SECTION 3

ANALYSIS

CONTENTS

3. ANALYSIS OF TESTIMONY

General. Three of the surviving flight crew of "Trucker 5" were interviewed immediately after receiving medical attention upon their arrival in Edmonton. Wo Hull was not interviewed post crash due to his injuries. All of the key ground witnesses were also interviewed starting 27 Jul 93. The medical member conducted interviews with all survivors 23 - 24 Jul 93. The flight crew were re-interviewed 25 Jul 93 and 4 Aug 93. This section will only deal with that testimony leading up to the accident.

The testimonies of the flight crew were generally consistent and in accord with each other's. They also agreed in general, with the data retrieved from the FDR/CPI.

Aircraft Commander. Maj Niles, through discussions with ATGHQ/SOTAC, had decided to give Capt Allen the left seat in order to have him current for his employment with the TALS. He knew that the pilot had not flown left seat LAPES in a long time, but was confident in his abilities. Although the departure was delayed due to loading problems, he found that all proper briefing items had been covered thoroughly. He stated that the pilot wanted to do the live drop without any dry passes. In view of the pilot's long lay-off, he insisted that they complete one pass at Namao before going enroute. Since the co-pilot was also un-current, he elected to stand in order to give both pilots the live extraction. Except for himself, the cockpit crew had never been to EZ Saville Farm.

All of the crew agreed that the dry pass went well except for the fact that the pilot had been slow to initiate a "secure the load" call following a simulated emergency. They then proceeded enroute to Saville Farm. The route portion went well. He stated that he thought that the co-pilot was letting the navigator do all of the navigation. He also noted that the co-pilot had to be prompted on some of his radio calls. Once inside the one minute call, all went normally until the co-pilot forgot to call the "15 second" warning. He remembers thinking that the co-pilot was behind

the a/c when someone else called "15 seconds". The pilot had called for "deploy the drogue" and he thought that he had started his descent. In actual fact, the pilot did not descend until 3.2 seconds later (after the "good drogue"call). Shortly after the descent was initiated, he realized that they would be high over the release panels. He was expecting the co-pilot to compensate for this by delaying the "green on" call somewhat. He was surprised when the co-pilot called "green on " at the normal release point. When the co-pilot surprised him with the early call he looked in his direction and by the time he looked forward again the a/c was 2.5 seconds from impact. He did not realize that they were going to hit.Even after viewing the video of the accident, he remained convinced that their profile wasn't that far off from a normal one.

Therefore, based on the testimony of the AC, the board deduces that he had great confidence in the pilot's abilities. However, he became aware that the co-pilot wasn't performing as he had expected. At the critical point of the profile, he became distracted by the co-pilot's late warning call and his decision to call "green on" at the release panels. His focussed attention prevented him from noting the excessive rate of descent created by the pilot and was unable to prevent the impact with the ground.

Navigator. The navigator was familiar with LAPES and EZ Saville Farm. He knew the pilot well and was confident of his abilities. He also agreed that the on board briefing was well handled and complete. He emphasized that although they were late starting, that all departure procedures were carried- out in an orderly fashion. Although they were late setting course (due to the dry pass), they quickly regained the planned time line and continued normally to the EZ. He noted that the co-pilot was letting him do all the navigation. He remembers thinking that the 15 second warning was going to be late. According to the FDR, Capt Juneau was the person who called the first 15 second warning. He remembers that during the descent, the a/c seemed somewhat left of the EZ axis. He also knew that they were high at the

release panels, and shortly thereafter that they were going to touch down.

Therefore, based on the testimony of the navigator, the Board deduces that although the navigator was well experienced in TAL flying, he did not have sufficient LAPES experience and training to determine the precariousness of the profile.

Flight Engineer #1. Sgt Lous was on this trip to monitor the second FE who was uncurrent. The testimony of both flight engineers confirmed that all systems were serviceable. He found the on-board briefing to be complete. Although they were late starting, he found that all departure checklist items were carried out in the normal fashion. The dry pass went well except that the engineer in the seat did have some difficulties with the simulated emergency checklist.

He felt that all progressed normally all the way to the "15 seconds" call. He thought that the call came late but that the a/c started the descent as expected. Just prior to impact, he knew things were not normal and that they were going to touch down. He did not notice the airspeed or rate of descent. However, he was positive that the a/c was operating normally.

Therefore, based on the testimony of the #1 flight engineer, the Board deduces that the a/c was serviceable prior to impact. Also, that during the final stage of the profile, he concentrated on looking outside and did not notice a/c performance instruments (airspeed, rate of descent, pitch attitude).

Flight Engineer #2. WO Hull was on this trip to regain currency in LAPES. He also confirmed that all a/c systems were serviceable. When asked, he was somewhat confused as to who conducted the on-board briefing. Also, along with most other crewmembers, he does not remember MWO Castonguay being on board the a/c. He did not feel rushed on departure. He did have some difficulties recognizing the simulated emergency when it was called by the loadmaster on the dry pass. He is

also the only survivor that remembers the flight that day as being rough (turbulence). All other testimony and weather reports indicate that the air was calm at the time. He also remembers being slightly left of the EZ axis in descent. He could not recall noting any a/c parameters during the profile, however, he is certain that the a/c was performing normally. He also felt that they were going to hit the ground shortly after the "green on" call was made.

Therefore, based on the testimony of the #2 flight engineer, the Board deduces that the a/c was functioning as expected. Due to his unfamiliarity with the area, the FE was drawn to look outside during the descent and did not note the aircraft attitude or rate of descent.

3.1 HISTORY OF FLIGHT

"Trucker 5" was a continuation training mission tasked to support the CABC EZ, LZ, DZ Controller Course at EZ Saville Farm, Camp Wainwright, Alta. It was also intended to provide re-currency training for Capts Allen and Shurman and WO Hull. The flight departed Namao slightly late due to loading delays, but made up the time enroute. After take off at 221555Z Jul 93, Trucker 5 carried out a dry pass on EZ1, at Namao, in order to give the crew the opportunity to practice a LAPES profile prior to a live drop. Following a successful dry pass, the crew proceeded on the VFR low level portion of their TAL mission. Flight was carried out at 1,000 ft AGL for most of the route to avoid noise sensitive areas. This portion of the mission was uneventful.

The aircraft descended to 200 ft AGL while approaching the IP and attempted contact with EZ Saville Farm. Communications with the EZ controller were initially difficult due to the low altitude of the aircraft, but were resolved when the flight got closer in. Up to this point all warnings and checklist items had been carried out normally. The a/c was slowed and configured for the drop at Saville Farm. The EZ was called visual by the co-pilot and acknowledged by the pilot and navigator. The a/c manoeuvred slightly

to line-up with the EZ axis of 164 degrees (M). Following the one minute call by the navigator, the a/c descended over the escarpment to the north of the EZ and, at this point, was stabilized at drop airspeed (130KIAS), and initial descent altitude (200ft).

The navigator called "15 seconds", and the pilot called for "deploy the drogue". Level flight was maintained until the loadmaster called "good drogue", at which time the pilot quickly lowered

the nose of the a/c to initiate the final phase of the profile. It was noted that they were high at the release panels when the co-pilot called for the "green on", and initiated the extraction sequence. The a/c continued on the profile until the round-out was initiated. The a/c impacted the ground at approximately 221630Z Jul 93. Following a lengthy skid along the EZ axis, the a/c came to rest in three major sections at position 52 46.0N /111 10.3W.

3.2 INJURIES TO PERSONNEL

A. CREW FATALITIES

Both Capt Allen and Capt Schurman were found strapped in their seats in the inverted cockpit section. Their seat backs were broken and they were lying in a horizontal position with their heads looking towards the ceiling and feet towards the nose. Both died as a result of crush injuries to the chest from the weight of the fuselage pressing them on the instrument panels. Death would have been instantaneous and both were pronounced dead at the scene. Surprisingly, there were only minor injuries to the head and extremities of both pilot and co-pilot.

Sgt Michaud was the number one loadmaster and was found lying on the ground near the left side of the cockpit. His death was caused by multiple blunt injuries which included head and neck injuries, fractured pelvis and damage to the internal organs. He was wearing a helmet which had a crack in the front. In the back, there was a crack and a yellow scrape the same colour as the

wheel chocks which were stored loosely near his position. He also had damage to the skin on his back, likely caused by contact with aircraft fuel. His death would have been instantaneous and he was pronounced dead at the scene.

MCpl McWilliam was the number two loadmaster and his body was located on the ground aft of the wreckage. His death was caused by multiple blunt injuries which were consistent with being unrestrained and thrown from the cargo section of the aircraft. The injuries included extensive head injuries, numerous rib fractures and injuries to both shoulders. He was found wearing his helmet and safety harness. Death would have been instantaneous, and he was pronounced dead at the scene.

MWO Castonguay was found pinned between the fuselage and cockpit on the left hand side. He was believed to be seated in the cargo compartment, on the right hand troop seat monitoring video equipment. He died from blunt injuries to the chest. He was not wearing a helmet. A lap belt, if worn, probably was only loosely fastened. His death would have been instantaneous and he was pronounced dead at the scene.

B. CREW - SERIOUSLY INJURED

WO Hull was in the flight engineer's seat and was found in the inverted cockpit still strapped to his seat. He had a head injury with a fractured skull. He was evacuated by helicopter to the University of Alberta Hospital in Edmonton, where he arrived in stable condition.

Capt Juneau was the navigator and, at the time of the crash, he was standing to the right and behind the right co-pilot's seat. He remained conscious throughout the incident and was able to get himself out of the cockpit. Once stabilized, he was transferred to the Royal Alexandra Hospital in Edmonton where he was found to have a separated shoulder and a puncture wound near his left buttock.

Sgt Lous was another flight engineer who was standing behind the flight engineer's seat. He was found conscious in the cockpit with his right arm pinned underneath one of the cockpit seats. He was transferred to the Royal Alexandra Hospital in Edmonton in stable condition. Sgt Lous had a broken right arm and an extensive laceration of his scalp.

Maj Niles was standing in the cockpit behind and slightly left of the pilot's seat. He suffered some temporary loss of consciousness and needed help getting out of the cockpit. He sustained a scalp laceration, dislocated right shoulder and injury to his right knee. He was sent to the Royal Alexandra Hospital in Edmonton after being stabilized.

3.3 DAMAGE TO AIRCRAFT

Testimony from survivors and evidence obtained from the wreckage confirmed that the aircraft was serviceable before impact. The aircraft suffered "A" category damage upon impact and subsequent deceleration. The aircraft broke into three major sections:

a. flight deck;

b. fuselage and wings; and

c. tail.

The load, consisting of 11,900 lbs of cement weighted barrels, was transferred to the parachutes and was on the ramp when the trailing edge of the ramp contacted the ground. The force of the impact, combined with the weight of the load, caused the ramp hinges to fail. The leading edge of the platform nosed down and dug into the ground while the raised trailing edge of the platform contacted the underside of the cargo door. This pole vaulting action of the platform severed several main structural members which punctured the upper skin surfaces on either side of the vertical stab. The aircraft vertical impact was probably less than 5G, therefore the frangible switches did not initiate the FDR/CPI

deployment at this time.

However, the platform also severed the dispenser battery (PN 102217) attached to a structural member thus disabling the voltage required for CPI deployment. Despite this initial hard impact, the aircraft remained intact although primary structure in the area of FS 245 and FS 737 was visibly weakened. The subsequent bounce caused the nose gear and lower radome to impact the ground in an approximately 10 degree nose down attitude causing instantaneous failure of the nose gear and shattering of the radome. Evidence of major undercarriage and radar failure was found shortly after the second impact point, 500 feet from the impact marks.

The next impact occurred as the nose of the aircraft ski jumped over the berm and separated from the main fuselage at FS 245 and impacted the ground 300 feet away from the berm. During this tumble, the nose wheel door and 25 litre liquid oxygen converter were thrown from beneath the flight deck area and landed in the vicinity. Further analysis of the flight deck was difficult since the wreckage was severely disrupted during the extrication of the two pilots trapped in the wreckage.

