National Transportation Safety Board
Aviation Accident Final Report

Location:	Walker, CA	**Accident Number:**	LAX02GA201
Date & Time:	06/17/2002, 1445 PDT	**Registration:**	N130HP
Aircraft:	Lockheed C-130A	**Aircraft Damage:**	Destroyed
Defining Event:		**Injuries:**	3 Fatal
Flight Conducted Under:	Public Aircraft		

Analysis

The airplane was making a fire retardant drop over a mountain drainage valley when the wings separated from the fuselage. A videotape of the accident sequence showed the airplane as it flew down the valley and proceeded to make a fire retardant drop. When the drop was almost completed, the airplane's nose began moving up, and the airplane started to arrest its descent and level out. The nose of the airplane continued to rise, and the airplane's wings folded upward until they detached from the fuselage at the center wing box beam-to-fuselage attachment location. Close examination of the video revealed that the right wing folded upward first, followed by the left wing about 1 second later. Metallurgical examination of the center wing box lower skin revealed a 12-inch long fatigue crack on the lower surface of the right wing beneath the forward doubler, with two separate fatigue crack initiation sites at stringer attachment rivet holes (which join the external doubler and the internal stringers to the lower skin panel). The cracks from both initiation sites eventually linked up to create a single crack. The portion of the wing skin containing the fatigue crack was covered by a manufacturer-installed doubler, which would have hidden the crack from view and, therefore, prevented detection of the crack from a visual inspection of the exterior of the airplane. The investigation found that the airplane was probably operated within the maximum takeoff gross weight limits specified in the airplane flight manual. The airplane was delivered new to the U.S. Air Force (USAF) in 1957 and was retired from military service in 1978. The U.S. Forest Service (USFS) acquired it from the USAF in 1988 for use as a fire suppression tanker. Between 1978 and 1988, it was kept in a desert storage facility. It was transferred to a civilian contractor for firefighting operations and modified for that role, then sold to a Part 135 operator. The airplane was certificated by the FAA in the restricted category under a type certificate held by the USFS. A Lockheed study concluded that firefighting missions were substantially more severe than typical military logistics operations and aircraft operated in this role would require inspection intervals as much as 12 times more frequently than typical military transport usage for meeting damage tolerance requirements. Concerning the detectability of the cracks, Lockheed reported that nondestructive x-ray inspection methods in current industry and military depot level maintenance processes could have detected, with high confidence, the fatigue cracks when they were 0.50 to 0.75 inch long. Inspection intervals appropriate for this detectable crack size can be determined from a damage tolerance crack

growth analysis; however, this requires an extensive knowledge of the operational loads environment and internal stresses of the C-130A wing such as would be found in a military depot level maintenance program. The operating limitations accompanying the restricted certificate specified that it be flown and maintained in accordance with the then-current (1988) USAF technical orders for the C-130A. The USAF depot level maintenance program was not included in the maintenance technical orders and was not individually specified on the certificate's operating limitations. The limitations letter did not specify compliance with USAF maintenance program modifications/amendments in technical orders issued after 1988. The operator devised a maintenance and inspection program based on the specified USAF maintenance technical order but did not develop a depot level inspection requirement to ensure continued long-term airworthiness and damage tolerance that would account for the stresses on the airplane resulting from its new firefighting role and the increasing age of the airplanes. Investigation found that there are five separate FAA-issued type certificates owned by five separate firms for the C-130As used as tankers. Although the five certificates have similar maintenance requirements, none are standardized, there is no depot level maintenance program specified for any of them, and none require full compliance with all military airworthiness technical orders. In 1991, the Department of Interior (DOI) began to doubt the continued airworthiness of the C-130A firefighting tanker fleet and was specifically concerned that the lack of a depot level maintenance program or any requirement for compliance with all military airworthiness technical orders could compromise the safety of the airplane. The DOI asked the FAA to standardize the type certificate for the C-130A and mandate improvements in the maintenance and inspection requirements. In a written opinion, the USAF agreed and urged the FAA to mandate that operators establish a depot level type continuing airworthiness program for the airplane and mandate compliance with all technical orders. In a series of meetings held in 1993, FAA management internally agreed that the DOI and USAF positions held merit and began to develop requirements. In late 1993, in a meeting between the FAA, DOI, USFS, and the airplane operators, the USFS and the operators objected to the idea of depot level maintenance programs and full compliance with all technical orders on the basis of the potential economic impact of these requirements. As of the time of the accident, the FAA had not standardized the existing five type certificates nor had they imposed any additional maintenance or inspection program requirements.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: the inflight failure of the right wing due to fatigue cracking in the center wing lower skin and underlying structural members. A factor contributing to the accident was inadequate maintenance procedures to detect fatigue cracking.

Findings

Occurrence #1: AIRFRAME/COMPONENT/SYSTEM FAILURE/MALFUNCTION
Phase of Operation: MANEUVERING - AERIAL APPLICATION

Findings
1. WING - FAILURE,TOTAL
2. (C) WING,SPAR - FATIGUE
3. (C) WING,SKIN - FATIGUE
4. (F) MAINTENANCE,INSPECTION - INADEQUATE - COMPANY/OPERATOR MANAGEMENT

Occurrence #2: IN FLIGHT COLLISION WITH TERRAIN/WATER
Phase of Operation: DESCENT - UNCONTROLLED

Findings
5. AIRCRAFT CONTROL - NOT POSSIBLE

Occurrence #3: IN FLIGHT COLLISION WITH TERRAIN/WATER
Phase of Operation: DESCENT - UNCONTROLLED

Findings
6. TERRAIN CONDITION - MOUNTAINOUS/HILLY

Factual Information

HISTORY OF FLIGHT

On June 17, 2002, about 1445 Pacific daylight time, a Lockheed C-130A, N130HP, broke apart in flight while executing a fire retardant delivery near Walker, California. The airplane was registered to Hawkins and Powers Aviation, Inc., Greybull, Wyoming, and operated by the Department of Agriculture (USDA), US Forestry Service (USFS) under 14 CFR Part 91 for the public-use firefighting flight. The three flight crewmembers were fatally injured and the airplane was destroyed. Visual meteorological conditions prevailed, and a company flight plan had been filed. The airplane had departed Minden, Nevada, about 1429, to participate in firefighting efforts near Walker.

The accident flight started with the airplane, using the call sign tanker T130, at the Minden Air Tanker Base for loading of fire retardant. According to the relevant Minden Air Tanker Dispatch/Flight Record sheet, tanker T130 was loaded with 3,000 gallons of fire retardant but no fuel was added. The airplane departed Minden at 1429, for its sixth drop of the day, and proceeded directly to the Cannon Fire located adjacent to Walker. Although the aircrew of tanker T130 had already made five previous drops on a north to south axis the day of the accident, the sixth drop was to be their first run on an east/west course. Prior to the run, tanker T130 made a pass over the drop area in the direction of the intended drop. The intended run required a course heading of approximately 90 degrees over and perpendicular to a ridgeline and down a steep drainage valley.

A witness to the accident videotaped the accident sequence starting with T130 at the top of the ridgeline to a point after the wings had separated from the airplane. The following account of the accident sequence is based on the video footage. Tanker T130 flew down the east side of the drainage valley and proceeded to make a ½ salvo fire retardant drop. Just prior to the completion of the drop, the nose of the airplane appeared to rise and the airplane started to initially arrest its descent and to level out. The nose of the airplane then continued to rise towards a nose up attitude and almost at the completion of the ½ salvo fire retardant drop, the airplane's wings folded upwards and detached from the fuselage at the center wing box beam-to-fuselage attachment location. Close examination of the video revealed that the right wing folded upwards first followed slightly less than 1 second later by the left wing. After the wings separated, the fuselage continued to travel in the direction of the intended flight path, the nose pitched down, and the fuselage rolled to the right (clockwise) becoming inverted until the airplane was out of camera shot.

