C-17 AIRLIFT AIRCRAFT

Air Force ACAT IC Program		**Prime Contractor**
Total Number of Systems:	134	Boeing
Total Program Cost (TY$):	$41,185M	
Average Unit Cost (TY$):	$343M	
Full-rate production:	1QFY96	

SYSTEM DESCRIPTION & CONTRIBUTION TO JOINT VISION 2010

The C-17 is a four-engine turbofan aircraft capable of airlifting large payloads over intercontinental ranges without refueling. It is intended to allow delivery of outsize combat cargo and equipment directly into austere airfields. The C-17 is required to deliver passengers and cargo over intercontinental distances, provide theater and strategic airlift in both airland and airdrop modes, and augment aeromedical evacuation and special operations missions.

Significant features of the C-17 include: supercritical wing design and winglets to reduce drag, in-flight refueling capability, externally blown flap configuration, direct lift control spoilers and high impact landing gear system, a forward and upward thrust reverser system that provides backup capability, a cargo handling system that permit operation by a single loadmaster, a two-person cockpit, and maximum use of built-in test features to reduce maintenance troubleshooting times.

The C-17 supports the ***Joint Vision 2010*** operational concept of ***focused logistics***.

BACKGROUND INFORMATION

IOT&E of the C-17 was conducted in four phases from May 1992-June 1995. Based upon results of IOT&E and live fire testing, DOT&E submitted an Operational and Live Fire Test and Evaluation Report (B-LRIP) to Congress in November 1995. The report assessed the operational effectiveness and suitability of the aircraft to conduct operational missions within the context of the existing airlift system. The C-17 was judged to be operationally effective (with limitations) and operationally suitable. Survivability was not sufficiently evaluated to make an assessment. A full-rate production decision, Milestone IIIB, was made in November 1995.

A three-year initial period of FOT&E commenced in June 1996. It was conducted by the Air Mobility Command (AMC), with management by the Headquarters Test and Evaluation Directorate, Scott AFB, IL, and test execution by the Air Mobility Warfare Center's Flight Test Squadron (33 FLTS) at McGuire AFB, NJ, utilizing a detachment (Det 1) stationed at the test location, Charleston AFB, SC. The primary FOT&E objectives included completing tests deferred from IOT&E tests, developing and refining employment procedures and tactics, and addressing IOT&E deficiencies.

A major observation from IOT&E cited deficiencies associated with personnel airdrop, including equipment and procedural shortcomings. Specific areas requiring further evaluation during FOT&E included exit rate for static line personnel drops, combination paratrooper and bundle drops, and development/refinement of personnel airdrop formations.

TEST & EVALUATION ACTIVITY

Initial FOT&E, which commenced in FY96, concluded in FY99. Continuing OT&E will be needed. Similarly, future DT&E continues at Edwards AFB, focusing on aircraft modifications and upgrades.

Approximately 90 percent (123 of 136) of items identified in IOT&E have been closed. This includes "deficiencies" (did not meet Operational Requirements Document (ORD) requirement), "inadequacies" (qualitative assessment that failed), "recommendations" (met criteria but had problems which could be improved), and "deferrals" (test not accomplished during IOT&E). Although all deficiency items are considered closed, fault isolation procedures/manuals and built-in test equipment are inadequate.

Significant IOT&E items satisfactorily addressed and closed include the 40 bundle container delivery system drops and cargo compartment temperature gradients.

Other high visibility FOT&E items still in progress include the determination of adequate formation element spacing for strategic brigade airdrop and improvements to the on-board inert-gas generating system. Strategic brigade airdrop testing was postponed earlier this year due to operational requirements. Testing is now ongoing and will culminate with a six ship formation paratroop airdrop in December 1999.

The C-17 passed the 100,000 flight-hour mark in 1998. A draft report addressing reliability, maintainability and availability (RM&A) performance was released in May 1999. The final AMC report should be released in December 1999. Preliminary results indicate that all RM&A measures are meeting requirements with the exception of the Mission Capable (MC) and Fully Mission Capable (FMC)

measures. Results of both measures, presented as a range of monthly averages over three different measurement periods, are shown below, together with standards from the 1993 ORD and the 1998 ORD.

