

C-130J AIRLIFT AIRCRAFT



Air Force ACAT IC Program

Total Number of Systems:	37
Total Program Cost (TY\$):	\$3178M
Average Unit Cost (TY\$):	\$85.6M
Full-rate production:	N/A

Prime Contractor

Lockheed Martin Aeronautical Systems

SYSTEM DESCRIPTION & CONTRIBUTION TO JOINT VISION 2010

The C-130J Hercules II is a medium-range, tactical airlift aircraft designed primarily for the transport of cargo and personnel within a theater of operations. The cargo area must be adaptable to accommodate a combination of passenger, cargo, and/or aeromedical airlift missions. Variants of the C-130J will perform missions such as psychological operations (EC-130J), weather reconnaissance (WC-130J), and aerial refueling (KC-130J).

The C-130J retains many structural characteristics of the C-130H, having the same overall interior/exterior dimensions. However, the C-130J is more than 70 percent unique, relative to previous models. Significant differences include an advanced integrated digital avionics system, a redesigned flight station intended to facilitate a two-person cockpit, a new propulsion system providing improved takeoff, climb and cruise performance, and cargo compartment enhancements.

The C-130J supports the concept of *focused logistics* for *Joint Vision 2010*.

BACKGROUND INFORMATION

The C-130J aircraft is a contractor-initiated substitute for the C-130H-3. Creation of a C-130J acquisition program was directed to provide the United States Air Force oversight of aircraft development. The C-130J aircraft procurement is proceeding under a commercial acquisition strategy.

Contractor DT&E commenced in spring 1996 and will continue through CY00. DT&E has focused on the satisfaction of aircraft requirements defined in the model specification. Government qualification test and evaluation (QT&E) has occurred in two formats. Initially, it evaluated designated military utility issues at Edwards AFB in March 1998. Subsequently, a Follow-On Test Program was established by the Air Force to permit evaluation of incremental development progress as well as formation airdrop, the towed-parachute retrieval system, defensive systems, and survivability. These additional tests will be conducted prior to the commencement of each phase of qualification operational test and evaluation (QOT&E).

DOT&E and the Assistant Secretary of the Air Force agreed, in March 1998, to execute a LFT&E program that addresses wing dry bay fire, composite propeller ballistic vulnerability, wing fuel tank hydrodynamic ram, engine and engine bay fire, vulnerability to man-portable air defense systems threats, and mission abort vulnerability. The agreement established a joint DOT&E/Air Force C-130J LFT&E program that takes advantage of testing and evaluation under both the DOT&E funded Joint Live Fire (JLF) program for the C-130E/H and the Air Force funded C-130J vulnerability reduction program.

A TEMP, submitted for approval in January 1996, was returned to the Air Force disapproved. The operational test program that it defined was not executable because of inadequate funding and the LFT&E program was deemed insufficient. A revised TEMP was submitted and approved by OSD in July 1999.

TEST & EVALUATION ACTIVITY

The Federal Aviation Administration (FAA) awarded Lockheed Martin a type certificate for a civilian version of the C-130J-30 aircraft (a stretch model designated as the 382J, which currently exists only on paper) on September 9, 1998. However, significant C-130J military requirements are not included in the certification. This necessitates additional testing by the Air Force.

In August 1999, the Air Force Flight Test Center completed QT&E of mission computer software version 5.1. This software enables numerous basic airland functions, excluding assault landings and unimproved runway operations. Qualification tests for versions 5.2 and 5.3 are tentatively scheduled to start in January 2000 and October 2000, respectively. Operational testing will follow QT&E by two to four months in each case.

On September 16, 1999, the Program Executive Officer for Airlift and Trainers certified the C-130J as ready to commence Phase 1A (basic airland) QOT&E with limitations. The AFOTEC Commander reviewed that certification plus the analyses and recommendations of his staff before concurring with the recommendation to start QOT&E. The Director of Operational Test and Evaluation

considered total developmental progress as well as AFOTEC's three-phase OT program before approving the recommendations to proceed. QOT&E will start in November 1999.