Subsequent examination of the wreckage and the right wing disclosed evidence of fatigue cracks in the right wing's lower surface skin panel, with origins beneath the forward doubler at Center Wing Station (CWS) 53R at the stringers 16 and 17 location. The origin points were determined to be in rivet holes, which join the external doubler and the internal stringers to the lower skin panel. These cracks, which grew together to about a 12-inch length, were found to have propagated past the area where they would have been covered by the doubler and into the stringers beneath the doubler and across the lap joint between the middle skin panel and the forward skin panel.

PERSONNEL INFORMATION

First Pilot Information

The pilot held an airline transport pilot certificate with single and multiengine land airplane ratings, rotorcraft helicopter and gliders limited to aero tow. His certificate was endorsed with type ratings for DC-6, DC-7, CY-P4Y, FA-119C, DC-826, L P2V, L-382 (the civil version of the C-130E). His most recent second-class medical certificate was issued on March 12, 2002, and contained no limitations. He also held a flight engineer certificate for turbo propeller powered airplanes and was a certificated airframe and powerplant technician. According to the Forestry Service Airplane Pilot Qualification and Approval Record, dated March 30, 2002, the pilot had recorded a total flight time of 10,833 hours, with 130 hours in the last 12 months. He was approved to fly C130A, P2V, and PB4Y2 aircraft. The form lists 1,790, 915, and 1,450 hours in the approved aircraft as listed. The pilot's last documented biennial flight review occurred on March 30, 2002, in a C130.

Copilot Information

The copilot held an airline transport pilot certificate with a multiengine airplane land rating. He also held certificates as an advanced ground instructor, an airframe and powerplant technician, and a flight engineer with a rating for turbo propeller powered airplanes. His certificate was endorsed with a type rating in the L-382, the civil version of the C-130E model. The copilot's most recent second-class medical certificate was issued January 23, 2002, and contained the limitation that corrective lenses be worn. The Forestry Service Airplane Pilot Qualifications and Approval Record, dated February 4, 2002, recorded a total flight time of 2,407 hours with 199 hours in the last 12 months. He was approved to fly the C-130, or perform the functions of a flight engineer in the C-130. The record documented 322 hours of flight time as pilot-in-command. The date of his last flight check was September 19, 2001. The copilot's last biennial flight review equivalent occurred on January 29, 2002.

Flight Engineer Information

This crewmember held a Flight Engineer certificate with ratings for jet and turbo propeller airplanes. In addition, he held a commercial pilot certificate with land airplane ratings for single engine, multiengine and instruments. He also held a Flight Instructor certificate with the same airplane ratings found on his commercial pilot certificate. Other certificates held were a ground instructor and a certificated airframe and powerplant technician.

AIRCRAFT INFORMATION

General Airplane History

The USDA Forest Service promoted the transfer of military surplus C-130A airplanes to the contract fire tanker operators in an effort to update the fleet of airtankers to an all turbine fleet. After the USDA Forest Service facilitated transfer of an airplane, it became the operator's financial responsibility to prepare the airplanes for the airtanker mission. The operators then had to competitively bid for the contract at a low enough price to be awarded a year-long contract for fire suppression missions. According to statements from Forest Service contracting specialists, the monetary element of the bid may be the most critical in getting work for the airplanes because of Forest Service budget constraints.

The accident airplane was delivered to the United States Air Force (USAF) in December 1957 as a Lockheed Aircraft Corporation C-130A Hercules, Air Force serial number 56-0538, Lockheed serial number 3146, and was retired from military service in 1978 and placed in storage at the Davis-Monthan Air Force Base near Tucson, Arizona. On May 24, 1988, the Forest Service acquired SN 56-0538, along with six other C-130A airplanes, from the General Services

Administration (GSA). According to the a GSA transfer order dated January 1988, the airplane's total time was 19,546.8 hours time since new (TSN). On August 12, 1988, the airplane was sold by the USFS to Hemet Valley Flying Service, Hemet, California, along with five other recently acquired C-130A airplanes, for installation of retardant tanks. Hemet Valley applied for a US civil registration number of N134FF for airplane SN 56-538 on July 19, 1988, and subsequently sold it to Hawkins & Powers Aviation, Inc. (H&P), on December 5, 1988.

In accordance with 14 CFR 21.53, on December 10, 1988, H&P prepared and presented to the FAA a Statement of Conformity, FAA Form 8130-9, for civil type certification of the airplane. This statement included a declaration that the aircraft, engines and propellers conformed to the type design, 14 CFR 21.33, and Type Certificate (TC) A15NM, revision 2. That same day, the company also applied to the FAA for a Special Airworthiness Certificate in the Restricted Category. On December 15, 1988, the FAA's Phoenix Manufacturing Inspection Satellite Office (MISO) issued H&P a Restricted Category Special Airworthiness Certificate in accordance with 14 CFR 21.185(b). In addition to the certificate, they also issued the accompanying Operating Limitations, which required that the airplane be operated in accordance with USAF Technical Order (T.O.) 1C-130A-1 (USAF Series C-130A airplane flight manual) and that the airplane must be serviced and maintained in compliance with USAF T.O. 1C-130A-2-1 through 1C-130A-2-13.

On December 28, 1988, H&P applied for and was granted an aircraft registration number change from N134FF to N130HP. The FAA's Helena FSDO reissued a Restricted Category Special Airworthiness certificate for the airplane for the purpose of Carriage of Cargo on August 8, 1989, with the same operating limitations.

On June 1, 1998, the FAA's Flight Standards Field Office (FSFO), Casper, Wyoming, rescinded the August 8, 1989, Restricted Category certificate and associated operating limitations and issued a new Restricted Category Special Airworthiness Certificate for the following special purpose operations: agricultural missions, forest and wildlife conservation, aerial surveys, and any other type of operation approved by the FAA. Along with the new Special Airworthiness Certificate, the FAA also issued a new Special Operating Limitation sheet, which required compliance with all the same operational, service, and maintenance required USAF T.O's as previously required, but also added a requirement that the company use a self-developed maintenance document entitled "H&P-C-130A Inspection Guide."

Airplane Operating Limitations

The FAA approved operating limitations for the airplane were based on two documents, one the original US Air Force flight manual, T.O. 1C-130A-1 (the Restricted Category certificate operating limitations required adherence to this document), and the supplemental operating limitations issued with the Supplemental Type Certificate for installation of the retardant tank and dispensing equipment. The original maximum-g load factor for the C-130A was +3.0 g/-1.0 g up to maximum level flight speed (Vh) at design gross weight (108,000 pounds); +2.0 g/-1.0 g up to maximum level flight speed (Vh) at maximum alternate gross weight (124,200 pounds). Operational limitations are defined in terms of gross weight and airspeed limits at 2.0g, 2.5g, and 3.0g missions in Figure 5-5 of T.O. 1C-130A-1. The maximum load factor on the FAA approved N130HP airplane flight manual is 2.5g based on the FAR Part 25 (25.337) and Car 4b. (4b.210) requirements. There are no structurally limiting factors for 2.5g. The maximum maneuver load factor regardless of cargo load, gross weight, or airspeed combination with any flap deployment was 2.0g; this is based upon the historical Military

Specification (C-1803-E "Stress Analysis Criteria", dated June 17, 1949), which in turn defers to CAR 4b.212. Specifically, the flight manual cautions that "The maximum maneuver load factor, regardless of cargo load, with any flap extension is 2.0g." The event aircraft wreckage evidence indicated 50 percent flap extension. The flaps on a C-130A are considered secondary structure.