The fuselage section from FS 245 to 437, the beginning of the wheel well fairing, was diagonally accordioned, rippled and disintegrated. As the wing section and centre fuselage climbed the crest of the berm, the a/c skin and supporting structure were crumpled and compressed. The floor section, although intact, was ripped from its support structure. The main body of the fuselage from approximately FS 450 to 697 including the wings overturned when the propellers contacted the ground approximately 65 feet beyond the ridge. All propellers appeared to have contacted the ground at approximately the same time and disintegrated on impact and generally tumbled down the flight path. The No. 3 QECU was entirely ripped off at the wing. The Nos. 1, 2 and 4 engines remained mounted on the wing but sustained severe damage. The No. 4 engine was damaged by impact and fire. The two external tanks were

damaged by the impact and the right external tank by fire as well. The No. 1 propeller, having departed the engine, punctured the No. 2 main fuel tank when the wing rotated and fell onto the flight deck and wreckage debris. The wings were subsequently punctured with fire axes by rescue personnel to defuel the wings. Approximately 16,000 lbs of fuel was recovered from the aircraft.

The tail section was seriously damaged and mangled, first by the cargo ramp and loaded platform departing the aircraft as described above, and secondly by the high shear loads on deceleration, the first deceleration on initial impact caused skin fracturing at FS 737 and subsequent total separation when the main fuselage tumbled and rotated.

3.4 COLLATERAL DAMAGE

The only collateral damage resulting from this accident is the scarring of the earth and the limited environmental damage caused by the estimated 7,000 lbs JP4 spilled during the crash.

3.5 PERSONNEL INFORMATION

The aircrew members will be discussed under the following headings : Aircraft Commander (AC), Pilot(LS), Co-pilot(RS), Navigator, Flight Engineers (FE1 and FE2),Loadmasters (LM1 and LM2), and Crewmember (CABC observer).

3.5.1 AIRCRAFT COMMANDER

Maj Niles completed flying training on the CT114 Tutor a/c in Sep 67. Following his graduation, he then went to 3CFFTS to train on multi-engine a/c. He flew 94 hrs on the C45 Expeditor before proceeding to 442 Sqn for training on the C47 Dakota. He flew the C47 for 569 hrs before being converted to the Albatross a/c in which he accumulated another 1074 hrs. He stayed at 442 Sqn until Aug 70 at which time he was posted to 435 Sqn to fly CC130s. During his first tour at 435 Sqn, he became a qualified AC in SAR, TAL and LAPES operations. In Aug 74, he was posted to 426

Sqn as an Instructor Pilot (IP) for the CC130 a/c and simulator.

In Jul 78, Maj Niles was posted to ATGHQ as the EA to the Comd, BGen McKenzie. Following his tour as an EA, he was posted in Jul 80 to 2CFFTS, to instruct on the CT114 Tutor a/c. He quickly achieved an A2 instructor rating, and accumulated 1485 hrs on the Tutor, of which 914 hrs was instructional time. In Jul 84, he was posted back to Edmonton as the BFSO. He held that position until Jul 87, at which time he returned to fly with 435 Sqn. From 87 to 89 he in turn was the 435 Sqn Aircrew Leader, and DCO. In 90, he was appointed as the Deputy Commander of the TALS (DOC TALS), a position he held until 91 at which time he was designated OC TALS.

On the day of the accident, Maj Niles was, in fact, an augmentee with the TALS since his posting to the 18 Wing ops and plans staff in Jul 93. He had just returned from Trenton where he supervised 8 Wing crews in their recurrency training for personnel drops. Maj Niles was fully current as per CFACM 60-2604. Maj Niles has accumulated 10,608 flying hrs of which 7,307 hrs are on the CC130 a/c. During his CC130 tours, he completed a total of 83 LAPES and countless TAL missions. He holds all possible TAL qualifications and has participated in major ATG operations over the past decade, the most notable being : Op Scimitar, Gulf War, and two rotations with Op UNHCR (Yugoslavia). His flight evaluations in both strategic and TAL flying rate him as an above average to superior pilot.

Maj Niles is a dedicated and very experienced pilot who is known for his meticulous and calm approach to flying. He underwent Aircrew Coordination Training (ACT) in Jul 93 during his semi-annual simulator session.

3.5.2 **PILOT (Left Seat)**

Capt Allen completed flying training on the CT114 Tutor a/c in Aug 88. This was followed by his first tour as a CC130 pilot with 436 Sqn. During his tour, he demonstrated steady progress and

became a dual qualified AC in both TAL and strategic roles. His abilities also led him to become qualified in the very demanding TAL specialties of LAPES and Advanced TAL (ATAL). He was heavily involved in the operation of the Sqn TAL cell, and was also employed as a pilot training officer. He was involved in major ATG operations such as : Gulf War, Op Assist (Turkey), Op Deliverance (Somalia), and two rotations on Op UNHCR.

Capt Allen had just recently returned from the Land Forces Command and Staff College in Kingston,prior to being posted to 435 Sqn. He completed a Proficiency/IRT check 22 Jun 93 prior to leaving 436 Sqn. Following his arrival at 435 Sqn, he was given a local check-out 13 Jul 93, and flew a trip to Resolute Bay and back 16 Jul 93. He was current for strategic operations as per the CFACM 60-2604. However, he was uncurrent in all TAL events since his last drop had occurred 16 Jan 93. He flew a LAPES right seat flight with a recent LAPES course 13 Jul 93. He also flew on another LAPES sortie as an observer in order to refresh himself on LAPES procedures. At the time of the accident, Capt Allen had accumulated 32 LAPES missions. He graduated from the left seat LAPES course in Jul 91, and since then had completed five LAPES drops with his last left seat drop dating back to 27 Jun 92. He had accumulated 3,056 hrs, of which 2,800 were on the CC130.

Capt Allen was a very dedicated individual who had both talent and personality. His flying skills were above average and had never been in doubt before this accident.The combined effects of having been off flying for six months and not having flown left seat LAPES for 12 months may have played a role in this accident.

Capt Allen had not undergone any formal ACT.

3.5.3 **CO-PILOT (Right Seat)**

Capt Shurman completed flying training on the CT114 Tutor a/c in May 89. This was followed by his first posting to 436 Sqn as a CC130 pilot. In Jan 90, he was posted to the newly formed 429 Sqn

(Det) Trenton,were he continued his upgrade programme to AC. During his tour at 429 Sqn, he qualified in BTAL and progressed to the more demanding sub-specialties of Advanced TAL (ATAL) and LAPES (right seat). He was also involved in the running of the TAL Ops cell. He was posted to 435 Sqn in Jun 93, with strategic, BTAL and ATAL AC and right seat LAPES qualifications.

Capt Shurman was a participant in several major ATG operations such as : Op Scimitar, Gulf War, Op Assist(Turkey), two Op Preserve rotations (Somalia), and six rotations on Op UNHCR. At the time of the accident, he was current in all areas except for LAPES which he last did in Jan 93. His last two assessed TAL check rides were rated as low average due to some inconsistencies in some procedures. On arrival at 435 Sqn, he was given a local check out and a route check on which he achieved high average results. He had flown a total of 11 LAPES mission prior to the crash.

Capt Shurman was a very capable individual who displayed a high degree of dedication to his work as demonstrated by his 114 missions into Sarajevo. He had acquired a total of 2,495 hrs, of which 2,270 hrs were on the CC130. He received ACT in Jul 93.

3.5.4 **NAVIGATOR**

Capt Juneau completed the Air Navigation School and the 426 Sqn OTU by Sep 86. He was then posted to 436 Sqn were he continued his upgrade programme until attending the Advanced Air Navigation Course in Feb 88 were he obtained his operational category. During his tour at 436 Sqn, he qualified as BTAL, ATAL and Lead navigator. He was posted to 435 Sqn TALS in Jul 90. He has flown on such operations as Op Friction, the Gulf War, and Op UNHCR. He had been on four previous LAPES missions, one of which was a live drop in the arctic (Ice Shelf). He recently returned from Canadian Forces Staff School and had completed a proficiency check 12 Jul 93 to regain his strategic currency. His TAL currency was still valid as per CFACM 60- 2604 direction.

Capt Juneau is a highly capable individual who is well liked and respected. His performance on the Trucker 5 mission was in no way a factor in this accident. He has accumulated 2388 hrs on the CC130 and has not undergone ACT.

3.5.5 FLIGHT ENGINEER 1

Sgt Lous has accumulated 4,497 flying hours (1610 hrs CC130). He was previously employed on the CC109 and CH135.

His files and records show his qualifications and currencies in order. Sgt Lous has logged 57 hrs TAL/LAPES since being TAL trained in Apr 91, including nine previous LAPES missions. In the past 12 months, he has logged 7.8 TAL hrs but no LAPES missions.

Sgt Lous is currently qualified and actively employed in three separate CC130 roles. (strategic, TAL, AAR). His qualification status and performance had no direct bearing on the accident.

Sgt Lous is an intelligent, articulate and highly capable flight engineer. Although he has not yet received ACT, his competence and co-operation during flying operations is beyond question. At the time of the accident, Sgt Lous was supervising WO Hull who was not current in the TAL/LAPES role.

3.5.6 FLIGHT ENGINEER 2

WO Hull has accumulated 4,478 flying hours (2,417 hrs CC130). Previous employment included tours on the CH135 and CH118 helicopters. His files and records showed no deficiencies in required qualifications except that his TAL/LAPES currently had lapsed as of 1 Jul 93. WO Hull was, in fact, occupying the FE seat under supervision IAW CFACM 60-2604 at the time of the accident. Since becoming TAL/LAPES qualified in Sep 89, he has logged approximately 155 hours TAL including 13 LAPES missions. He has logged 7.4 hrs of TAL and two LAPES missions during the past 12 months.

WO Hull is highly motivated and extremely capable.

His manner while flying is congenial and co-operative and very mission oriented. He attended a Cockpit Resource Management briefing in Nov 92 and is not reluctant to state his opinion during aircraft operations. Neither WO Hull's qualification status or performance had a direct bearing on the accident.

3.5.7 **LOADMASTER 1**

Sgt Michaud completed the Loadmaster Course in Aug 84. He was employed at 436 Sqn for a period of five years and was fully qualified in TAL and LAPES. On 5 Jul 89, he was posted to 435 Sqn TALS as an instructor and standards check loadmaster. He accomplished 88 LAPES drops and accumulated a total of 4,287 flying hours. A review of his performance and qualifications have indicated no deficiencies in his flying proficiency. Sgt Michaud was a mature, confident and above average loadmaster who worked very well in the crew environment. His performance was in no way a factor in this accident.

3.5.8 **LOADMASTER 2**

During his first tour at 435 Sqn (Sep 80 to Aug 81), MCpl McWilliam acquired 694 flying hours on the CC130. In Apr 89, again, he successfully completed the Loadmaster Course and was posted to 435 Sqn. Only one year after his arrival, he was employed in TAL training for a a period of two years. Given his vast knowledge and expertise in this field, he became an instructor at the TALS. He accomplished 27 LAPES drops and accumulated a grand total of 2,935 hours. A review of his training and qualifications have indicated no deficiencies in his flying proficiency. MCpl McWilliam was a knowledgeable, dedicated and dependable loadmaster with a sound appreciation of his duties and responsibilities. His performance was in no way a factor in this accident.

3.5.9 **OBSERVER**

MWO Castonguay was posted to Canadian Forces Base Edmonton, Canadian Airborne Centre, Airborne Trials and Evaluation Section (ATES), 2 Jul 92.

