-17 a long-term solution to the airlift shortfall.

The collapse of the Soviet Union ushered in a New World order, and the national security strategy shifted from thwarting a Soviet-led Warsaw Pact invasion of Europe to responding to regional conflicts around the globe. During Bush's and Clinton's tenures, strategic airlift mobility requirements went from attaining a wartime capability of 66 MTM/D, which justified 210 C-17s, to 49.7 MTM/D — roughly a 25-percent reduction. The United States also got involved in a major conflict in Southwest Asia. The Gulf War brought about a renewed ap-

preciation of airlift's reach and rapid responsiveness. The C-17's direct delivery concept enabled it to adjust well to the new requirements, as proven in military operations in Bosnia and Kosovo. And during the C-17's gestation, the U.S. Air Force underwent the most extensive reorganization since its inception in 1947, resulting in strategic airlift giving way to the rapid global reach of airlifters and tankers working in tandem.

Will future weapon systems face similar circumstances? It is highly probable. Substantiating this view are examples of



Maxim No.

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Guard against negative cause and effect exchanges. Once born, they take on ugly, counterproductive lives of their own.

the C-5 and C-141 transports. Both became operational during the Vietnam War and then endured lean flying years as a massive post-war drawdown and reorganization of resources and mobility requirements followed.

Maxim No. 3: What can be managed should be; otherwise, bear the consequences.

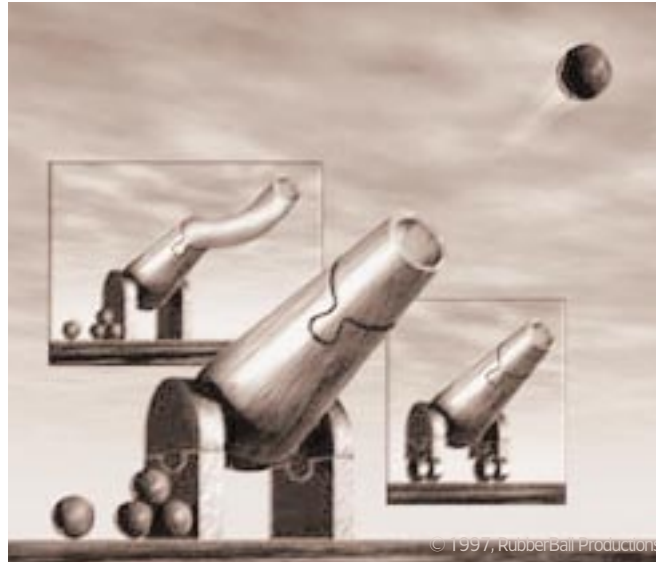
At first, congressional support was lacking, which stalled the program's progress. Nor was funding forthcoming. OSD and Air Force also differed on what was desired before and after source selection, making the program easy prey to its competitors and powerful legislators. Initially, mobility requirements for airlift had not been quantified. The escalation of costs exposed the program to cancellation and alternative aircraft. Reactive adversarial relationships developed when the contractor failed to perform as required, robbing the program of efficiencies and hampering positive solutions. Thus, bearing the consequences meant the C-17's IOC date changed at least seven times, resulting in a delay of some eight years.

Maxim No. 4: Guard against negative cause and effect exchanges. Once initiated, they take on counterproductive lives of their own.

Acquisition programs can fall prey to a cause and effect merry-go-round. From the beginning, the C-17 program became trapped in such a cycle. Air Force and OSD indecision caused Congress to limit funding; as a result, limited funding caused the Air Force and OSD to propose a short-term (C-5B and KC-10) and a long-term (C-17) solution. The short-term solution delayed the long-term solution. Delay (and limited funding) laid the groundwork for contractor engineering and development problems, which caused ... Get the picture?

In order for the C-17 program to "get well," the vicious cycle needed to stop, which proved difficult, at best. In 1992, Air Force officials realized the program

Maxim No.
5
Design weapon systems with the flexibility to grow and adapt.



could no longer continue in its current state; Air Force desperately needed Congress to fund the program at adequate production rates. By this time, Congress' ingrained tendency was to cut funding. Yet, for McDonnell Douglas to improve, the program required adequate funding of production rates.

Maxim No. 5: Design weapon systems with the flexibility to grow and adapt.

Although doctrine, tactics, and national strategy will always accommodate change faster than a weapon system, incorporating an eye toward change within the design of a weapon system is necessary. Doing so gives a little extra return on a huge investment that will stay in service for over 30 years. The C-141 and the C-5 illustrate this point.

In the decades since the introduction of these aircraft, their mission requirements have evolved. Special operations low-level requirements, fuselage stretching, and air refueling modifications to the C-

141 are examples. Already, C-17 designers had no choice but to adjust to the weight growth of the Army's combat-configured tank and the changeover from Jeeps to High Mobility Multipurpose Wheeled Vehicles. And the C-17 has added airlift defensive systems for a more forward, threat-filled role. The changeover from single-row to dual-row airdrop within its first years of operations also speaks to the need for the flexibility to grow and adapt.

McDonnell Douglas, now Boeing [the two companies merged in 1997], has even proposed a "stretched" C-17 as well as a tanker version, and has resolved range limitations by offering a modification, which adds a fuel tank in the center wing structure.

It might also behoove the air mobility community to be a bit more proactive by initiating ongoing research and development for all kinds of items as well as the systems on airlift and air refueling aircraft, developing, for instance, troop

seats ahead of an aircraft acquisition program or standardizing the placement of switches to prevent inadvertent discharges. Having the flexibility to accommodate software growth remains unquestionable. Both the C-17 and the C-130J have faced this issue as new weapons systems. Recently, a need has emerged to meet the International Civil Aviation Organization's and the Federal Aviation Administration's air navigation requirements (Global Air Traffic Management), requiring the C-17 to plan for communication, navigation, and surveillance modifications.

While some aspects of the C-17's troubled acquisition were unforeseeable, others could have been better managed from inception. Quite simply, the ducks — make it airplanes — should have been lined up.

Editor's Note: The author welcomes questions or comments on this article. Contact her at Betty.Kennedy@scott.af.mil.