Aircraft Weight and Balance

Supplemental Type Certificate (STC) SA4835NM for the fire retardant tank installation requires a supplement to the Lockheed C-130A USAF Series Flight Manual T.O. 1C-130A-1. The FAA approved supplement for Hemet Valley Flying Service, dated January 30, 1990 specifies maximum takeoff gross weight and maximum zero fuel weight limits of 120,000 and 97,000 pounds, respectively. It also specifies that 617 pounds more fuel should be maintained in each outboard tank than in each inboard tank and requires placards on each retardant tank at each fill valve emphasizing a maximum capacity of 13,650 pounds.

According to an H&P aircraft weighing record, dated June 17, 1999, the operating empty weight listed was 68,261 pounds, including unusable fuel and full oil. The most recent record is Hawkins and Powers Form #45, a weight and balance worksheet for serial #56-538 dated April 19, 2001. This worksheet contains itemized weights of 600 pounds for the 3 crew members including nominal baggage and 1,240 pounds for a flyaway kit (consisting of spare parts and other mission consumables). The operating empty weight as of April 19, 2001 was documented to be 67,928 pounds.

Records indicate that the total flight time on the day of the accident was 3 hours 9 minutes and the aircraft logged six takeoffs, each time loaded with 3000 gallons of fire retardant. The density of the fire retardant is assumed to be 9 pounds per gallon. The retardant drop in progress just prior to the event was the first of two planned salvos. Repeated inquiries as to the actual retardant dropped just prior to wing separation returned consistent estimates of 13,500 pounds.

Tanker T-130 reportedly refueled the night before the accident and did not take on any fuel on the day of the accident. The gross weight estimation assumed that 1) enough fuel was added on June 16, 2002 to bring N130HP to maximum takeoff gross weight with a full retardant load for the first flight of the day, 2) the flight manual supplement fuel management constraint of 617 pounds more fuel in each outboard tank than in each inboard tank was practiced, and 3) the outboard and inboard tank capacities were 1335 and 1190 gallons for a total fuel capacity of 5,050 gallons .

The fuel consumption rate is 730 gallons per hour, which assumes that 1 takeoff, 2 climbs, 1 drop, and 1 landing occur during a one-hour mission. On the day of the accident, N130HP averaged 34-minute missions. The additional takeoffs and the short flights may have consumed more fuel than the contract-based fuel burn rate predicts. Assuming N130HP was loaded to maximum takeoff gross weight at the first flight of the day, the maximum weight at the time of the accident was estimated at 91,553 pounds. Given 13,500 pounds of retardant remaining on board, a contract allowance of 1240 pounds for the flyaway kit, 600 pounds for nominal crew and baggage, and an operating empty weight of 67,928 pounds, the maximum fuel on board at the time of the accident was 8,285 pounds.

The maximum zero fuel weight constraint would be violated with the given operating empty weight, crew and crew baggage allowance, flyaway kit allowance, and full retardant load any

time additional spares and/or personal effects exceeded 232 pounds.

While uncertainties exist with respect to 1) the weight of personal effects, 2) the weight of spare parts compared to the flyaway kit allowance, and 3) the actual fuel burn, N130HP was operated within the maximum takeoff gross weight limits specified in the airplane flight manual, including supplements, according to Safety Board estimates.

Airplane Maintenance Records

General Maintenance

At the time of the accident, T130 had accumulated 21,863 hours time since new (TSN), 45 flight hour since last "A" check, 168 flight hours since last "B" check, and 462 flight hours since last "C" check. The last "A", "B", and "C" checks were all performed by H&P and the inspections were completed on June 17, 2002, September 1, 2001, and March 8, 2001, respectively. The total aircraft flight time at the last "A", "B", and "C" checks were 21,863 hours, 21,695 hours, and 21,401 hours respectively. The last detailed 2,400 hour inspection of the wings was completed as part of a "C" check completed on June 22, 1996, and documented on Work Order (WO) 96-0030. The total aircraft flight time at this "C" check was 20,417 flight hours.

H&P's maintenance records for both the left and right outer wings revealed that they were recently installed rehabilitated wings. The Safety Board was unable to find any documentation indicating that SN 56-538 had ever had the center wing replaced. According to H&P's Work Order (WO) 4487, dated May 20, 1998, the left-hand outer wing, SN 3093, was removed and replaced with a rehabilitated outer wing SN 3096L during a "C" check. The total aircraft flight time on T130 was 20,762 hours when the rehabilitated left-hand outer wing was installed. According to the H&P's WO 11027C, dated March 8, 2001, the right-hand outer wing, SN 3224, was removed and replaced with a rehabilitated outer wing SN 3095R during the last "C" check of T130 before the accident. The total aircraft flight time on T130 was 21,401 hours when the rehabilitated right-hand outer wing was installed. USAF Form AFTO 95 shows that the outer wings SN 3096L and 3095R were both rehabilitated on December 6, 1985, and subsequently installed on C-130A, SN 57-459, as part of a depot level maintenance event.

Center Wing Section Doubler Repairs

Review of the H&P maintenance records for documentation of the doubler repairs at CWS 61L Lower Skin and No. 2 Engine Drag Angle Location CWS 213L revealed that both repairs were performed in March 2000 due to cracks found during a scheduled maintenance check. The doubler repair in the drag angle location at CWS 213L and the lower skin repair at BL61L were listed as performed in accordance with approved FAA data on FAA Form 8110.

Center Wing Inspections

The center wing inspections that were being performed by H&P were based on inspections taken from various United States Air Force (USAF) Technical Orders (T.O.s). Review of the H&P IPG-182 and the USAF T.O. 1C-130A-36 maintenance manuals found that there was no specific inspection requirement for cracks in the fastener holes beneath the doublers located at either CWS 53L or 53R; however, several tasks were identified in both documents that provided crack inspection instructions in the general area of those doublers. These inspections called out various, visual, eddy current, and fluorescent penetrant inspections in the skin panel seams and stringers at the fastener hole locations. Further review of the manual revealed a

procedure for an x-ray inspection in the fastener holes for the doublers located outboard of CWS 61. The protocol for this inspection included having the doubler still installed on the wing, and, if cracks were detected, then the doubler would be removed and a backup eddy current inspection would be performed. For the C-130A model only, two doublers are installed on either side of BL 61L and 61R. C-130 models B and E have only those doublers located outboard of 61L and 61R. The outboard doubler inspection called for in the manual was not included in the set of center wings inspection called out in H & P IPG-182.

The inspection and maintenance programs employed by H&P were based on an established military program developed in the late 1980's when this airplane was first delivered to the Forest Service. Review of these programs revealed that they were based on the original design intent and military mission profile, and that no continuing airworthiness program had been established to determine if the current inspection and maintenance programs were appropriate and effective taking into account the increased age of the aircraft and the new low level firefighting mission.

FAA Service Difficulty Reports

A review of the FAA's Service Difficulty Report (SDR) data base for Lockheed C-130A airplanes revealed that one SDR was submitted for N130HP in April 1998. The reported difficulty was two chordwise cracks found in the lower skin at outer wing station 33. No other SDRs were submitted for N130HP and none of the fleet wide submitted C-130A SDRs documented a previous history of center wing lower surface cracking.

USFS Aviation Mishap Information System

The Aviation Management part of the Forest Service has developed a reporting system called the Aviation Mishap Information System (AMIS), which is an electronic data base encompassing all aspects of aviation mishap reporting within the Forest Service. A review of the data for the C-130A airplanes from January 1, 1988, to June 17, 2001, revealed a total of 11 entries, with two for N130HP. None of the entries were directly or indirectly related to the wings or any damage to the wings.

Type Certificate History For C-130A, SN 56-0538

In accordance with FAA regulations, H&P issued a Statement of Conformity, dated December 10, 1988, stating that SN 56-0538 conformed to Section 21.33 and to the Type Certificate (TC) A15NM, revision 2.