He was qualified basic parachutist, pathfinder, rappel master, aerial delivery basic and military free fall. He was the section expert on the use of the remote lense video camera system and was tasked to film the operations of the tow plate during a live extraction. He was a gregarious individual who enjoyed the diverse challenges of his work, always being meticulous and safety conscious while completing assignments.

One of the roles of ATES in relation to the air delivery of personnel, stores and equipment is to support other units and agencies in any Airborne or air transported trials which they maybe tasked to conduct. MWO Castonguay was a highly qualified and respected individual. His performance was in no way a factor in this accident.

3.6 AIRCRAFT INFORMATION

Aircraft CC130321 was an E model Hercules with a total 33,189.0 airframe hours since new. A No. 3 Progressive Structural Inspection in conjunction with a No. 1 Periodic had been carried out at 32,212.2 hrs at Northwest Industries 26 Oct 92. This inspection was followed by a Supplementary Inspection at 32,706.8 on 1 Apr 93. The No. 2 Periodic was due at 33,156.8 hrs and this was extended by 45 hrs to 33,201.8 hrs, thus the aircraft had 12.8 hrs to go before its next major inspection. The next Primary Inspection was due in 83 hrs.

	Component	S/N	TSN	TSO	Hours Remaining
#1	Eng Prop	AE102922 N238754	25433.5 6281.8	4940.6 1782.5	459.4 3617.5
#2	Eng Prop	AE102302 N227951	29145.5 18985.5	1644.5 4266.8	3755.5 1133.2
#3	Eng Prop	AE105404 N223642	25359.1 19472.2	976.8 3865.0	4423.2 1635.0
#4	Eng Prop	AE105435 N222555	26883.1 24959.8	976.8 3014.2	4423.2 2385.8

The following maintenance inspections and

modifications were outstanding, however they did not affect the capability of the aircraft to complete its mission:

a. Special Inspections C-12-130-000/NS-xxx:

(1) NS-395 Coupling Clamp, Engine Starter Assembly;

(2) NS-415 SP4041 (MB2) Tie Down;

(3) NS-416 QECU Hose Assy P/N R20988;

(4) NS-417 ADI Bank Steering Bar Operation In Conjunction With The AN/ARN 509 Omega;and

(5) NS-427 Fire Extinguishing System Tube Assemblies.

b. Modifications C-12-130-000/CF-XXX:

(1) CF-602 Auxiliary Ramp Stowage;

(2) CF-630 Flight-deck Sun Visor Monorail Addition; and

(3) CF-651 Mounting of Type APC-30 Speakers.

The aircraft minor defect record indicated 18 outstanding minor rectifications to be carried out, none of which was significant.

Since the completion of its last major inspection in Oct 92 at Northwest Industries, there were no major trends or significant maintenance events. On return from its last previous flight, 16 Jul 93, there were ten maintenance actions completed before its last flight. Five entries were made to rectify aircraft snags on the following:

a. brakes;

b. No. 3 engine oil temp;

c. No. 3 engine oil quantity gauge; and

d. No. 3 engine hydraulic leak.

Five entries were made to configure the aircraft for a LAPES mission including:

a. strakes removal;

b. towplate installation;

c. latch tests;

d. ADS inspection; and

e. aircraft rigging.

Although the aircraft had been tasked several days prior, the final rigging and loading were not completed until the morning of the flight. Nonetheless, at 1525 hrs (0925 local), the aircraft was signed out by the Aircraft Commander. All accounts from the witnesses and aircrew confirmed that the aircraft was serviceable prior to the crash.

The Weight and Balance Clearance Sheet was not found at the crash site, nor the duplicate copy which should have been filed with 18 AMS by the loadmaster prior to departure. The figures used below are based on a reconstructed Weight and Balance Sheet by the Board of Inquiry. Given an accurate fuel load and load plan, the Board of Inquiry believes that these suggested figures are accurate. The normal maximum take-off weight authorized is 155,000 lbs. The calculated all-up weight as indicated on the Weight and Balance Clearance Sheet would have been 118,914 lbs with a C of G of 24.4% The normal recommended landing weight is 130,000 lbs. The Board of Inquiry calculated the landing weight as 101,914 lbs with a C of G of 24.8% based on a fuel burn of 5,000 lbs per hour and the 12,000 lb platform extracted at the EZ as planned. The Aircraft Commander confirmed that he had signed the Weight and Balance Sheet and that the aircraft was within the calculated limits 18.8% and 30% during the entire flight.

3.7 METEOROLOGICAL INFORMATION

The weather prior to and following the impact was

good, with scattered clouds at 5,000 and 10,000 feet, visibilities of 15 miles or more and a temperature of 20 degrees C. The reported area winds were 250 degrees (T) at seven knots. No reporting station exists at Camp Wainwright, but Lloydminister, which lies approximately 45 miles to the north east, was forecasting scattered clouds for the period of the accident with occasional broken ceilings at 1,500 feet with more than six miles visibility. Eye witness reports confirmed that the EZ weather was mainly sunny with some clouds drifting through the area. Winds were light, and visibility was unrestricted. Crew testimony indicated that weather was great and they could not confirm whether any shadows were covering the EZ area. There is no evidence to suggest that the weather was a factor in this accident.

3.8 AIDS TO NAVIGATION AND TRAFFIC SERVICES

EZ Saville Farm was not equipped with any navigational aids other than a Motorola radar beacon, which was situated between the release panels at the extraction zone. Nearby nav aids included the Wainwright VOR/DME facility. Flight was conducted in VFR uncontrolled airspace with advisory services provided by Lloydminster and Vermilion Flight Service Station. The a/c nav systems were reported to be serviceable except for the doppler which was said to be unreliable. Navigation to the EZ was conducted solely by use of 1/250,000 and 1/50,000 scale maps. The crew reported no difficulties with the route navigation, and did not use/require any outside navigational aids, or ATC services other than the mandatory transmissions required in controlled airspace. Navigational aids and ATC services were not a factor in this accident.

3.9 COMMUNICATIONS

Communications with Wainwright Range Control (Pegasus), and EZ Saville Farm were conducted on UHF 229.8 MHZ. Communications with the EZ controller were initially difficult due to the low altitude of the a/c. These difficulties were resolved when the flight got closer in to the EZ.

The crew reported that initially, only Range Control was answering their calls, and they requested that they relay their transmission to the EZ controller. By the time Range Control initiated the relay, EZ Saville Farm started answering the calls. The remaining transmissions went as expected except for the fact that the EZ controller passed the wrong wind info (110 degrees at 5 knots),to Trucker 5. The navigator immediately advised the pilot that these winds were incorrect and gave him the proper wind assessment of westerly winds at 5 to 10 knots. This was confirmed by smoke at the EZ.

Although communications were somewhat erratic at first, they were back to normal prior to the one minute call. The crew did not feel that these initial communication difficulties affected their mission in any way. Communications were not a factor in this accident.

3.10 ALIGHTING AREA

EZ Saville Farm is located in the Camp Wainwright military training area and is used for drops in support of Army and militia units. On the day of accident, an EZ had been set-up by the students of the EZ, LZ, DZ. Controller Course run by the CABC. The EZ lay-out was IAW CFACM 60-2601(1). The EZ is situated on a large open field with a slight upslope from east to west. Run-in to the EZ axis on a heading of 164(M) brings the a/c over an escarpment 700 meters north of the EZ. Small trees border the zone to the east and south. Average EZ elevation is 2,075 feet. One ambulance and two medical assistants were at the site to support the paradrops which were to follow the LAPES mission.

The crew had thoroughly briefed the terrain they expected to see. However, given the topography at and around the EZ, it is possible that height perception may have been difficult to judge using the area around the EZ. Interviews conducted with other pilots who had dropped at this EZ revealed that during a winter exercise, two separate crews had touched down on the EZ while conducting LAPES training. They stated that the terrain did prove

more challenging than usual; however, they did not think that their height references for the LAPES pass were any more difficult to achieve than elsewhere. Having reviewed the evidence, we feel that the terrain at EZ Saville Farm may have been a contributing factor in this accident.

3.11 RECORDING DEVICES

The FDR/CPI, AN/USH 502(V)-1, S/N 87001, is a combined recording and beacon assembly. The recording set was operating while the flight was in progress but ceased to operate on initial impact. The beacon set began operating due to the force of the impact. The initial signal was picked up by SARSAT at 221658Z Jul 93 from position 52 47.4N, 110 57.5W. The actual position of the crash is 52 46.0N, 111 10.3W. The airfoil did not deploy from its recess in the tail section. FDR/CPI results are at annex P.

The following is an analysis of the flight profile, between reference time 12:00 and reference time 12:53, cross referenced with FDR voice input data (CVR), in quotations, where it is considered relevant and/or precipitous. For the purpose of this analysis the start time of 12:00 will be indexed at 00:00.

Analysis of the flight profile indicates the aircraft between reference times 00:00 and 00:23 at a stable pressure altitude of 2500 ft with heading variations from 168 to 176 degrees magnetic. Vertical acceleration readings remained constant in the +1.0 to +1.2 G range. At time 00:23, the aircraft began a descent to 200 ft AGL at a calculated rate of 1500 fpm levelling at time 00:36. During the descent, increase pitch changes occurred, beginning at time 00:32, peaking at +2.8 degrees and finally stabilizing at +2.0 degrees at time 00.38. At 0:43.33 the "15 seconds" call was made. At time 00:44.10 the "deploy the drogue" call occurred; another "15 seconds" call came at time 00:45.26 followed at time 00:47 by a slight descent (500 fpm), a pitch change from +2.0 to 0.0 degrees, and a decrease in vertical velocity from 1.0 G. The "good drogue" call came at time 00:47.25, as did a pitch change from 0.0 degrees

to -10.5 degrees. At time 00:49 the heading changed from 170 to 168 degrees magnetic. At time 00:50, the following occurred: the "green on" call was made (00:49.40 on the voice transcript); the rate of descent increased to approximately 2500 fpm; vertical acceleration began to increase from 0.60 G, and the aircraft began to pitch up from -10.5 degrees. At time 00:51, the aircraft pitched up again from -8 degrees. At time 00.52 the aircraft was at a pitch attitude of -2 degrees and the heading changed from 168 toward 170. At time 00:53 (slightly less) the vertical velocity was at 2.6 G. No voice transmissions were recorded after time 00:49.40.

From initial descent from 2,500 ft pressure altitude until time 00:52 (one second prior to impact), the engine power remained stable with only gradual adjustments. At TOD, engine power was 4000 in lbs of torque which gradually increased to 6000 in lbs by time 00:45. Between time 00:44.10 (the "deploy the drogue" call) and 00:47.25 (the "good drogue" call) torque decreased to 5000 in lbs. Subsequently, the torque increased to 6000 inlbs by time 00:52.

3.11.1 FDR (Data Channels)

The FDR is the Sound Recording Set of the AN/ASH-502(V)I which records, along with certain aircraft performance data, the pilot's and co-pilot's ICS, and all crew position microphone audio signals. Data recovery was good until elapsed time 00:53 at which time the FDR ceased to function. For the purpose of this analysis, the start time will be indexed at 00:00.00.

From level off at 200 ft AGL, at time 00:06, onward flight deck communications were normal for a LAPES mission. Check list procedures were smooth except that the AC reminded the co-pilot, at time 00:47, "don't forget your one minute call" referring to the external call to EZ Saville. The navigator, thinking the AC was prompting him, commented that he had already done so, to which the AC replied "external". This prompted the co-pilot to make the call at time 00:58. There was also a comment by the navigator at time 01:24 that the winds given

were incorrect and were "... coming from the right". It is the Board's opinion that the pilot made a correction to the right just prior to impact. There were two "15 seconds" calls. The first by the navigator at time 01:43.33 and the second by the co-pilot at 01:45.26. The first "15 seconds" call came 8.52 seconds before impact. The remaining two steps: deploying the drogue chute and initiating the load extraction, signified by the "green on" call took the next 5.30 seconds. The "green on" call came 2.45 seconds before impact. The aircraft had descended 200 ft after the "deploy the drogue" call at time 00:44.10. At a normal LAPES profile rate of descent of approximately 1200 fpm, it should have taken 10 seconds; it was done in 7.75 seconds, which indicates an average descent rate of approximately 1550 fpm. However, evidence shows the aircraft descended less than 10 ft in the first 3.15 seconds (at the "good drogue " call). Therefore, it dropped 190 ft in the remaining 4.60 seconds, an average descent rate of approximately 2300 fpm. The sound of the crash came at time 00:51.85.