Wing dry bay fire testing (Phase I) has been the focus of 1999 LFT&E activities. Wing leading edge dry bay (Phase IA), engine area dry bay (Phase IB), and wing trailing edge dry bay (Phase IC) tests were completed. The Air Force designed, manufactured, and tested replicas of the dry bays and surrounding structure. Baseline tests were conducted on the replicas to ensure that fires were consistently ignited in the dry bays. C-130H production wings, which are structurally similar to C-130J wings, were then tested to verify replica test article results. A series of tests was then conducted to determine the amount of agent required to successfully extinguish fires in the various dry bays. Pentafluoroethane (HFC-125) and solid propellant gas generators (SPGG) were the fire-extinguishing agents tested.

The Air Force conducted pre-test analyses using the WINFIRE dry bay fire model to estimate the vulnerability of unprotected dry bays. They used the formula developed during the Halon Replacement Program for Aviation to estimate amount of agent required to extinguish the fires. A bracketing procedure based on the success or failure of the estimated mass of extinguishing agent was then used to optimize required agent.

TEST & EVALUATION ASSESSMENT

Major issues confronting the C-130J program have included contractor logistics funding; delayed FAA certification; hardware, software, and technical order deficiencies; and parallel development of numerous variants to the basic platform.

These issues will continue to affect the program as it begins operational testing and concurrent delivery of selected users' aircraft. Operational capabilities will be limited for the immediate future.

The overriding shortfall has been in software development and integration. A second-critical issue impacting both OT&E and user implementation has been the lack of funding for logistics support. These logistics shortfalls will likely render the C-130J "not operationally supportable." Interim contractor support, repairable items, logistics and maintenance data, and maintenance training will all be degraded. Although logistics received additional funding in FY99, the funds needed for FY01 have not been budgeted.

Numerous aircraft deficiencies were discovered during QT&E. Multiple software anomalies within the communication/navigation/identification computer, affecting both logic and integration, are impacting navigation and automatic (hands-off) airdrop, while a paratroop retrieval system hardware limitation is limiting the capability to retrieve hung jumpers. Lack of a continuous sideslip indicator has also been a problem.

The ongoing identification of deficiencies, as well as the extent and timeliness of corrective action implementation, is a concern during QOT&E. In light of the numerous deficiencies reported by government and contractor testers, three major upgrade phases involving hardware and software are planned by Lockheed Martin to bring the aircraft into system specification compliance. These upgrades will address more than 50 deficiencies, with precedence given to the most critical deficiencies where possible. Upgrades will be phased in through the fall of 2000. The relevance and potential impact of these deficiencies are being assessed throughout the first phase of QOT&E and subsequent phases.

The C-130J TEMP was approved by DOT&E on July 29, 1999. The delay in developing a comprehensive test strategy was due, in part, to the uncertain program structure and deployment objectives. The operational test programs to examine the C-130J variant configurations (WC-130J, EC-130J, and KC-130J) and the associated missions beyond the basic combat delivery aircraft are currently under development and review. The WC-130 TEMP is in final draft.

The Air Force is preparing detailed reports on Phase I testing. Preliminary evaluation of results indicates that wing dry bay vulnerabilities exist in the C-130J and that fire-extinguishing systems using reasonable masses of HFC-125 or SPGG can be designed to alleviate these vulnerabilities.

CONCLUSIONS, RECOMMENDATIONS, LESSONS LEARNED

From 1996-1999, AFOTEC has played a significant role in improving the C-130J for military use, exhibiting tremendous influence during its three-year presence at the Lockheed Martin factory. AFOTEC maintained the only continuous Air Force presence at Lockheed Martin. Their pilots, loadmasters, maintainers, and analysts offered operational insights, explained military functionality, and interpreted mission tasks in a manner beneficial to the contractor and government without being directive. AFOTEC repeatedly demonstrated the benefits of early OT involvement in a program, well before the concepts or designs were formalized or finalized. AFOTEC has moved to Keesler AFB where QOT&E will be conducted.

Ballistic testing of the C-130J wing dry bays has shown them to be extremely vulnerable to realistic threats, however at the same time, although not planned for production design, gas generators (SPGG) have proven to be highly effective in extinguishing fuel fires resulting from ballistic impact.

Preliminary results of LFT&E indicate that identified C-130J wing dry bays are vulnerable to expected threats and that an SPGG system could be designed to effectively extinguish ballistically induced dry bay fuel fires. Careful consideration should be given to installing SPGGs for dry bay protection to reduce identified vulnerabilities.