According to 14 CFR 21.41, a TC is considered to include the type design, the operating limitations, the certificate data sheet, the applicable regulations pertaining to records compliance, and any other conditions or limitations prescribed for the product. The Forest Service had listed SN 56-0538 on TC A15NM, revision 2 when T130 was first registered and an airworthiness certificate issued. The Safety Board was unable to obtain a copy of TC A15NM, revision 2; therefore, the date of issuance and the exact requirements outlined in the type certificate data sheet (TCDS) is unknown. However, the Operating Limitations - Restricted Category sheet that accompanied the original December 15, 1988, Airworthiness Certificate for SN 56-0538 outlined the operating, service, and maintenance requirements much like what would be listed in the TCDS. According to this operating limitations sheet, the airplane must be operated in accordance with USAF T.O. 1C-130A-1-1 flight manual and maintenance and serviced in accordance with T.Os. 1C-130A-2-1 through 1C-130A-2-13.

The TCDS applicable to SN 56-538 at the time of the accident was A15NM, revision 4. The Safety Board was unable to obtain a copy of TCDS A15NM, revision 3, to develop a chronology of changes from the original TCDS (revision 2) that SN 56-538 was certificated under. Revision 4 of TCDS A15NM states the certification basis as 14 CFR 21.25(a)(2), which pertains to aircraft that were manufactured in accordance with the requirements of, and accepted for use by, an Armed Force of the United States and has been later modified for a special purpose.

A review of TC A15NM, revision 4, revealed that there are six NOTES at the end of the TCDS. Note 1 states that aircraft approved under this TC may only be used as a fire fighting aircraft, and note 3 requires the airplane to be operated in accordance with USAF T.O. 1C-130A-1 and USAF T.O. 1C-130A-1-1 (USAF Series C-130A airplane flight manual performance index). Note 4 pertained to the continuing maintenance procedures and stated that the airplane must be maintained and serviced in accordance with USAF T.O. 1C-130A-2-1 through 1C-130A-2-13 as maintenance directives, but did not include future programs, updates, or any continuous airworthiness engineering support. The TCDS did not require the use of the USAF TO 1C-130A-6 Aircraft Scheduled Inspection and Maintenance Instruction manual for developing the appropriate inspection intervals. The Dash 6 manual provides detailed instructions on when particular parts of the aircraft require inspections (usually based on a calendar year), what type of inspections are to be performed, and what critical features are to be noted.

Supplemental Type Certificate (STC) History For C-130A, SN 56-0538

On March 26, 1990, H&P issued Major Repair and Alternation FAA Form 337, for alteration of SN 56-0538 in accordance with the requirements of Hemet Valley STC SA4835NM. Although H&P issued FAA Form 337 for the incorporation of STC SA4835NM, Hemet Valley performed the modification to SN 56-0538.

C-130A Maintenance Program

USAF C-130A Testing, Restrictions, and Inspection Program

In the late 1970's Lockheed performed a series of service life analysis tests on major components of the C-130 aircraft, one of which was the center wing and, in 1978, delivered their findings to the USAF. With respect to the C-130A center wing, three main areas were considered for analysis, each one constituting a major discontinuity in the center wing — fuselage longeron carry thru at CWS 20L/R, fuselage-to-wing joint at BL 61, and outer-to-inner wing point CWS 220. Each location was analyzed using utilization and endurance criteria in flight hours based on the then existing military mission profiles and environmental data at that time. The data gathered during the testing was considered valid only if there was no change to the future mission definitions, mission utilizations, annual flying rates, and structural status of the fleet. The results of the service life calculations were that the service life endurance point and the structural action point for the center wing were 19,384 and 11,910 flight hours respectively. The structural action point was defined as that point where 10 percent of the center wings would be expected to have major repair or replacement due to fatigue cracks and the service life endurance point was defined as that point where 50 percent of the center wings would be expected to have major repair or replacement due to fatigue cracks.

During a hydrostatic fatigue test on a C-130A fuselage, the center wing failed catastrophically at BL 61 at 13,203 cycles with an applied load of 62 percent limit design. Inspection of the failed area revealed multiple site fatigue damage in the lower skin panels in the vicinity of BL 61. The cracks ran through and/or along the lower skin doublers inboard of BL 61. Based on

these findings, Lockheed recommended that the C-130A fleet be inspected for cracks in the vicinity of WS 61 center wing lower surface with the initial inspection to be performed at 12,000 flight hours and a recurring inspection every 2,500 flight hours.

USAF Technical Order 00-25-4 addresses depot level maintenance of aircraft in the inventory and outlines the types and scope of program depot maintenance support. According to the order, depot level maintenance comprises a set of heavy inspections requiring skills, equipment, or facilities not normally possessed by operating locations. It is the highest level of maintenance performed by the military and is similar to a "C" check performed by an air carrier. It establishes procedures for scheduling aircraft for depot maintenance and is based on data from reliability centered maintenance (RCM) programs, with the objective of achieving the inherent, or designed-in, reliability of a system. The concept is a derivative of the standard civilian airline/manufacture maintenance planning documents, which incorporate Aircraft Structural Integrity Programs (ASIP) that consist of time-phased sets of required actions performed at the optimum time during the life cycle (design through phase out) of an aircraft system to ensure continued structural integrity (strength, rigidity, damage tolerance, durability and service life capability) of the aircraft.

Part of this program takes data from various in-service inspections, structural analysis of representative aircraft, fatigue and damage tolerance testing, and engineering analysis to identify critical areas for increased inspection scrutiny and/or modification or repair. Based on this data, inspection protocols and intervals are changed as necessary to reflect the evolving condition and increased maintenance needs of the airframe.

Within T.O. 00-25-4, Tables 1 and 2 lists aircraft scheduled for programmed depot maintenance (PDM) on a cyclic interval with the cycle time stated in months. The PDM interval is measured from the output date of the last PDM to the input date of the next due PDM. The USAF has changed the PDM interval for the C-130A and its variants several times throughout the model "A" history. The most recent version of T.O. 00-25-4, dated 30 June 2002, lists the PDM interval for the NC-130A airplane at 60 months, and the June 15, 1995 version has the AC-130A at 36 months.

Hawkins & Powers General C-130A Airplane Maintenance

The Operating Limitations sheet that accompanied the original Special Airworthiness Certificate for T130 back in December 1988 required that maintenance and servicing be performed in accordance with USAF T.O. 1C-130A-2-1 through 1C-130A-2-13. The latest revision to tanker T130's Operating Limitation sheet, dated June 1, 1998, required the airplane be maintained and serviced in according with the same USAF T.O. manuals as the previously issued Operating Limitations sheet and further added a requirement for the additional service and maintenance of the airplane in accordance with a company derived manual entitled "H&P-C-130A Inspection Guide". The referenced H&P-C-130A Inspection Guide is also called the "Inspection Planning Guide (IPG-182)", which was approved by the FAA Long Beach Aircraft Evaluation Group on March 22, 1995. IPG-182 for the C-130A aircraft is based on the information in USAF T.O. 1C-130A-6, Aircraft Scheduled Inspection and Maintenance Instruction. At the time of the accident, the current version of T.O. 1C-130A-6 was published 15 May 2000 (basic) with change No. 3, dated June 2002.

IPG-182 breaks the airplane inspection into three separate basic checks ("A" – "C") plus certain other special inspections. An "A" check is performed every 7-calendar days and consists of a

visual inspection of the aircraft for obvious defects, operational checks of certain systems, and security and condition of specified structure. A "B" check is performed every 300 flying hours or 12 calendar months, whichever occurs first, after a preceding "B" or "C" check, and consists of structural integrity inspections, operational checks, troubleshooting, adjustment procedures, servicing, and visual security and condition of specified structure. A "C" check is performed every 600 flying hours or 36 calendar months, whichever occurs first, after the preceding "C" check and consists of the same types of inspection performed in the "B" check, but those inspection are performed in greater detail. Also, the "C" check includes structural repairs.