3.11.2 CVR (Sound Channels)

The CVR is the Sound Recording Set of the AN/ASH-502(V)I which records, along with certain aircraft performance data, the pilot's and co-pilot's ICS, and all crew position microphone audio signals. Data recovery was good until elapsed time 00:53 at which time the FDR ceased to function. For the purpose of this analysis, the start time will be indexed at 00:00.00.

From level off at 200 ft AGL, at time 00:06, onward flight deck communications were normal for a LAPES mission. Check list procedures were smooth except that the AC reminded the co-pilot, at time 00:47, "don't forget your one minute call" referring to the external call to EZ Saville. The navigator, thinking the AC was prompting him, commented that he had already done so, to which the AC replied "external". This prompted the co-pilot to make the call at time 00:58. There was also a comment by the navigator at time 01:24 that the winds given were incorrect and were "... coming from the right". It is the Board's opinion that the pilot

made a correction to the right just prior to impact. There were two "15 seconds" call. The first by the navigator at time 01:43.33 and the second by the co-pilot at 01:45.26. The first "15 seconds" call came 8.52 seconds before impact. The remaining two steps: deploying the drogue chute and initiating the load extraction, signified by the "green on" call took the next 5.30 seconds. The "green on" call came 2.45 seconds before impact. The aircraft had descended 200 ft after the "deploy the drogue" call at time 00:44.10. At a normal LAPES profile rate of descent of approximately 1200 fpm, it should have taken 10 seconds; it was done in 7.75 seconds, which indicates an average descent rate of approximately 1550 fpm. However, evidence shows the aircraft descended less than 10 ft in the first 3.15 seconds (at the "good drogue " call). Therefore, it dropped 190 ft in the remaining 4.60 seconds, an average descent rate of approximately 2300 fpm. The sound of the crash came at time 00:51.85.

3.12 WRECKAGE INFORMATION

The ramp and right rear main wheel contacted first and absorbed a significant amount of the initial impact, however the 12,000 lb load on the ramp drove the ramp downward breaking the two hinge points under counter clockwise torsion and downward pressure. The left corner of the leading edge of the 12 foot aluminum platform supporting the weighted barrels impacted the ground causing a 45 degree gouge in the ground, severing structural members through the cargo door and piercing two holes on either side of the tail at FS 890 BL30L, FS 985 BL30R. At this point, the FDR/CPI battery was severed and precluded the FDR/CPI from deploying. The curved imprint of the ramp followed by the right main and then by the left wheels main determined the touch down sequence upon impact, then quickly followed by lighter scarring indicating that the aircraft became airborne again. The hard nose landing was confirmed by pieces of the radome, radar and landing gear being found at the second impact point shortly after the first. After this initial touch down, the wreckage is limited to minor pieces of ramp and load material. After the initial contact, the aircraft maintained

a relatively high forward velocity since the main gear remained intact and the ground was free of significant obstacles. The major portion of wreckage was found 300 feet from the berm. The aircraft contacted the berm at an estimated 60 knots. The impact severed the weakened flight deck and catapulted it approximately 300 feet from the berm and impacted the ground upside down and facing rear ward. The fuselage also became airborne and impacted the ground approximately 50 feet beyond the berm. The propellers began to contact the ground first due to the forward shift in C of G and the downward angle of the trajectory. The initial propeller strikes were razor thin cuts indicating low power settings. This was later confirmed by the throttle positions. The torquing momentum and forward motion of the engines caused the propellers and their components to disintegrate, as evidenced by the wreckage. The No. 3 engine was completely torn off the wing while the Nos. 1, 2 and 4 engines, complete with combustion chambers, compressors and turbines, stayed together although severely mangled. The No. 1 propeller departed the aircraft and impacted the ground 250 feet ahead and to the left of the flight deck. When the wings toppled the upper surface of the fuselage FS 437 - 497 pinched the bottom of the flight deck and creased between BL40L and BL40R. The upper surface of the wing area between Nos. 1 and 2 engines was punctured by No. 1 propeller lying on the ground. The flight deck sustained further serious damage as a result of the rescue and extricating process. The empennage became detached and continued to fly past the wreckage over the LOX converter and landed facing right side up and to the right.

3.13 MEDICAL AND PATHOLOGICAL INFORMATION

See Section 3.2. Injuries to Persons and 4.3.1 Synopsis of Medical for information on personnel injuries.

3.14 FIRE, EXPLOSIVE DEVICES, AND MUNITIONS

The aircraft had no munitions or explosive devices other than two squibs on the emergency fire bottles. These were safetied and removed by the

maintenance armament technicians. Although the potential for fire was high, the only fire occurred several seconds after the main body of the wreckage came to rest. Residual fuel in the right external tank, approximately 200 lbs, was spilled on break up and probably splashed onto the No. 4 engine, igniting the fire and causing the external fuel tank to melt. A surviving crew member unsuccessfully attempted to extinguish the flames. The Fire Chief from Camp Wainwright responded within 30 minutes to extinguish and secure the area.

3.15 SURVIVAL ASPECTS

3.15.1 CRASH SURVIVABILITY

The main factors that made this crash survivable are:

a. the extreme shallow impact angle;

b. break up pattern;

c. no fuel in the external tanks;

d. engine bleed air valves were closed prior to impact; and

e. the quick rescue/Fire Chief response.

Upon impact, the aircraft, although structurally weakened, maintained its integrity and tobagganed into the berm. At this point, the flight deck and empennage became completely detached at FS 245 and FS 737 respectively. The fact that the LOX converter was catapulted from beneath the flight deck without ignition greatly increased the probability of survival. Furthermore, the fire hazard from spilled fuel was extremely reduced because the structural integrity of the fuel tanks in the wings was maintained. The external tanks were empty (residual fuel, approximately 200 lbs), and the fact that the bleed air manifold had no hot bleed air in it. Finally, the rapid response by the Camp Wainwright Fire Chief prevented the existing fire on the No. 4 engine from expanding.

3.15.2 STRUCTURAL INTEGRITY

The initial contact on the right main wheels caused high vertical and torsional stresses to be absorbed by the main landing gear structure, thereby imposing a severe bending and twisting moment on the tail section aft of the para doors. The ensuing nose first impact on the nose gear caused the nose gear to collapse and transfer the impact loads vertically and longitudinally from the radome to the 245 ring. The aircraft maintained its structural integrity up to the point when it ski jumped over the berm. The flight deck became separated at FS 245 and the section of aircraft from FS 245 to FS 377 disintegrated under compression. The wing and body section from FS 377 to FS 737 remained relatively intact and flipped upside down onto the cockpit. The tail section, with a severely damaged cargo door, minus the ramp, was torn off and was propelled by the forward velocity over the wings. The probability of survival in the cargo bay area was very low. The probability of survival in the flight deck was very high had it not been for the wing and main fuselage landing on the cockpit.

3.15.3 LIFE SUPPORT EQUIPMENT

Life Support Equipment (LSE) is primarily valuable for inflight physiological emergencies. The accident damaged some of the onboard equipment, including LSE which does not appear to be a factor. However, after deceleration, the cockpit's LSE was destroyed by the wheel well crushing the cockpit.

There were only two fire extinguishers lost/destroyed out of six bottles. In this particular scenario, the navigator and the witnesses prevented the fire from spreading by using a halon bottle from the aircraft and extinguishers from ground vehicles. The fire extiguishers were found in fair condition around the wreckage of the main fuselage.

3.15.4 EMERGENCY TRANSMITTERS

The FDR/CPI did not deploy upon initial impact; nevertheless, the beacon was activated and

transmitted the required signal. The beacon was disabled by the rescue team upon arrival. The signal was detected and reported by CMCC Trenton. No other beacons or emergency transmitters were used.

3.15.5 **EJECTION SYSTEMS**

N/A

3.15.6 **SEARCH AND RESCUE**

The response to this crash occured within seconds of the impact. The CABC controller course was present at the edge of the EZ and a field ambulance from 1 Fd Amb was also present. The only reason why the field ambulance was there was because the CABC was planning para drops later over that field. Immediately after the a/c crashed, the ground crew notified Range Control who in turn notified fire and medical personnel. A one bell was called in at 18 Wing Edmonton at 1040 hrs for an off base crash.

The first rescuers on scene were the instructors of the controller course and two Med A's from the field ambulance. They delayed their arrival by a few minutes because of the danger of explosion from the fire. Capt Juneau was already walking around the wreckage when they arrived and he also assisted in the rescue. They pulled the survivors out of the cockpit and initiated first aid.

Two British Gazelle helicopters landed around 1100 hrs carrying the MO from Wainright, Capt Carbol. The decision was soon made to evacuate WO Hull in one of the helicopters because he was the most seriously wounded. WO Hull was flown directly to the University of Alberta Hospital in Edmonton.

The other three casualties were stabilized on site. A British MO, Maj Gillespie (who happened to be on exercises in the area), arrived with Gurka Med A's in two ambulances. He helped Capt Carbol to stabilize the patients and prepare them for transport by CC130 (one of the a/c used by the SAR techs). Maj Gillespie accompanied the patients enroute to the Edmonton Municipal airport where a casualty transport van and police escort were

waiting to take them to the Royal Alexandra Hospital. There were no problems noted during this part of the transport.

At approximately 1145 hrs four SAR techs parachuted in from a CC130 and a CC138 Twin Otter. There was not much work left for them to do because all the bodies had been located, the medical personnel were already looking after the casualties and the fire crews were looking after the wreckage.

There was a fire present around number four engine on the right wing. The initial fire fighting attempt was made by Capt Juneau and the Airborne personnel present. They used the small extinguishers they had in their trucks and salvaged some of the plane's extinguishers from the wreckage. They were able to contain the fire to some extent.

The fire department arrived about 23 minutes after the crash because the site was 25 km from the fire station. They responded with a utility vehicle, two crash trucks and five personnel. When they arrived, the fire was still burning around number four engine and there was fuel that had leaked out of the left wing. They put foam on the fuel while simultaneously putting out the fire on the right engine which turned out to be a combustible metal fire. It took about 15-20 mins to completely extinguish this fire.

While the fire fighting was going on, they were also trying to locate the bodies in the wreckage. The two pilots were still trapped in the cockpit. MWO Castonguay was found later trapped on the left side between the rubble of the fuselage and the cockpit itself. Initially, it was thought that only eight crewmembers were on board at the time of the accident. This situation was clarified once the officer in charge of the CABC trials and evaluation team arrived on scene and confirmed that MWO Castonguay was on board. The fire crews had to wait for the jaws of life to be flown in from Edmonton and for a crane to be positioned so that the fuselage could be lifted from the cockpit. The last body was extricated 15 hours after the crash.

The fire chief had a few concerns about the event. For the first few hours while there was still a danger of fire, there were a lot of personnel around the wreckage and it was difficult to determine who had an essential role to play. There was also some difficulty communicating with OSCER initially because the radios were not tuned into the same frequencies. In addition, the Wainwright's base paging system interfered with the firefighter's frequencies. Finally, he had concerns that they were not informed about the LAPES drop (a demanding mission) ahead of time.

3.15.7 OTHER SURVIVAL ASPECTS

Shortly after the crash, most of the cockpit crew were extracted from the wreckage and accounting for all persons was initiated. As soon as the navigator orientated himself to the situation, he immediately went over to control the fire on number four engine by using a halon 1211 fire extinguisher. At the same time, the CABC personnel used the fire extinguishers from their trucks to help control the fire.