C-17 Flight-Hour Mission Capable (MC) and Fully Mission Capable (FMC) Rates

Measured Values

	Jun 93–Aug 95	Sep 95–Aug 97	Sep 97–Sep 99
MC	30.5-83.5%	75.7-93.0%	81.7-91.1-%
FMC	0-74.4%	7.8-75.0%	41.6-71.5%

Standards

	1993 ORD	1998 ORD	AMC FY98 Standards
MC	82.5%	90.0%	87.5%
FMC	74.7%	80.0%	77.5%

Notes:
Standards for MC are "threshold" (minimum acceptable) values while FMC standards are deemed "objective" values (goals).

Actual values for MC surpassed the 100,000 flight-hour standard specified in 1993; however, the standards were increased in the 1998 ORD when it was felt that higher rates were attainable. The MC rate hovered at approximately 90 percent in 1997 before spare shortfalls and other difficulties caused it to drop. The measures for FMC, although all well below the 1993 and 1998 ORD objectives, have been trending upward. FMC is primarily being impacted by the Head-Up-Display (HUD) and the on-board inert gas generating system (OBIGGS), which provides inert gas to the empty space within the aircraft fuel tanks. Extensive downtime was due to a lack of equipment to re-boresight and realign HUD mounting trays to correct the problem. A HUD alignment program is in work and is scheduled to be completed in January 2000. OBIGGS upgrades are improving reliability, but are also causing long downtimes awaiting improved parts. An OBIGGS improvement program is scheduled for FY00.

Additional OT&E and subsequent report preparation was transferred to the 33 FLTS at McGuire AFB, AMC's parent test organization.

Ongoing DT&E will continue at Edwards AFB under the heading of the follow-on flight test program (FOFTP). This effort is budgeted to continue through FY08. AFOTEC-Det 5 at Edwards AFB will maintain involvement through ongoing communication with the Program Office and the C-17 Test Team resident at Edwards AFB.

TEST & EVALUATION ASSESSMENT

Upon conclusion of FOT&E, nearly all items (deficiencies, inadequacies, recommendations and deferred tests) identified during IOT&E are expected to be closed. The most highly visible challenge currently facing the program is the effort to reduce strategic brigade airdrop formation spacing and subsequent drop zone pass time. The current 40,000-foot formation element spacing was established based upon the criteria of no allowable paratrooper interactions while under canopy. A model developed by the Air Force Institute of Technology (AFIT), to simulate vortices behind formation aircraft and predict paratrooper interactions, has facilitated convergence on an acceptable formation spacing with an

acceptable interaction probability. The U.S. Air Force and U.S. Army developed a test plan to evaluate spacing, and test started in January 1999 at 28,000 feet spacing between aircraft formation elements. Interactions at this spacing, although within model predictions, were judged to be more severe than Army evaluators expected. The element spacing was moved to 32,000 feet spacing and limited data was collected before testing was deferred to December 1999 due to operational needs. Some DOT&E concern still exists regarding the fidelity of the AFIT model and the quality of the data used to support the model. Data from over 3,000 mannequin drops have been analyzed; however, the majority of the data has been qualitative data collected via observation. Very limited vortex mapping data has been collected.

An additional concern discovered during recent testing may also impact Strategic Brigade Airdrop. The apparent limited ability to perform simultaneous dual-row airdrops (release of two rows of cargo positioned side-by-side in the aircraft) necessitates a sequential release of special 88-inch wide by 16-foot long platforms to prevent collisions of the cargo platforms in the air. The resultant effect is an increase in delivery time and required drop zone length; however, the number of aircraft required to drop equipment has been significantly reduced. The overall effect on strategic brigade airdrop execution time is impacted by both the dual-row airdrop and the reduced element spacing.

The Program Office is developing a new TEMP that will address continuing flight tests, particularly the Follow-On Flight Test Program at Edwards AFB and continued operational testing by the 33 FLTS at McGuire AFB. The current TEMP was approved in 1995 and contained substantial information on FOT&E. The 1995 TEMP is being updated to better address FOFTP at Edwards AFB and operational testing by the 33 FLTS. In addition, an updated OT test plan will be submitted. The updated plan will focus on the transfer of OT management responsibility to the 33 FLTS and planned testing for the next four years in greater detail.

Challenges to developmental and operational flight testing in 2000 and beyond include constraints to individual project budgets, test resources, and aircraft availability for test. Only a single dedicated aircraft exists for developmental flight testing. Requests for flight test time on operational aircraft are in stiff competition with high operational mission demands. These challenges may affect the amount of testing conducted for aircraft modification and upgrade.