IPG-182 lists the following additional USAF TO's to be used in when performing inspection and maintenance: 1C-130A-3 (Structural Repair Instructions), 1C-130A-23 (System Peculiar Corrosion Control), and 1C-130A-36 (Nondestructive Inspection Procedures). At the time of the accident, the most recent revision of the TCDS, revision 4, had not been updated to include the IPG-182 or the additional maintenance manuals called out in the IPG-182.

Hawkins and Powers C-130A Center Wing Inspections

General visual inspection of the wings occur at every check; however, detailed inspection of the wings are not covered in any particular check but are called out in section III of IPG-182, entitled Structural Inspection Program. Inspections for the wings are covered under zonal inspections 500 (left wing) and 600 (right wing). Twelve separate detailed center wing inspections are called out in the Structural Inspection Program section of IPG-182 with an inspection frequency of 2,400 flight hours or 48 months depending on the specific inspection.

The origin of the fatigue cracks found in the lower surface skin panel was determined to be beneath the forward doubler at CWS 53R at the stringers 16 and 17 location. These cracks not only propagated past the area where they would have been covered by the doubler but they also propagated into the stringers beneath the doubler and across the lap joint between the middle skin panel and the forward skin panel. Review of the IPG-182 manual and the USAF T.O. 1C-130A-36 (basic issue date of 1 December 1984, change 33 dated 30 January 2000) found that there was no unique inspection requirement for cracks in the fastener holes beneath the doublers located at either CWS 53L or 53R; however, several tasks were identified in both documents that provide crack inspection instructions in the general area of those doublers.

Inspections CW 11 and CW 21 in USAF T.O. 1C-130A-36 call for inspections of the skin panels, stringers, and lap joints. Inspection CW 11 covers all upper and lower skin panels and seams from CWS 220 left to CWS 220 right, and calls for an initial visual crack inspection using a mirror and flashlight and a confirmatory inspection if cracks are suspected using a Fluorescent Penetrant Inspection (FPI) technique. Inspection CW 21 covers the lower center wing skin panel lap joins from CWS 220 left to 220 right and calls for an eddy current inspection of the fastener holes in the skin lap areas. This inspection is performed with the fasteners still installed, with a backup visual or FPI inspection if a crack is suspected. According to the CW 21 crack inspection requirements, if a doubler exists, a scan around the edges is called out for any cracks emanating in the covered wing panel. Inspection CW 21 is specifically called out in section III of IPG-182, wings zonal 500 & 600, as inspection No. 5, while CW 11 is not addressed in the manual. Certain parts of the CW 11 inspection, such as a visual inspection of interior and exterior center wing box beam lower surface panels from BL 61l to 61R, are incorporated into the wing's zonal 500 & 600 inspection No. 8, but not all items, such as inspection of the stringers.

Further review of the USAF TO 1C-130A-36 manual revealed an inspection, CW 30, that calls out a crack inspection in the fastener holes for the doublers located outboard of CWS 61. However, for the C-130A model only, there is a set of two doublers on either side of BL 61L and 61R. Inspection CW 30 covers the left and right side lower center wing surface panels under the doublers at stations from CWS 61.5 outboard to CWS 80. The inspection provides a detailed preliminary nondestructive inspection (NDI) of the lower skin doubler, with the doubler still installed, using a portable x-ray unit. If cracks are detected using the x-ray, the doubler is removed and a backup eddy current inspection is performed. The outboard doubler inspection called for in CW 30 is not included in the set of center wings inspection called out in IPG-182.

Lockheed Service Bulletin 82-557

The C-130 models B through E had the doublers installed only outboard of BL 61L and 61R. The C-130J has no lower skin doublers at all. Lockheed issued SB 82-557 on February 27, 1985, to remove the doublers from the center wing lower surface CWS 62 to CWS68 Left/Right for the 130B/E model airplanes. The reason given in the text of the Service Bulletin was, "...a fatigue improvement modification" to remove the doublers that were "...determined to be a potential source of stress hard points..." The applicability of this Service Bulletin was to all civil model 382 versions and military versions from the C-130B to the C-130K. The C103A model was not addressed because Lockheed no longer supported this version. The USAF followed the Lockheed SB with T.O. 1C-130-1256, dated April 9, 1987, directing the same requirements outlined in the SB. The C-130A model was not addressed.

METEOROLOGICAL INFORMATION

In general, surface observations around the time of the accident indicated that the region was experiencing winds from 10 to 16 knots, with gusts above 20 knots at some locations. On average, winds were out of the west. Large dew point depressions (temperature minus dew point temperature) signified a dry atmosphere. Stations were reporting high visibilities (greater than 10 statute miles).

There were two stations located within 3 nautical miles of the accident site; a remote Automated Weather Station (RAWS), and the Coleville, California, weather station. The location of the accident and the two weather-reporting stations were not separated by any major topographical features. At 1447, the RAWS reported a temperature of 86 degrees Fahrenheit, wind speed of 13 knots, gusts to 23 knots, and the winds out of the west. The 1445 report from the Coleville station indicated a temperature of 85 degrees Fahrenheit, wind speed of 16 knots, gusts to 23 knots, and winds out of the northwest. This station also supplied surface pressure at 5-minute intervals, and during the hour preceding the accident, there was no significant pressure jumps reported. Mechanical and/or mountain wave induced turbulence and down slope winds most likely existed at the time of the accident.

WRECKAGE AND IMPACT INFORMATION

Safety Board investigators examined the wreckage at the accident location in a pasture along the east side of Highway 395, 31.47 miles east southeast of the departure point at Minden. There were two debris fields separated by a barbed wire fence. The first debris field consisted of the wings, engines, and propellers, and started 250 feet east of Highway 395. It was measured about 500 feet in length on a magnetic bearing about 090 degrees. A post accident fire consumed major portions of the wing structure and engine magnesium components. Not

all components of the right wing structure were recovered.

A second debris field, consisting of the fuselage and empennage, started about 550 feet east of Highway 395, and measured about 720 feet in length on an approximate 090-degree magnetic bearing. There was no fire damage at the second debris field. The fuselage was in a state of structural collapse and disintegration. The landing gears were scattered beyond the main wreckage and the rear drop door was separated. Most instrumentation was destroyed or displayed unreliable indications.

The center wing structure was recovered to the Marine Corps Mountain Warfare Training Camp hangar, located near Bridgeport, California. Subsequently, all wreckage was relocated to a secure storage site at Pleasant Grove, California.

MEDICAL AND PATHOLOGICAL INFORMATION

On June 18, 2002, the Mono County Medical Examiner performed an autopsy on the pilot. During the course of the procedure, the FAA Civil Aeromedical Institute in Oklahoma City, Oklahoma, obtained samples for toxicological analysis. The analyses were negative for carbon monoxide, cyanide, ethanol, and all screened drug substances. Samples were not available from the copilot or the flight engineer.

TESTS AND RESEARCH

Metallurgical Examinations

Subsequent metallurgical examination of the right wing disclosed evidence of multiple fatigue cracks in the right wing's lower surface skin panels, with origins beneath the forward doubler at Center Wing Station (CWS) 53R at the stringers 16 and 17 location. The origin points were determined to be in rivet holes, which join the external doubler and the internal stringers to the lower skin panel. These cracks, which grew together to about a 12-inch length, were found to have propagated past the area where they would have been covered by the doubler and into the stringers beneath the doubler and across the lap joint between the middle skin panel and the forward skin panel.

Chemical analysis, and conductivity and hardness measurements disclosed that the specimens met the requirements for 7075 aluminum alloy heat treated to a T6 temper. The microstructure of the respective skin and stringer specimens were consistent with the manufacturers specifications for those parts.