In this particular case, the survival gear which was not used, was available for use.

3.16 TESTS AND RESEARCH ACTIVITIES

Toxicological tests are being analysed at DCIEM. Furthermore, the instrument panel and several aircraft components are being analyzed by QETE.

Fluid samples of the aircraft engine oil, hydraulic fluid, propeller oils and fuel from the wing and engine were analyzed. The QETE report confirmed that there were no abnormalities. Note that some fuel samples contained sand and metal particulate. These minor amounts of contaminant were a result of the recovery procedures used at the site. Fluid samples from the fuel bowser were analysed at ARC and confirmed serviceable.

3.17 OTHER INFORMATION

Analysis of all information gathered from personnel interviews, video tapes, still pictures and

inspection of all LAPES components at the crash site give a clear LAPES profile of aircraft CC130321.

The drogue parachute was deployed approximately 3.2 seconds prior to aircraft descent. The drogue parachute fully inflated and was considered to be a good drogue. Load transfer was initiated over the release panels while the aircraft was still descending. The line bag and 1901 deployment bag exited the aircraft cleanly and deployed normally. The extraction phase of the 12 foot LAPES platform and load had begun and the load was being extracted from the aircraft when ground contact occurred. The platform and load were on the ramp when the ramp was torn off and the 1901 extraction parachute separated from the platform.

The 1901 deployment bag, line bag, extraction link assembly and 15 foot drogue parachute with 60 foot 2-ply drogue line were found approximately 20 yards southeast of the release panels. The 1901 deployment bag, line bag, extraction link assembly and 60-foot drogue line were inspected and found serviceable. The 15 foot drogue parachute, local Serial Number D0522, manufacture Serial number 77563, manufactured by Irvin Industries May 73 had a total of 20 deployments. It was last packed for service use at Canadian Forces Parachute Maintenance Depot (CFPMD) by Cpl Cameron and rigger checked by MCpl Hamilton 22 Apr 93. The drogue parachute sustained stress damage to every "A" section at the radial seam on gores 1 through 16.

The Positive Indicator Load Transfer (PILT) was found near the line bag. The PILT lanyard was broken approximately 18 inches from the PILT. This type of break indicates that the lanyard was over stressed but had functioned normally prior to impact.

The 1901 extraction parachute was found approximately 200 yards due south of the 15 foot drogue parachute and 30 yards east of the impact panels. The four point clevis was found approximately 10 yards south of the left impact panel. Two plies of the 8-ply right extraction sling were still attached to the four point clevis

but were cut at a 45 degree angle approximately eight feet from the clevis. The left extraction sling was not on the clevis. The rest of the extraction slings were found with the Attitude Control Bar (ACB) and remainder of the platform approximately 30 yards north of the climb out panels. All right hand extraction sling plies had been cut cleanly at a 45 degree angle and four plies of the left extraction sling were cut eight feet from the platform attachment point. The four point clevis and 60 foot 12-ply extraction line were inspected and found serviceable as was the 1901 extraction parachute local Serial Number G0524, manufacture Serial Number 1125, manufactured by Irvin Industries Nov 80, and was last packed for service use at CFPMD by Cpl Cawley and rigger checked by Cpl Blaney 28 Jan 93. The towplate assembly was found attached to the ramp with no visual damage and in excellent condition. All LAPES components functioned as designed and video evidence confirms these findings.

3.18 **USE OF EFFECTIVE INVESTIGATION TECHNIQUES**

The accident occurred in an area readily accessible by both air and land. The crash and load extraction sequence were captured on video since all LAPES drops are tapped. Also, 35mm film was obtained showing the entire crash sequence. The area was quickly cordoned off by Army personnel. The WFSO completed an initial survey of aircraft components shortly after the crash, and took a video of the entire crash scene. A detailed survey of the accident site was commenced 23 Jul 93.

Detailed aerial videos and 35mm film were also taken on the day of the crash. The FDR/CPI were recovered intact and proved invaluable in post crash analysis. Due to the proximity of a public road, extensive security was necessary to prevent intrusions. A tent city was established in order to support all personnel involved in the investigation and recovery of a/c 321. At its' peak, the number of personnel at the site reached approximately 100. Extensive personnel and equipment support from 18 Wing was required. Vehicle and fire and rescue support was also provided by Camp Wainwright. Flight support was

provided by CC130s, CC138s, Twin Hueys and Kiowa aircraft.

Although a large number of personnel were at the crash site, care was taken to ensure that nothing was moved prior to the inventory and survey of the crash site being completed. However, the main wreckage had to be shifted in order to extricate the two pilots and the CABC observer. Extensive still and video coverage of this area was taken prior to moving the wreckage. Also, during the immediate post-crash rescue, some equipment was moved in order to help the injured and fight the fire. The analysis of all the physical, human and electronic evidence resulted in detailed knowledge of the crash and break-up sequence rarely afforded to an investigation team.

3.19 PROBABLE ACCIDENT SCENARIO

In determining the probable accident scenario, the Board of Inquiry was greatly assisted by the evidence provided by video tape and photograph coverage of the LAPES profile, on-board video tape which provided coverage of the tow plate and the extraction sequence, the a/c FDR/CPI data, survivor witness statements and ground personnel witness statements.

Trucker 5, a/c 130321, departed 18 Wing Edmonton on a LAPES mission in support of a DZ, EZ, LZ Controller Course. A dry pass was conducted over EZ1 Edmonton. Although the profile was satisfactory, the crew was slow to initiate the correct check list during a simulated emergency. After the dry pass, the crew proceeded on a TAL route prepared by the pilot. Although initially slightly behind time, the crew re-established the flight plan as scheduled and resumed the planned 210 KIAS at 1,000 ft AGL. The 20 and 10 minute checks were completed uneventfully and the navigator ensured that an accurate track and timing were maintained. The slow-down check was completed, the a/c was configured for the drop and a descent to 200 ft AGL was commenced. The one minute warning was called on time and the EZ panels were identified. Minor corrections were required to line up with the EZ axis. Although minor EZ-a/c

communication difficulties existed, proper winds were determined and the clearance to drop was obtained. Following a further descent, as the terrain permitted, the a/c was stabilized at 200 ft AGL, 130 KIAS. Line-up with the EZ axis was acceptable but slightly left of centre line.

During the final descent to 200 ft AGL, the co-pilot failed to call the "15 seconds" warning to alert the crew. At 8.6 seconds prior to impact, the navigator called "15 seconds", followed shortly thereafter by the "deploy the drogue" call by the pilot (7.4 seconds prior to impact). The co-pilot, realizing that he had missed his warning call, then stated "15 seconds". The pilot maintained level flight until the "good drogue" call was made by loadmaster # 2. Between the "deploy the drogue" call and the "good drogue" call, 3.2 seconds elapsed. Possibilities for the pilot electing to maintain level flight for this 3.2 second period are:

a. he wanted to ensure drogue status before commencing descent;

b. he felt that he had not yet reached his descent point; and/or

c. he was thrown off stride by the late "15 seconds warning".

Immediately prior to the "good drogue" call, the pilot lowered the a/c nose two degrees and at the "good drogue" call (4.6 seconds prior to impact), the a/c nose down attitude increased noticeably to establish the final descent profile.

Noting the co-pilot had to be prompted regarding the 15 second warning, the AC divided his attention between the pilot and the co-pilot. In doing so, he monitored only a few seconds of the profile and did not notice the 10.5 degree nose down attitude. As the a/c passed over the release panels, the co-pilot called "green on" and initiated the extraction sequence (2.5 seconds prior to impact). As this call was made, the AC looked over to the right side of the a/c and noted that the a/c was higher than the normal 30 ft AGL. At this instant,

the a/c was established in a 10.5 degree nose down attitude, descending at approximately 2400 fpm and 2.5 seconds from impact.

Immediately after passing the release panels, the pilot applied aft control column pressure in an effort to reduce his sink rate. Realizing that the a/c was drifting left, the pilot also applied a slight right bank input while continuing to apply back pressure on the control column.

The extraction sequence functioned normally and the LAPES platform began moving aft. Just as the LAPES platform reached the rear of the ramp, the a/c impacted the ground - ramp first, in a nose high, slight right wing down attitude.

The severity of the impact drove the ramp and LAPES platform upwards, contacting the cargo door. The load then violently impacted the ground and caused severe damage to the aft fuselage. Simultaneously, the extraction lines were severed and the main chute collapsed. The a/c hit hard collapsing the nose landing gear and damaging the forward fuselage section. At some point after the initial impact, the throttles were retarded to flight idle and the pilot placed both hands on the control column. The a/c continued to slide in a straight line along the EZ axis. Following impact with a berm, the cockpit separated from the fuselage and flipped over on its upper surface. Shortly thereafter, the propellers contacted the ground and the wing and centre fuselage also flipped over coming to rest on the inverted cockpit. The tail section, after separating from the fuselage, flew over the wing and came to rest right-side up, ahead and slightly right of the wing and cockpit wreckage.

SECTION 4

STATEMENT OF THE INVESTIGATION TEAM

CONTENTS

4. GENERAL

4.1 AIRCREW MEMBER'S REPORT

4.1.1 ANALYSIS OF THE TESTIMONY

After careful analysis of the testimony, only a few discrepancies with factual information were noted. In particular, the aircraft commander, the navigator and both flight engineers agreed that the aircraft was high over the release panels; however, no one could testify to the fact that the aircraft had entered a very steep descent profile. Also, no one could remember who had called the first "15 seconds" call. Only the navigator noted that the aircraft was lined-up slightly to the left of the EZ axis during the final approach. The only testimony which indicated that the a/c had slight bank at impact, was that given by a CABC instructor. After viewing the accident video, the aircraft commander still believed that their descent profile was not excessively steep. Other survivors had little or no additional comments to add to their previous statements.

4.1.2 HISTORY OF FLIGHT

Aircraft 130321, (Trucker 5), departed Namao airbase at 221555Z Jul 93. The mission was in support of the DZ, EZ, LZ Controller course at EZ Saville Farm. The route to the EZ was preceded by a dry pass at EZ 1 in Namao. Once the dry pass was completed, the aircraft continued on its route to Saville Farm for the live drop.

The Board examined pertinent maintenance records and determined that aircraft 130321 had been properly inspected and was serviceable at the time of the accident.

The flight was properly authorized and the crew qualified, but with several members being supervised due to their uncurrent status (Plt,Co-Plt,and FE2). The pilots were experienced in TAL, but were both uncurrent in LAPES, and had never been to this particular EZ. The AC elected to stand in order to allow both pilots the opportunity to regain their currency status (IAW

CFACM 60-2604, chap 13). The current FE was also standing in order to allow FE 2 the opportunity to regain currency. There are no restrictions preventing this type of practice. A dry pass at EZ 1 Namao
was carried-out prior to departing enroute. However, EZ 1 had not been prepared, and no EZ panels were available for the dry pass.

There are no restrictions precluding this type of practice. Also, at the time of impact, three crewmembers were standing (AC, Nav, FE1). Since there is no intent to land, there is no direction which precludes this practice during a LAPES profile.

4.1.3 **PERSONNEL INFORMATION**

The nine member crew consisted of the following:

Aircraft Commander	Maj	A.G.	Niles
Pilot	Capt	M.G.	Allen
Co-pilot	Capt	V.L.	Shurman
Navigator	Capt	E.R.M.	Juneau
Flight Engineer #1	Sgt	H.J.	Lous
Flight Engineer #2	WO	S.J.	Hull
Loadmaster #1	Sgt	J.D.A.	Michaud
Loadmaster #2	MCpl	R.J.	McWilliam
Crewmember (CABC)	MWO	J.S.	Castonguay

This particular crew was experienced in CC130 operations. Cumulative CC130 flying time amongst the three pilots was over 12,000 hrs. The AC has over 10,000 hrs of flying time and has done multiple instructional tours. He holds all possible qualifications in TAL operations, and has extensive LAPES experience (83 missions) and had also recently completed ACT.