Safety Board Performance Study

The Safety Board conducted a performance study to in part determine the operating speed and load factor on the airplane both during the retardant drop run and at the time of wing separation. Video, photographic and other evidence was used during the study to reconstruct the performance of the vehicle. The evidence indicates that the aircraft was operating within placard speeds, but outside the maneuver load factor constraint of 2.0g with flaps deployed. The results of the performance analysis of the video and photographic evidence are consistent with the aircraft manufacturer's residual strength analysis of the normal load factor required for wing separation. The estimated load factor at the time of the wing separation was 2.4 g, based on the combined effects of the pull up maneuver and retardant release. The presence of

wind gusts or turbulence would require additional load factor corrections. The airplane was operating at 146 knots, just below it's 150-knot limit airspeed.

At the request of the Safety Board, Lockheed performed a residual strength analysis to identify the vertical load factor that would have caused the center wing lower surface to fail based on the known fatigue damage documented in the metallurgical report. Lockheed concluded from the analysis that: "The center wing failed at a load that was approximately 30 percent of the design ultimate strength of the center wing and that the presence of fatigue cracks at multiple locations and in multiple structural elements reduced the residual strength to approximately 50 percent of design limit load and compromised the fail-safe capability of the structure." The report opined that, "Failure was likely caused by a symmetric maneuver load exceeding 2.0g during the final drop of fire retardant."

Concerning the detectability of the cracks, Lockheed reported that, "Non-destructive inspection methods could have detected the existing fatigue cracks in the wing lower surface skin panel prior to this accident occurring." The company noted that a directed radiographic inspection in the area of each lower surface doubler is capable of detecting fatigue cracks in order of 0.50 to 0.75 inches with high confidence, providing skilled inspectors are used. Inspection intervals appropriate for this detectable crack size can be determined from a damage tolerance crack growth analysis; however, this requires an extensive knowledge of the operational loads environment and internal stresses of the C-130A wing. C-130 Operational Loads Recording Programs has shown the firefighting missions to be substantially more severe than typical military logistics operations and consequently, aircraft operated in this role would require inspection intervals as much as 12 times more frequently than typical military transport usage for meeting damage tolerance requirements.

Firefighting Tanker Airplane Flight Envelope Performance Study

An industry study was conducted during the fire seasons 1983 through 1989. The study, Operational Retardant Evaluation (ORE), addressed all phases of aerial firefighting. Excerpts from the study addressed the potential for fixed wing airplanes exceeding their structural operating limitations. Recorders were installed on some airplanes for data collection. Airspeed and g-loading exceedences were recorded. Airspeed exceedences were associated with the normal practice of making downslope runs that result in an airspeed increase. In one test airplane, a C-119, maximum drop speeds were exceeded over 90 percent of the time, and 2.5 g's were exceeded on 17 percent of the drops. The exceedences on the instrumented airplanes were outside the operating envelope specified by the Type Certificate or Supplemental Type Certificate.

ADDITIONAL INFORMATION

C-130A Certification, Airworthiness & Maintenance Issues

In 1991, during inspections into the operation of large surplus United States military aircraft certificated in the restricted category, the FAA discovered that some confusion existed as to under what circumstances persons or property may be carried. The FAA addressed this issue with a letter to the United States Department of Agriculture (USDA), dated July 1, 1991, which outlined the operating limitations of restricted category aircraft, but went on to address airworthiness standards as well by stating that: "Because of the special nature of the intended use of the restricted category civil aircraft, their airworthiness certification standards are not designed to provide the same level of safety that is required for aircraft certificated under

standard category airworthiness standards."

The Federal Aviation Regulations (FARs) provide airworthiness standards for normal, utility, acrobatic and commuter under Part 23, and airworthiness standards for transport category aircraft under Part 25 but no such airworthiness standards exists in the regulations for restricted category aircraft.

During a 1991 contract pre-award on-site evaluation of an Alaskan C-130 operator, the DOI's Office of Aircraft Services (OAS) inspectors identified inadequacies with the certification, maintenance, and use of Lockheed C-130A airplanes, and were concerned that the identified problems may extend throughout the airtanker industry. The OAS inspectors found that the FAA had certified for civilian use a C-130A aircraft for this operator after its military inspection program requirement had lapsed, which the OAS inspectors felt was in conflict with the TCDS requirement of compliance with all Technical Orders (TO's). Additional research into the military and FAA records for other Forest Service contract airtankers conducted by the OAS investigators revealed that other airtankers, including N130HP, had been certified without the aircraft complying with all the T.O.s that affect airworthiness.

On March 26, 1992, an internal memorandum from the DOI's Alaskan Regional Director of the OAS in Anchorage to the DOI's Director of the OAS in Boise, Idaho, provided the details of the Alaska site visit plus it included several concerns. The memorandum cited discussions with military and civilian authorities knowledgeable in the operation of this aircraft, who in turn advised against using these aircraft without the proper inspections and maintenance being performed, specifically including PDM, (depot level) inspection and maintenance as well as adherence to life-limited and/or calendar maintenance requirements. DOI's Alaskan Regional Director stated, "Our concern manifests itself in whether the airtanker industry can furnish the Government the level of maintenance required for this type aircraft…Our findings in the cited examples leave us questioning the safety of our joint use of these aircraft." The memorandum further said that it was the position of Division of Technical Services Chiefs that C-130A aircraft not be operated for the Department of the Interior (DOI) beyond an inspection, or component overhaul/replacement requirement identified in that aircraft's military maintenance program. The Regional Director added, "The basis for their position is supported and shared by the U.S. Air Force's C-130 System Program Engineers from Robins Air Force Base…They advised against using these aircraft beyond an inspection or maintenance requirement."

As part of the March 26, 1992, internal memorandum, OAS recommended that DOI notify the FAA of the findings and solicit their assistance in resolving the airworthiness problem, with specific help in providing some standardization among operators. The memorandum further recommended that DOI's use of these C-130A aircraft should be based upon an inspection and maintenance program, which incorporates all the inspection life-limited component overhauls/replacement and maintenance requirement for continued airworthiness.

In response to a request from DOI, FAA personnel from the Aircraft Certification Service (AIR) and Flight Standards Service (AFS), along with National Aviation Safety Inspection Program (NASIP) members, meet to review DOI's C-130A concerns and on October 26, 1992, the FAA sent a reply letter stating that they felt that in the case of the Alaska C-130A, that the aircraft records were sufficient for certification and that a standardized maintenance program for the C-130A airplane was not practical and that in some cases might degrade the level of safety rather than improve it based on different operating requirements and environments.

An internal DOI information paper written after the FAA's response to DOI's request for assistance continued to raise the issue of the minimum and acceptable certification and maintenance requirements for C-130A aircraft. The document noted that there was less than universal agreement on what constituted required maintenance of C-130A surplus military aircraft and further stated that the basis of the confusion appears to be a lack of common and continuous interpretation of the language provided in the "Note" portion of the Type Certificate, and secondly, a process that does not require critical PDM items to be accomplished in a civilian operating environment. In summary, the paper said that it appears the current C-130A surplus military aircraft maintenance standards to which commercial operators are being held are not equivalent to minimum essential PDM inspection and TBO items necessary to sustain an aircraft in an airworthy condition regardless of the flight environment in which the aircraft is operated.

On January 14, 1993, representatives from the FAA and the DOI met to discuss C-130A certification and maintenance issues. Stemming from this meeting, several action items were suggested to enhance the FAA certification and inspection program of C-130A aircraft. Each action item was assigned a time frame for completion – immediate (1- 3 months), medium (3-9 months), long (9-18 months), and ongoing (continuous). The suggested action items and completion times (in parenthesis) were as follows:

1. Aircraft Certification Service (AIR) will ensure future issuances of TCDS clearly define what USAF T.O.s are applicable (medium /ongoing)

2. Maintain close AFS/AIR coordination on the certification and inspection program approval of surplus military aircraft (immediate/ongoing)

3. Flight Standards should issue an Advisory Circular specific to C-130A inspection program approval requirements (long)

4. AIR should establish an USAF/FAA liaison relationship for C-130A airworthiness necessary to establish a "core" list of T.O.s of the Programmed Depot Maintenance (PDM) inspection items (immediate/ongoing)

5. Flight Standards should issue a bulletin to FAA Field Offices on approval of C-130A inspection programs to ensure that the minimum "core" items are incorporated (immediate)

6. AIR should issue Airworthiness Directive specific to the C-130A as appropriate (ongoing)

Action item No. 5 tasked Flight Standards to issue a bulletin to FAA field offices on approval of C-130A inspection programs to ensure that the minimum "core" items of the PDM are incorporated. Warner Robins Aviation Logistic Center (WR-ALC) PDM provided to DOI's OAS a list of the "core" tasks, which the USAF felt were required to maintain the airworthiness of the C-130A aircraft. FAA's AFS-510 issued a briefing paper on February 11, 1992, discussing the regulatory requirements for incorporation of these "core" inspection items.