The pilot was a very competent individual who, in one tour, had successfully achieved all TAL qualifications except that of Formation Lead. He had completed a total of 32 LAPES missions during his first operational tour. However, he had only flown three left seat drops since graduating from the left seat course in Jul 91. Additionally, his last left seat LAPES drop was flown 22 Jun 92. He also had been off flying for six months due to the

LFCSC. Prior to the day of the accident, he had flown a total of 15 hrs since his return to flying. He was posted to 435 Sqn for employment as a TALS instructor and flew his first mission 13 Jul 93. He had not received formal ACT. The co-pilot was also an experienced TAL pilot with extensive ATAL training and employment (RED FLAG, MAPLE FLAG , six rotations in Yugoslavia). However, he was relatively new to LAPES with a total of 11 missions since his course in Mar 91. His last drop was 11 Jan 93. He also recently completed ACT. He had flown his first trip with 435 Sqn 24 Jun 93.

The purpose of this mission was to support the CABC's controller course; however, it also presented an opportunity to get two pilots,new to 435 Sqn,current in LAPES. The AC had discussed the idea of getting Capt Allen current on this mission with ATGHQ/SOTAC and had received SOTAC's endorsement. EZ Saville Farm was new to both pilots flying the mission.

4.1.4 **METEOROLOGICAL INFORMATION**

The weather at the time of the occurrence was very good with a temperature of 20 degrees C, scattered clouds, good visibility and light westerly winds. Testimony from the crew indicate that the weather was not a factor in this accident.

4.1.5 **AIDS TO NAVIGATION AND AIR TRAFFIC SERVICES**

Given the VFR nature of this flight, ground navigational aids were not reported as having been used. Aircraft navigational systems were working, however, the doppler system was reported to be intermittent. According to testimony, this posed no problems to the crew. Communication with ATC was minimal given the flight profile, and did not influence the flight in any way.

4.1.6 **ALIGHTING AREA**

The wreckage site was determined to be at N 52 46.0 W 111 10.3 at an elevation of 2,075 ft MSL. The a/c hit the ground 50 ft short of the impact panels and travelled approximately 1,160 ft before

coming to rest in three sections. The a/c hit the ground ramp first, at 130 KIAS, in a nose-up attitude with slight right wing down. Flaps were set at 50% and the landing gear was down. The EZ has slight upslope from east to west, and a small vertical obstruction (berm), approximately 900 ft from the impact point at 90 degrees to the EZ axis. Contact with the berm resulted in severe a/c damage.

4.1.7 **SEARCH AND RESCUE**

The rescue efforts immediately after the crash were carried out by the CABC personnel at the scene. All proper first aid actions were taken for the survivors and an accounting for all crewmembers was done. Some confusion existed, initially, as to the actual number of crew since the first accounting did not include the CABC observer.

Crash response from the Wainwright Fire Department was good given the distance they had to travel to the accident scene. SAR technicians jumped into the site, but were not required due to the amount of medical support already in place.

4.1.8 **SUMMARY**

Trucker 5 flight had been without major problems until the last minute of flight were events took a tragic turn. The sequence began to fall apart when the 15 second call was missed by the co-pilot and given by the navigator (late).

The pilot did not deploy the drogue until he heard this call, and did not descend until the "good drogue" was called. An aggressive descent was initiated and the "green on" was called shortly thereafter. All survivors knew they were high at the release panels when the "green on" was called, but expected the pilot would accept the high extraction. At the "green on" call, the AC once again focussed his attention on the co-pilot and did not notice the steep profile. No one in the cockpit noticed the steep descent angle and excessive rate of descent. The pilot initiated his flare aggressively but was unable to arrest

his downward vector.

After reviewing the FDR/CPI, and analyzing visual evidence and witness testimony, the following conclusions can be drawn from the data;

a. the pilot had not flown left seat LAPES in the last 12 months;

b. the co-pilot had not flown LAPES in the last six months;

c. both pilots had never been to EZ Saville Farm;

d. the pilot felt he didn't need a dry pass prior to the live drop;

e. the pilot had flown a total of 15 hrs in the last six months, 0.5 hrs of which was TAL related;

f. some of the cockpit crew were not aware that a CABC observer was on-board for the mission;

g. the "15 seconds" warning was given late and was called by the navigator;

h. the pilot did not descend until after the good drogue call;

j. although late and high, the pilot attempted to achieve the normal load release height by the impact panels;

k. the AC was pre-occupied with the co-pilot during the critical phase of the profile;

l. no crewmember questioned the abnormal profile; and

m. the pilot attempted to regain the normal profile.

In summary, the pilot had flown a good trip up the final profile. He did not initiate his descent until well past the normal descent point. At the "green on", he committed himself to a profile from

which impact with the ground was unavoidable. The load, being on the ramp at impact, caused severe structural damage and precluded any chance the a/c had of flying away after the initial impact.

4.2 TECHNICAL MEMBER'S REPORT

Aircraft CC130321 was tasked to support the CABC with a LAPES drop at Saville Farm. The aircraft records, FDR data and investigations of this Board confirmed that the aircraft was serviceable before impact. Furthermore, the extraction system functioned normally and fluid samples showed no abnormalities. The aircraft was due for its No. 2 Periodic in 12.8 hours. There were no maintenance anomalies discovered during the investigation.

The aircraft sustained A category damage on initial impact and slid into a berm causing the aircraft to disintegrate into three major components; flight deck, main fuselage with wings and tail. All four propellers contacted the ground after the aircraft hit the berm. The Nos. 1, 2 and 4 engines remained on the wing but suffered extensive damage. The No. 3 engine departed the aircraft wing on impact. The wing remained intact during the crash and the only fuel leak was caused by the upper wing surface coming to rest on the No. 1 propeller. A small fire erupted on the No. 4 engine several seconds after the aircraft came to rest. The LOX converter, situated in the nose wheel well was thrown from beneath the flight deck and did not initiate any fire. The FDR/CPI, although transmitting, failed to deploy.

In conclusion, there are no significant statements or conclusions that can be made regarding the technical aspects of this accident.

4.3 MEDICAL MEMBER'S REPORT

4.3.1 PAST AND CURRENT HISTORY

All crew members were physically fit for flying and current with respect to their aircrew medicals. They were all well rested and fed in the 72 hours prior to the accident. There were no

other significant psycho-social stresses found.

4.3.2 LIFE SUPPORT EQUIPMENT (LSE)

In general, the LSE was found in fairly good condition except for the oxygen equipment which was extensively damaged. Some of the safety systems equipment had been moved from their original positions due to the dangers of fire and explosion.

The only cockpit personnel wearing lap and shoulder restraints at the time of impact were the pilot, co-pilot, and flight engineer. Their harnesses were cut in order to extract them from the a/c. Neither loadmaster was restrained by any LSE because they had to be standing or crouching in order to perform their duties during the LAPES mission. At the time of impact, the loadmasters were wearing Gentex 411 helmets with their visors in the down position. It could not be determined whether or not the Airborne crewmember was strapped into his troop seat. He was probably sitting in order to operate the LCD and VHS VCR equipment. A troop seat has been sent to DCIEM for further analysis.

There were only two fire extinguishers lost/destroyed out of six bottles. In this crash, the navigator and the ground crew prevented the fire from spreading by using a halon bottle from the a/c and extinguishers from the ground vehicles.

4.3.3 RESCUE RESPONSES

The response to this crash occurred within seconds of the impact. The CABC controller course was present at the edge of the EZ and a field ambulance from 1 Fd Amb was also present. The only reason why the field ambulance was there was because the CABC was planning para drops later in the day over that field. Immediately after the a/c crashed, the ground crew notified Range Control who in turn notified fire and medical personnel. A one bell was called at 18 Wing Edmonton at 1040 hrs for an off base crash.

The first rescuers on scene were the instructors of the controller course and the Med A's from the field ambulance. They delayed their arrival by a few minutes because of the danger of explosion from the fire. Capt Juneau was already walking around

the wreckage when they arrived and he also assisted in the rescue. They were able to extricate the survivors very quickly, administer appropriate first aid and help contain the fire. Although dead bodies are not supposed to be moved from the wreckage, the decision was made to move Sgt Michaud and MCpl McWilliam because of the risk of fire and explosion in this particular crash. MWO Castonguay was not found until about 45 minutes after the crash because the CF K 1017 only listed eight individuals on board (Capt Juneau's name was not on the 1017) and eight POB had been found up to that point. In addition, many of the crew members did not know that Castonguay was aboard or had simply forgotten. This situation was clarified once the officer in charge of the CABC trials and evaluation team arrived on scene and confirmed that MWO Castonguay was on board.

Two British Gazelle helicopters landed around 1100 hrs carrying the MO from Wainwright, Capt Carbol. The decision was soon made to evacuate WO Hull in one of the helicopters because he was in the worst shape with a possible basal skull fracture. The MO started an IV in him and decided to send Sgt Miles, an Airborne first aid instructor, to accompany him because he did not want to lose the Med A at that point. The IV fell out of the patient while enroute and he vomitted. Although it would have been preferable to send a Med A for air transport because of the risks of vomitting and choking (especially in a head injured patient), a quick decision had to be made based on uncertainty of the conditions of the other patients and the scarcity of medical personnel. On the receiving end, there was no one waiting to receive the patient on the roof of the hospital. The staff had been waiting down in the ER. In addition, the ER staff had been expecting more casualties. The records from Range Control (who had sent all the medevac messages) indicated that they sent a message stating that two patients were being air-evacuated to the University of Alberta Hospital.

The other three casualties were appropriately stabilized on site. A British MO accompanied the patients enroute to the Edmonton Municipal airport where a casualty transport van and police escort were waiting to take them to the Royal Alexandra Hospital. There were no problems noted during this part of the transport.

At approximately 1145 hrs, four SAR Techs

parachuted in from a CC130 and a CC138 Twin Otter. There was not much for them to do at that point. All of the bodies had been located, the medical personnel were already looking after the casualties and the fire crews were looking after the wreckage.

There was a fire present around number four engine on the right wing. The initial fire fighting attempt was made by Capt Juneau and the Airborne personnel present. They used the small extinguishers they had in their trucks and salvaged some of the plane's extinguishers from the wreckage. They were able to contain the fire to some extent.

The fire department arrived about 23 minutes after the crash because the site was 25 km from the Fire Station. They responded with a utility vehicle, two crash trucks and five personnel. They were able to put out the metal fire and prevent the fuel on the ground from catching fire. None of the bodies could be extricated because they were trapped under the wreckage. They had to wait for the jaws of life to be flown in from Edmonton and for a crane to be positioned so that the fuselage could be lifted from the cockpit. The last body was extricated 15 hours after the crash.

The fire chief had a few concerns about the event. For the first few hours while there was still a danger of fire, there were a lot of people around the wreckage and it was difficult to determine who had an essential role to play. There was also some difficulty communicating with OSCER initially because the radios were not tuned into the same frequencies. In addition, the Wainwright's base paging system interfered with the firefighter's frequencies. Finally, he had concerns that they were not informed about the LAPES drop (a demanding mission) ahead of time.

Overall, the Critical Incident Stress Debriefing (CISD) process was quite successful. However, it began with a hesitant start. Command had made a decision to delay many of the debriefings until all the funerals were over. As a result, the survivors and their families did not receive CISD for almost two weeks. Another problem encountered was that many people had negative experiences with the CISD team two years ago after the crash in Alert. Finally, there was a problem in finding out exactly who was present at the accident scene. While conducting interviews and reconstructing the

rescue response scenario with the Board of Inquiry, it was found that many individuals who were at the scene immediately went back to their home units. The two Med A's went back to Calgary (one of them went on leave right away and could not be reached), several individuals went back to Petawawa right away, and the Gurkha field ambulance unit went back to the field right away. None of these individuals had received any follow up for CISD. Fortunately, these people received appropriate follow up after it was found that they had been omitted (a few had been profoundly affected by the crash). However,there are likely quite a few people who did not receive help from the CISD team because they left the crash site and did not know that this help was available.