In a memorandum, dated February 26, 1993, from the OAS Deputy Director to the OAS Director, options were discussed on how to handle the concerns regarding C-130A PDM inspection requirements and the FAA's proposed corrective actions. The memorandum proposed that a policy be issued that no C-130A airtankers will be dispatched on DOI fires, pending compliance with new FAA directives pertaining to "core" PDM inspection and time change items, and that the C-130A airtanker issues should be elevated to the Secretaries of the Interior and Agriculture level to resolve the problems associated with interagency standards.

In a memorandum from the DOI Director of Program Services to Directors of the Bureau of Land Management, Fish & Wildlife Service, National Park Service, and the Assistant Commissioner for Indian Affairs, dated May 10, 1993, concerns over C-130A maintenance and inspection were again highlighted. Although the Forest Service had activated early the contract with Hemet Valley to provide C-130A airtanker services, the DOI believed "… that the risks associated with the use of current fleet of C-130A aircraft are too great to allow use in association with the Department of the Interior wildlife suppression activities, not withstanding the [FAA's] issuance of airworthiness certificates." The memorandum then prohibited the use of C-130A tankers on any fires on lands managed by the Department of the Interior.

On May 20, 1993, WR-ALC sent a letter to the FAA outlining the C-130A integrated maintenance plan that the USAF uses to ensure the airworthiness of the aircraft. In this letter, the USAF stated that the PDM interval was every 12 months ? 3months and that "…We [USAF] strongly recommend that those C-130A aircraft that are operated in civilian use, under the rules and regulations of the FAA, be required to accomplish the entire C-130A maintenance plan, which includes PDM, to assure the continued airworthiness of the aircraft."

The FAA, DOI, USFS, USAF, FAA, and the DOJ all met on May 14, 1993, to discuss the concerns as to the airworthiness of C-130A surplus military aircraft. During the meeting, the FAA agreed to evaluate the requirements of the FAA-approved inspection programs for the C-130A aircraft under 14 CFR Part 91 and compare those requirements to the military technical publications and produce a summary report following the evaluation. After the meeting, the FAA wrote a letter to the DOI Director of Program Service, dated May 28, 1993, outlining what the FAA intended to do in addressing the concerns of the DOI. Included with this letter was the FAA's action plan, which included additional items beyond what was recommended by the FAA in January 1993, such as establishing a working group to evaluate the C-130A maintenance program and to make revisions to the C-130A TCDS if necessary.

On May 28, 1993, the DOI Director of Program Services issued a memorandum to rescind the policy issued on May 10, 1993, prohibiting the use of C-130A airtankers on fires on DOI lands being managed by a DOI agency. The DOI rescinded the prohibition for use of C-130A airplanes based on the FAA's action plan and the FAA's opinion that the C-130A airworthiness certification would remain in effect as long as the maintenance and alternation are properly performed by the operators as set forth in the Federal Aviation Regulations.

On June 14, 1993, the Flight Standard National Field Office (AFS-500) sponsored a joint C-130 AFS and AIR working group, which consisted of the PMI for each of the four operators, safety inspectors for the Atlanta FSDO, and representatives from AFS-300 and AFS-500, convened to provide the following:

1. Guidance to be used in approving inspection programs submitted in accordance with 14 CFR 91.409(f)(4) of the FAR for C-130A aircraft.

2. Recommendations to the AIR concerning what, if any, AD's should be issued for the C-130A aircraft, engines, and/or propellers.

3. Recommendations to AIR concerning what, if any, revisions to the C-130A TCDS.

4. Review existing approved inspection programs of the C-130A aircraft and recommend to the PMI what revisions are needed for continued adequacy of the program provided by section 91.415(a) of the FAR.

During early August 1993, the FAA released a joint AFS and AIR C-130A airworthiness working group report to provide recommendations in accordance with previously outlined FAA action plan task items. Sixteen recommendations were proposed by the FAA on such C-130A specific topics as guidance for approving inspection programs submitted in accordance with FAR 91.409, for issuance of AD's on what life limited parts should be designated, and changes to be made to the TCDS. Furthermore, three additional recommendations were proposed that were not C-130A specific but dealt with such topics as: 1) reevaluating assigned principle inspectors job for continued surveillance of large, multiengine, turbine powered aircraft; 2) prior to issuing any TC for surplus military aircraft, determine the applicably of any AD and establish instructions for continued airworthiness; and 3) establish procedures between the Depart of Defense (DOD) and FAA for exchange of data concerning surplus military aircraft.

On August 12, 1993 the FAA issued a short and long-term action plan outlining the tasks to be taken by the Joint Flight Standards and AIR to address the recommendations received from the C-130A inspection working group.

On August 23, 1993, representatives from the FAA, USAF, Forest Service, and C-130A operators attended a FAA-sponsored C-130 airworthiness meeting held at AFS-500 at Dulles, Virginia. According to the minutes of the meeting, AFS-500 was concerned that there were a number of ex-military C-130A's in a variety of civilian uses but no standardized inspection program and no continuing airworthiness program. AFS-500 felt it was more important to address the scope of the inspections, what is inspected, rather than on the frequency of those inspected. The minutes also go on to reflect the USAF (WR-ALC) concerns over the lack of the operators performing the PDM items and that accidents could occur. AIR-200 stated that the FAA policy was not to go back and require testing once a TC has been issued but to correct design problems or safety defects with AD's. Operators of the C-130A expressed their concern of additional inspection requirements that incorporating the PDM "core" items may have on the cost structure of their operations and that the PDM requirements would be put off as long as possible then retire the airplane without complying. The Forest Service disagreed with the USAF position and stated that the current programs appear adequate and that rather than applying new requirements in bits and pieces, the FAA should apply new standards to all aircraft across the entire industry.

The recommendations that came from the June 14, 1993, Flight Standard National Field Office meeting resulted in several initiatives to clarify, define, and standardize FAA policy as it pertains to the maintenance requirements of restricted category surplus military airplanes. In response to the recommendations, AFS published Flight Standards Information Bulletin for Airworthiness (FSAW) 93-57. FSAW 93-57 clarified AFS policy concerning inspection standards and approval of inspection programs. In addition, AIR undertook several initiatives concerning the C-130A including the establishment of a focal ACO and clarification of FAA policy concerning instructions for continued airworthiness, AD, and life limited parts. With the experience gained from the C-130A, in the early 1990, the FAA issued Flight Standards Handbook Bulletin for Airworthiness (HBAW) 95-13A (Amended), effective date of October 23, 1995, to replace FSAW 93057 and provide a uniform policy concerning the maintenance of all restricted category surplus military airplanes.

HBAW 95-13A states that, "The inspection frequency and program structure established by the military may not be appropriate for use in a civilian environment…Therefore, inspection frequency and program structure may be adjusted to meet an individual operators

requirement." In addition it states that FAA inspectors should review existing approved inspection programs to ensure that "the scope and detail of the programs provides at least an equivalent level of safety as provided in this bulletin."

Airtankers Studies

The Safety Board located studies performed in the early 1970's by NASA on the Lockheed P2V and the Douglas DC-6 that examined the effects of the low-level firefighting missions on these converted surplus military airplanes plus a Canadian study on civilian Fokker F27 also converted to the firefighting mission. The results of the P2V study indicated that there were no adverse effects to the airframe structure due to the tank installation and the mission flown. The data for the DC-6 study drew conclusions that indicated that, unlike the P2V study, the firefighting mission did impact the structural life of the airplane. The report concluded that, "The severity of maneuver load applications, in both magnitude and frequency of occurrence, is such that significant shortening of the structural life of the aircraft should be expected."

In the 1990's a Fokker F27 firefighting aircraft was analyzed as part of a Canadian airworthiness study, which found that, "The F27 firefighting aircraft operated in a firefighting role is exposed to a harsher loading environment than initially intended for a typical transport role aircraft…the time spent in the firefighting role is 5.7 times more severe that the typical Fokker transport role operation." Because of these findings, the inspection intervals, limitations, mandatory replacement times, and remaining airframe life limits for the Fokker F27 firefighting aircraft were modified.

Public Aircraft

On April 19, 1995, the FAA issued Advisor Circular (AC) 00-1.1 entitled GOVERNMENT AIRCRAFT OPERATIONS to provide guidance on whether particular government aircraft operations are "public" or "civil" aircraft operations. Within the AC, "Firefighting" operations, which the FAA defines as including dispensing of water or fire retardants on a fire and the transport of firefighters and equipment to a fire or to a base camp from which they would be dispersed to conduct the firefighting activities, would be included as a governmental function and therefore classified as "public" aircraft activity.

On April 5, 2000, Congress passed P.L. 106-181 to amended Title 49 United States Code Section 40102(a)(37), which defined "governmental function" as an activity undertaken by a government, such as national defense, intelligence missions, firefighting, search and rescue, law enforcement, aeronautical research, or biological or geological resource management.

The FAA issued a Joint Flight Standards Handbook Bulletin for Airworthiness (HBAW), Air Transportation (HBAT), and General Aviation (HBGA), bulletin numbers HBAW 95-04, HBAT 95-06, and HBGA 95-02 entitled GOVERNMENT AIRCRAFT OPERATIONS; PUBLIC AIRCRAFT OPERATIONS VERSUS CIVIL AIRCRAFT OPERATIONS in June 1995. The purpose of the handbook bulletins was to provide information and guidance to be used by FAA inspectors when working with government-owned aircraft operators. The bulletin states that, "FSDO managers must ensure that a site visit is held with each governmental agency in their geographical area….Additionally, the FSDO's should provide the maximum assistance and advice to agencies which, while conducting public aircraft operations, desire to operate in accordance with the FAR." The bulletins also direct that government-owned aircraft operators, holding any type of FAA certification, will be included in the normal surveillance activities such as, spot inspections of the aircraft and aircraft records, and includes any aircraft exclusively

leased to the Federal government.

Pilot Information

Certificate:	Airline Transport; Flight Instructor; Commercial; Flight Engineer	**Age:**	42, Male
Airplane Rating(s):	Multi-engine Land; Single-engine Land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	Glider; Helicopter	**Restraint Used:**	Seatbelt, Shoulder harness
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	Airplane Multi-engine; Airplane Single-engine	**Toxicology Performed:**	Yes
Medical Certification:	Class 2 Valid Medical--no waivers/lim.	**Last Medical Exam:**	03/12/2002
Occupational Pilot:		**Last Flight Review or Equivalent:**	03/30/2002
Flight Time:	10833 hours (Total, all aircraft), 110290 hours (Pilot In Command, all aircraft), 108 hours (Last 90 days, all aircraft), 87 hours (Last 30 days, all aircraft)		

Co-Pilot Information

Certificate:	Airline Transport; Flight Engineer	**Age:**	36, Male
Airplane Rating(s):	Multi-engine Land; Single-engine Land	**Seat Occupied:**	Right
Other Aircraft Rating(s):		**Restraint Used:**	Seatbelt, Shoulder harness
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	Airplane Multi-engine; Airplane Single-engine	**Toxicology Performed:**	No
Medical Certification:	Class 2 Valid Medical--w/ waivers/lim.	**Last Medical Exam:**	01/23/2002
Occupational Pilot:		**Last Flight Review or Equivalent:**	01/29/2002
Flight Time:	2407 hours (Total, all aircraft), 1614 hours (Pilot In Command, all aircraft), 156 hours (Last 90 days, all aircraft), 87 hours (Last 30 days, all aircraft)		

Flight Engineer Information

Certificate:	Flight Instructor; Commercial; Flight Engineer	**Age:**	59, Male
Airplane Rating(s):	Multi-engine Land; Single-engine Land	**Seat Occupied:**	Rear
Other Aircraft Rating(s):	None	**Restraint Used:**	Seatbelt, Shoulder harness
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	Airplane Multi-engine; Airplane Single-engine; Instrument Airplane	**Toxicology Performed:**	No
Medical Certification:	Class 2 Valid Medical--w/ waivers/lim.	**Last Medical Exam:**	01/03/2002
Occupational Pilot:		**Last Flight Review or Equivalent:**	
Flight Time:	1630 hours (Total, this make and model)		

Aircraft and Owner/Operator Information

Aircraft Manufacturer:	Lockheed	**Registration:**	N130HP
Model/Series:	C-130A	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	No
Airworthiness Certificate:	Restricted	**Serial Number:**	56-538
Landing Gear Type:	Retractable - Tricycle	**Seats:**	3
Date/Type of Last Inspection:	09/01/2001, AAIP	**Certified Max Gross Wt.:**	120000 lbs
Time Since Last Inspection:	168 Hours	**Engines:**	4 Turbo Prop
Airframe Total Time:	21863 Hours	**Engine Manufacturer:**	Allison
ELT:	Installed, not activated	**Engine Model/Series:**	T56A-9D
Registered Owner:	Hawkins and Powers Aviation	**Rated Power:**	3750 hp
Operator:	USDA - Forestry Service	**Air Carrier Operating Certificate:**	

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	**Condition of Light:**	Day
Observation Facility, Elevation:	TVL, 6264 ft msl	**Observation Time:**	1453 PDT
Distance from Accident Site:	46 Nautical Miles	**Direction from Accident Site:**	300°
Lowest Cloud Condition:	Clear	**Temperature/Dew Point:**	24°C / 2°C
Lowest Ceiling:	None	**Visibility**	10 Miles
Wind Speed/Gusts, Direction:	15 knots/ 21 knots, 190°	**Visibility (RVR):**	
Altimeter Setting:	30.2 inches Hg	**Visibility (RVV):**	
Precipitation and Obscuration:			
Departure Point:	Minden, NV (MEV)	**Type of Flight Plan Filed:**	Company VFR
Destination:		**Type of Clearance:**	None
Departure Time:	1429 PDT	**Type of Airspace:**	Class G

Wreckage and Impact Information

Crew Injuries:	3 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:	N/A	**Aircraft Fire:**	On-Ground
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	3 Fatal	**Latitude, Longitude:**	38.520556, -119.481944

Administrative Information

Investigator In Charge (IIC):	GEORGE E PETTERSON	**Adopted Date:**	04/23/2004
Additional Participating Persons:	William C Kunder; FAA; Reno, NV William Bulger; USDA-FS; Boise, ID Carl Meyer; Hawkins and Powers; Greybull, MT Joe M Ead; Lockheed Martin; Marrietta, GA Mike A Weber; Rolls-Royce/Allison; Indianapolis, IN		
Publish Date:			
Investigation Docket:	NTSB accident and incident dockets serve as permanent archival information for the NTSB's investigations. Dockets released prior to June 1, 2009 are publicly available from the NTSB's Record Management Division at pubinq@ntsb.gov, or at 800-877-6799. Dockets released after this date are available at http://dms.ntsb.gov/pubdms/.		

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