4.3.4 PHYSICAL EXAMINATION

Of the deceased, Capt Allen and Capt Schurman both died from crush injuries to the chest. Sgt Michaud and MCpl McWilliam died from multiple blunt injuries and MWO Castonguay died from blunt injuries to the chest.

Among the survivors, one was seriously injured and the other three received only minor injuries. WO Hull had a skull fracture and sore hip. Maj Niles received a scalp laceration, dislocated shoulder, and a small fracture near his right knee. Capt Juneau had a few lacerations on his legs and groin area and a separation of the right shoulder. Sgt Lous had multiple areas of bruising, lacerations of the scalp, right hand and left cheek, and a fracture of the right arm.

4.3.5 TOXICOLOGY

Toxicological analysis is pending at this time. As noted earlier, all crew gave samples of blood and urine. Further, samples from the deceased were obtained at autopsy. At this time there are no concerns regarding toxicology.

4.3.6 PATHOLOGY

The injuries received are as described in Section 4.3.4. The injuries sustained were consistent with where they were positioned. The pilot and co-pilot's injuries were consistent with being crushed between the fuselage and instrument panels. The two loadmasters in the back received head and neck injuries that were in keeping with being thrown from the aircraft. MWO Castonguay's

injuries to the chest were in keeping with being caught between the fuselage and the cockpit during the accident. WO Hull's seat was likely pushed to the side when the nose wheel collapsed into the cockpit and was able to avoid injuries similar to the pilots. Finally, the other survivors' relatively minor injuries resulted from being unrestrained, thrown to the back of the cockpit by the bunk and being cocooned betweened the floor and the ceiling after the fuselage fell on the cockpit.

4.3.7 HUMAN FACTORS ANALYSIS

PSYCHOSOCIAL FACTORS

There was no evidence that significant psychosocial factors were affecting the crew members.

FACTORS AFFECTING JUDGEMENT OF HEIGHT AND DISTANCE

Even though visual illusions are not the cause of this crash, they may be contributory factors. On approach, the pilot is constantly comparing visual images with past experiences. In this case, all of Capt Allen's previous LAPES missions have been flown near Trenton or Edmonton (for the LAPES course). It had been 12 months since he had flown his last LAPES mission and he was flying over an unfamiliar field without the benefit of doing a dry run first. Misinterpretation of the visual information occurs when there are unusual topographical features, unfamiliar visual references and a lack of contrast and shadows. There is no way to know for sure to what degree visual illusions contributed to this crash but there are some interesting features about this area worth noting. It is curious that other experienced pilots have touched down in the snow on this same EZ.

The images of panels in the extraction zone compared to ground cues such as trees and buildings when compared to previous experience in Trenton would give Capt allen an accurate assessment of distance and altitude. If he was descending on the same panels on a featureless approach, he might find himself on a high glide path.

Shadows are one of the most important factors in depth perception. In the absence of shadows, such as in a wide open field, he may misinterpret his

altitude as being higher than he actually is.

Runway contrast also causes problems in depth perception. This occurs when the runway color approximates that of the surrounding terrain. Well documented examples include landing on a snow covered runway or glassy water surface. The same would also apply when landing on a flat grass covered field.

In addition to descending to a wide open field with very little contrast, there was a line of very low lying trees (10 - 20 feet high) off to the left in the pilot's peripheral vision. If the pilot was used to judging altitude from much taller trees, then he may perceive himself to be higher than he actually is.

There are likely factors aside from visual illusions influencing the pilot's decision making process. Expectation and motivation are two very important factors. With Capt Allen's previous experience, his mind was geared to hearing certain calls being made on his headset at scheduled times. Even though there was information to the contrary, the pilot perceived things the way he would like

them to be. This has been termed "anticipatory attitude" and occurs in highly motivated individuals. Expectations were also very high. Capt Allen had just arrived on a new squadron and was being evaluated by Maj Niles who felt that Capt Allen was the best TAL pilot in ATG.

Another factor which may be important here is distraction. Capt Allen was expecting calls in a particular order. When the right seat was late in calling the "15 seconds", it may have distracted Capt Allen and threw his timing off. This effect would be intensified if Capt Allen was a little unsure of his timing because it had been more than 12 months since he had flown his last LAPES mission.

Potentially the most significant factor affecting the pilot's judgement may have been due to what is known as "target fixation" or "target fascination". This phenomenon is well know among dive bomber pilots who are so intent on hitting their target that they lose their situational awareness and crash. It is not difficult to imagine a scenario in this crash where a highly motivated pilot is so intent on dropping the load

over the impact panels that he is not aware that he is descending too rapidly to recover.

4.3.8 CONCLUSIONS

The crew was well rested and mentally prepared for flying. The crew felt that everything was normal prior to the accident. All crew had current medicals and were fit to fly.

The cargo section where the two loadmasters and the observer were positioned was not likely survivable in this particular crash. The troop seat offered little or no protection to the observer. The two loadmasters, who were wearing helmets but were unrestrained, were simply thrown about. There was good evidence to suggest that one of the loosely stored wheel chocks struck Sgt Michaud on his helmet. During a crash, these wheel chocks can become lethal free flying objects. It would be fairly simple to construct a secure storage area for these wheel chocks. Also, the loadmasters received ankle injuries because their ankle boots came off during the crash. They should have been wearing the recommended Kodiak boots. In addition, it would be advantageous for those personnel in the cargo compartment to be equipped with crash-worthy seats. The project for this has been approved but not implemented as of the writing of this report. It is long overdue.

The fatalities and injuries in the cockpit were due to two factors. First, the weight of the fuselage

crushed the cockpit when it flipped over after hitting the berm. This could possibly be prevented from recurring by removing the berm. Second, three of the aircrew were unrestrained at the time of impact. Many of the injuries could have been prevented by strapping in and wearing helmets.

The rescue effort was extremely commendable. Despite the fact that one engine was on fire and the other wing was leaking fuel, the ground crew and medical personnel risked their lives to pull the survivors out of the wreckage and attempt to contain the fire. It was coincidental that a medical crew was present at the scene, there were two British Gazelle helicopters in the area and that the Gurkhas were on exercise in the area. The fire crews arrived fairly quickly despite their remote location.

Overall, the medevacs of the survivors went well. The most seriously injured was transported by helicopter within 30 minutes of the crash and the remaining were transported by CC130 within about 90 minutes of the crash. In retrospect, it may have been more prudent to send a more qualified medical person to accompany the head injured patient in the helicopter but the difficult circumstances at the crash site may not have allowed for this. Also there were some minor communication problems between the receiving hospitals and the crash site when messages were relayed through Range Control. Although these problems did not adversely affect the survivors in this crash, it could potentially affect the outcome in other scenarios. In the future, these problems could be avoided by setting up direct communications between the receiving hospital and the medical personnel conducting the transport.

The control over the co-ordination of the rescue crews at the scene could have been improved. The fire chief noted that there seemed to be unnecessary personnel around the area where there was a potential for explosion while the fire was going on. Reconstruction of the rescue sequences was done mostly through interviews with individuals present at the scene. There did not appear to be an attempt to keep an accurate record of who was present at the scene. This information is not only important to the Board of Inquiry but it is also useful information for the CISD teams (to determine who requires debriefings). Before being released from the scene, all rescue workers should receive an appropriate debriefing and should have their names, units, and addresses recorded. The presence of a CISD team on scene could help OSCER with the following:

a. monitor rescue workers for signs of burn out and advise command regarding their needs;

b. provide on scene counselling and defusings;

c. assist command with the release of personnel from the crash site; and

d. ensure that everyone receives appropriate follow up after the crash.

4.4 SPECIALIST MEMBER'S REPORT

The aircraft did not start its descent immediately after the drogue parachute was released from the bomb rack. The 15 foot drogue parachute functioned as designed but sustained damage that is consistent with material deterioration and/or parachute deployment when aircraft speed exceeds 130 KIAS. The load transfer was initiated over the release panels while the aircraft was still in a nose down attitude. The 1901 extraction parachute deployed as advertised. The extraction phase of the LAPES platform had begun, changing the centre of gravity of the aircraft. The aircraft was in a nose high attitude when it impacted the ground. The LAPES platform weighing 12,000 lbs was being extracted by the single 1901 extraction parachute and was on the ramp when the ramp was torn off. All parachutes and equipment associated with the LAPES drop functioned as designed and were not a factor in the crash.

4.5 PRESIDENT'S SUMMARY

An analysis of the testimony, in conjunction with evidence from the FDR/CPI, on-board video, ground video and ground photographs enabled the Board of Inquiry to accurately reconstruct the events up to the accident.

The Board of Inquiry convened at 18 Wing Edmonton at 0845 hrs 23 Jul 93 and commenced its investigation 22.3 hours after the accident.

TRUCKER 5, a Canadian Forces Hercules aircraft CC130321, based at 18 Wing Edmonton, was tasked to support a DZ, EZ, LZ Controllers Course 22 Jul 93. The aircraft was serviceable for the mission. The flight was authorized, the crew was qualified, and with the exception of the pilot, co-pilot and flight engineer # 2, current in the LAPES role. All orders, directives and instructions provided for the mission were satisfactory.

Although the TRUCKER 5 crew was experienced, both the pilot and the co-pilot were recently posted to 435 (T) Squadron from previous CC130 squadrons. The AC was, in fact, the most experienced LAPES pilot in ATG.

The crew reported for duty two hours prior to departure. Although the LAPES platform was late being loaded on the aircraft, the crew pre-flight preparation was basically uneventful. The

navigator's name was not recorded on the CF K 1017 (buff copy), and the Weight and Balance form was signed by the AC but was not left with 18 AMS. Additionally, not all crew members were aware that the CABC observer was to remain on board for the mission.

Following engine start, a snag with the aircraft brakes was quickly rectified and the aircraft taxied for departure. Following take-off from runway 30, the crew requested and received permission to perform a dry pass at EZ1, Namao. Because EZ1 was unmarked, the pilot was briefed by the AC to use the skid marks left by previous LAPES courses as the impact point. During the dry pass, all in-flight LAPES checks were simulated, for the most part, as required by the dry pass procedure. The "15 seconds" call was made 15 seconds before the "deploy the drogue" call. The profile was well flown and the pilot achieved a six to eight foot wheel height. During a simulated emergency, the crew were late to secure the load. Other than this, the dry pass went extremely well.

After the dry pass, the crew proceeded on a TAL route prepared by the pilot. Although initially slightly behind time, the crew re-established the flight plan and resumed the planned 210 KIAS at 1,000 ft AGL. The atmosphere within the cockpit was relaxed and ready. The 20 and 10 minute checks were completed uneventfully and the navigator ensured that an accurate track and timing were maintained. The Slow Down check was completed and the aircraft descended to a lower altitude. The one minute warning was called on time and the AC had to prompt the co-pilot to call the EZ controller. Although incorrect winds were given by the EZ controller, the clearance to drop was obtained. The navigator was quick to confirm the proper winds. Following a further descent, as the terrain permitted, the aircraft was stabilized at 200 ft AGL, 130 KIAS. Line up with the EZ axis was acceptable but slightly left of centre line.

Although the 15 second warning should have been given while crossing a clearly defined land mark (dirt road), the co-pilot missed this call. At 8.6 seconds prior to impact, the navigator called "15 seconds", followed shortly thereafter by the "deploy the drogue" call by the pilot (7.8 seconds prior to impact). The co-pilot then called "15 seconds" after realizing that he had missed the call.

As he had done during the dry pass at EZ1, the pilot maintained level flight until the "good drogue" call from loadmaster # 2 (4.6 seconds prior to impact). Possible reasons for the pilot maintaining level flight for this 3.2 seconds are:

a. he wanted to ensure drogue status before commencing descent;

b. he felt that he had not yet reached his descent point; and/or

c. he was thrown off stride by the late 15 second warning.

The Board of Inquiry believes that visual illusions were contributing factors, to some degree, in the decision to stay at altitude until the "good drogue" call, to establish such a steep descent profile and to continue such a steep descent profile. The extraction zone is located on a large open area void of distinguishing features, except for some small trees along the left hand side of the field. Although the extraction zone panels were clearly visible, the absence of shadows on a wide open and unfamiliar field would make interpreting visual cues necessary to determine the descent point more challenging. Once in the descent, the familiar visual cues used to ascertain depth perception may well have been lacking. Additionally, target fixation may well have been a contributing factor in maintaining the steep descent profile.

Although the Board of Inquiry does not include visual illusions in the findings, causes and recommendations, primarily because of their insidious nature, it was unable to dismiss the probable presence of visual illusions during the LAPES profile flown by TRUCKER 5.

The LAPES profile is generally considered the most challenging of the CC130 aircraft's tactical capabilities. It inherently involves a greater degree of risk to aircraft and crew because of the close proximity to the ground during the actual extraction of the load. During the LAPES mission, the final 15 seconds prior to the load leaving the aircraft demand that all crew members work as a single cohesive unit. Individual responsibilities require prompt, decisive, error free performance. There is little or no room for mistakes. It is important to note that the LAPES profile, necessitating pilot, co-pilot, loadmaster # 1 and

loadmaster #2 actions, alters the normal CRM routine because the activity is extremely focused. Nevertheless, crew synergy must always be present. The LAPES profile is not a pilot manoeuvre, it is a crew manoeuvre. Unfortunately, two valuable crew members, the flight engineer and the navigator,currently do not receive the formal training required to obtain the detailed expertise needed to make a significant contribution to this demanding tactical role. This situation compromises, to some degree, CRM during a very critical phase of the LAPES mission.

During a normal LAPES profile, the time from "deploy the drogue" to "green on" takes eight to ten seconds (adjusted for weight and ground speed). Additionally, the time from the "green on" to the ideal wheel height over the impact panels takes approximately three seconds. Thus a normal profile from the "deploy the drogue" call to over the impact panels requires 11-13 seconds of flight time. Timings extracted from the FDR indicate that the profile should never have been attempted. The late "15 seconds" call occurred only 8.6 seconds prior to impact and is well short of the normal 11-13 second profile timing. Commencing the profile by deploying the drogue and descending immediately after the late "15 seconds" call, would still have resulted in an uncomfortably steep descent rate. Waiting to descend until 4.6 seconds prior to impact resulted in a 10.5 degree nose down attitude and an approximate rate of descent of 2400 FPM at the release panels. Only 2.5 seconds from impact, it was highly unlikely that recovery without contacting the ground was possible. Unfortunately, the AC divided his attention between the pilot and co-pilot just as the "green on " call was made. In doing so, he monitored only the initial two seconds of the profile and did not note the 10.5 degree nose down attitude. As the aircraft passed over the release panels, the "green on" call was made. At this instant, the aircraft was established in a 10.5 degree nose down attitude, descending at approximately 2400 FPM and 2.5 seconds from impact.

The weather was not a factor in this accident. The Board of inquiry determined that unrestricted visibility, light winds and few clouds were present in the Camp Wainwright area at the time of the accident. Examination of the low level wind data does not support the possible existence of wind shear. While the aircraft crash was a

survivable one, the Board of Inquiry is convinced that the shallow impact angle and the structurally rugged integrity of the CC130 aircraft prevented complete loss of life. Although the aircraft eventually broke into three main sections, cockpit, centre fuselage and wings, and empennage, the aircraft remained relatively intact until impacting the berm. Because the bleed air manifold was depressurized prior to impact and the wings remained relatively intact, there was minimal post-crash fire. Fortunately, crash response was excellent. Instantaneous on scene response of medical and transport (helicopters) resources and firefighters ensured that survivors were promptly attended and evacuated and the aircraft fire extinguished.

SECTION 5

FINDING, CAUSE FACTORS AND RECOMMENDATIONS

CONTENTS

5.1 FINDINGS

The Board of Inquiry finds that:

5.1.1 AIRCRAFT, CREW RELATED:

1. The flight of "Trucker 5" was conducted in accordance with current regulations and orders. All crew members were qualified.

2. All crew members were current with the exception of the pilot, co-pilot, and flight engineer, all of whom were under supervision.

3. CC130321 had been properly maintained in accordance with Canadian Forces Technical Orders (CFTO). The a/c was serviceable at the time of the accident.

4. The crew of "Trucker 5" from 18 wing was comprised of the following personnel:

Aircraft Commander	Maj Niles, AG
Pilot	Capt Allen, MG
Co-pilot	Capt Schurman, VL
Navigator	Capt Juneau, ERM
Flight Engineer #1	Sgt Lous, HJ
Flight Engineer #2	WO Hull, SJ
Loadmaster #1	Sgt Michaud, JDA
Loadmaster #2	MCpl McWilliam, RJ
Extra Crewman (CABC)	MWO Castonguay, JS

5. All crew were on duty at the time of the accident. Any injuries or death were the result of military service.

6. The duplicate copy of the weight and balance was not filed at ams and the original was not found at the crash site.

7. The loadmasters started their a/c preparation check list prior to mams finishing the airdrop joint inspection check list.

8. The pilot had not flown a left seat lapes mission since 22 Jun 92.

9. The pilot had flown 15 hours in the last six months (LFCSC).

10. The co-pilot had last flown a LAPES mission 16 Jan 93.

11. Flight Engineer #1 (supervisor) had logged 7.8 Hours TAL and no LAPES in the past 12 months.

12. Flight Engineer #2 (in the seat) had logged 7.4 Hours including two LAPES missions in the past 12 months.

13. The crew was well rested and well prepared for the flight.

14. The crew was medically fit with current B2 medicals.

15. The tow plate assembly and the extraction system functioned normally.

16. The FDR/CPI failed to deploy on impact.

17. The flight engineer closed the engine bleed air valves prior to commencing the LAPES profile.

18. The a/c separated into three major sections: flight deck, mid-fuselage and wings, and empennage.

19. Post-crash fire was minimal.

20. The LOX converter (tank) departed the aircraft intact.

21. The navigator, flight engineer #2, and the aircraft commander were standing at the time of the impact.

22. Of the survivors, three sustained significant head injuries and none were wearing helmets.

23. The left ankle boot of each loadmaster came off during the crash.

24. The wheel chocks were not secured and became free flying objects during the crash.

25. The EZ1 at Namao was not marked for the dry pass.

26. The TAL/LAPES check lists are not in standard check list format.
27. Varying techniques exist regarding the deploy the drogue sequence, the descent angle and the rate of descent during a LAPES profile.

28. The "15 seconds" warning was given 8.6 seconds prior to impact.

29. CFACM 60-2601(1) does not cover, in sufficient detail, the procedures for discontinuing an abnormal profile.

5.2 ADDITIONAL FINDINGS

1. An impounding officer was not appointed in accordance with A-GA-135-001/AA-001. The developed film and video of the crash were viewed by unauthorized personnel prior to the arrival of the board of inquiry.

2. The navigator was not recorded on the CF K 1017 (buff copy).

3. Some crew members were not aware that the CABC observer was on board for the mission. This resulted in confusion regarding number of POB after the crash.

4. The troop seats installed did not withstand the crash.

5. The berm, 429 meters from the impact point, caused extensive break-up of the aircraft.

5.3 CAUSE FACTORS

The board of inquiry assigns the following cause factors:

5.3.1 Personnel - Management/CHQ - Other (Directives)

Inadequate directives governing crew composition/training for uncurrent LAPES aircrew.

5.3.2 Personnel - Management/GHQ - Training

Inadequate directives governing navigator and

flight engineer LAPES training/currency requirements.

5.3.3 Personnel - Pilot - Judgement

The pilot commenced the LAPES profile despite being past the descent point.

5.3.4 Personnel - Pilot - Pressing

Despite excessive altitude over the release panels, the pilot attempted to achieve normal wheel height by the impact panels.

5.3.5 Personnel - AC - Judgement

Knowing the elapsed currency status of the pilots and their unfamiliarity with the extraction zone, the AC elected not to occupy the right seat or conduct a dry pass at EZ Saville Farm.

5.3.6 Personnel - Co-pilot - Channelized Attention

Co-pilot concentrated on release panels to the exclusion of his other duties.

5.3.7 Personnel - AC - Channelized Attention

The AC was preoccupied with the activities of the co-pilot during a critical phase of flight.

5.4 RECOMMENDATIONS

Pursuant to the foregoing cause factors, the Board of Inquiry recommends:

5.4.1 Specific directives governing crew composition and training for uncurrent aircrew be promulgated, in order to limit the number of uncurrent aircrew occupying crew positions, at any one time.

5.4.2 CFACM 60-2604 be revised to incorporate more comprehensive LAPES training and currency requirements for navigators and flight engineers. This must include formal training and participation in a LAPES mission every 120 days.

5.4.3 LAPES procedures delineated in CFACM 60-2601(1)

include course of action in the event of encountering an abnormal profile.

5.4.4 A warning prohibiting attempts to regain normal profile because of excessive height be incorporated in CFACM 60-2601(1). Additionally, a spare drogue chute should be carried on all LAPES missions.

5.4.5 During LAPES conversion (duty codes F01 to F06) and continuation (duty codes G17 to G22) training, dry pass(es) will be conducted at the live drop EZ, prior to actual drop.

5.4.6 Act must emphasize that performing a specialty role does not relieve a crew member from the responsibility of performing basic duties IAW AOIs. Additionally, a note to this effect is to be incorporated into CFACM 60-2601(1), Chap 11.

5.4.7 All aircraft commander, flight instructor, and proficiency checker orientation and training must emphasize the absolute requirement to monitor the LAPES profile at all times. This information is to be incorporated into the ATG FIC.

5.4.8 Adhere to the existing directive in CFACM 7- 400(1) regarding the filing of weight and balance documents.

5.4.9 Loadmasters to wait until the joint inspection is complete prior to starting their a/c preparation checks.

5.4.10 All personnel, with the exception of the check pilot and the loadmasters, shall be strapped in during the LAPES profile.

5.4.11 All crew should wear helmets during LAPES operations.

5.4.12 Ankle boots not be worn by air crew during flying operations.

5.4.13 Aircraft to modified to incorporate a secure stowage area for the aircraft wheel chocks.

5.4.14 All dry runs to be conducted at marked extraction zones.

5.4.15 TAL/LAPES check list be amended to the standard check list format.

5.4.16 Standardize procedures for the deploy the drogue sequence (location), the descent angle, and the rate of descent during the LAPES profile.

5.4.17 Eliminate the "15 seconds" warning from the LAPES procedure.

5.4.18 Adhere to the impounding procedures contained in A-GA-135. Crash response check list to be amended accordingly.

5.4.19 The CF K 1017 be properly filled out prior to flight.

5.4.20 On board briefing to specify number of POB and duties.

5.4.21 AMDU project 2047C CC130 loadmaster seat should be expedited.

5.4.22 The berm at EZ Saville Farm should be removed.

ACKNOWLEDGEMENTS

5.5 The Board of Inquiry wishes to give special thanks to 18 Wing, CABC, 408 Sqn, DFS and NRC.

5.5.1 In memory of the deceased of "TRUCKER 5".

BOARD OF INQUIRY

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Aircrew Member — A. Deschamps, Maj

Technical Member — R. Beltempo, Maj

Medical Member — D. Filips, Lt(N)

6 Aug 93 — 18 Wing Edmonton