CANADIAN FORCES
FLIGHT SAFETY INVESTIGATION REPORT (FSIR)

FINAL REPORT

FILE NUMBER: 1010-130344 (DFS)
DATE OF REPORT: 17 Sep 2002

AIRCRAFT TYPE: CC130H-30 (CC130344)
DATE/TIME: 12 July 2001 1812Z (1412L)
LOCATION: 8 Wing Trenton
CATEGORY: "C" Category Accident

SYNOPSIS

The accident aircraft, a "stretch" Herc, was conducting a practice minor emergency and touch-and-go landing during a student pilot Operational Training sortie. After it touched down on runway 24 at 8 Wing Trenton, the crew initiated the "go" portion of the touch-and-go and became airborne shortly thereafter. The control tower then notified the crew that they might have struck the aircraft's tail on the runway. The Instructor Pilot (IP) took control and proceeded to carry out a right-seat flap 50 landing. The aircraft was taxied off the runway and inspected by the Instructor Flight Engineer. The IP decided to taxi to the ramp and shut down the aircraft after some scratches were detected on the skid plate.

The aircraft sustained "C" category damage.

TABLE OF CONTENTS

1. FACTUAL INFORMATION 1

1.1 History of the Flight 1
1.2 Injuries to Personnel 2
1.3 Damage to Aircraft 2
1.4 Collateral Damage 3
1.5 Personnel Information 3
1.6 Aircraft Information 3
1.7 Meteorological Information 3
1.8 Aid to Navigation 4
1.9 Communications 4
1.10 Aerodrome Information 4
1.11 Flight Recorders 4
1.12 Wreckage and Impact Information 5
1.13 Medical 5
1.14 Fire, Explosives Devices, and Munitions 5
1.15 Survival Aspects 5
1.16 Test and Research Activities 5
1.17 Organisational and Management Information 5

2. ANALYSIS 7

2.1 Instructor Pilot 7
2.2 Student Pilot 8
2.3 CC130H-30 8
2.4 426 Sqn Training and Supervsion 10

3. CONCLUSIONS 13

3.1 Findings 13
3.2 Causes and Contributing Factors 15

4. SAFETY MEASURES 15

4.1 Safety Measures Taken 15
4.2 Further Safety Measures Required 16
4.3 DFS Comments 16

Annex A:Photographs A1

1. FACTUAL INFORMATION

1.1 History of the Flight

The aircraft was flying in support of the CC130 Basic Course 0102. The operating crew consisted of an Instructor Pilot (IP) in the right seat, a Student Pilot (P1) in the left seat and a Student Flight Engineer (FE) in the FE seat. A second Student Pilot (P2) was sitting on the lower bunk and an Instructor Flight Engineer (IFE) was standing behind P1.

The mission was LP7, the aim of which is to ensure that the student is ready to complete the proficiency check and instrument-rating test. The crew briefed the mission at 0800 hrs for a planned take-off time of 0900 hrs. Due to unserviceabilities on the other CC130s at 8 Wing, only one aircraft was available for training, a CC130H-30, which is a stretched version of the CC130. As this aircraft was scheduled to participate in a practice flypast for the Wing Commander's change-of-command parade plus two other training missions, 40,000 lbs of fuel was loaded vice the normal single-mission training fuel load of 26,000 lbs.

Minor unserviceabilities with the accident aircraft delayed, and then finally cancelled, the practice flypast. The training mission was planned to last 3 hours, with 1.5 hours per student, and was to be conducted within the Trenton terminal area. The accident crew walked to the aircraft at approximately 1300 hrs and was airborne at approximately 1355 hrs. The first manoeuvre was a flap 100 touch-and-go to runway 24, flown without incident. The second circuit was planned as a flap 50 touch-and-go to runway 24, with a simulated emergency on the downwind portion of the circuit.

The simulated emergency, an A/C Bus "Off" light, was initiated abeam the control tower. The crew carried out the emergency checklist procedure, extended downwind slightly and began the landing checklist after the simulated emergency was secured. The crew briefed a flap 50 "option" (either a touch-and-go or a stop-and-go) with a landing weight of 125,000 lbs.

The student rolled-out onto Final slightly above the normal 3 degree glide path. He then reduced power from approximately 5000 in/lbs to 3500 in/lbs and shortly after, approximately 1 NM from the threshold, the aircraft began to descend below the glide path. At a distance of ½ NM to ¾ NM from the threshold, with 4 red lights on the PAPI, the student reduced power again, from 3500 in/lbs to 2000 in/lbs, and raised the nose of the aircraft, crossing the threshold below glide path but at the briefed threshold crossing speed of 132 knots.

At 150 feet AGL and 15 seconds from landing, while correcting for a right crosswind, with right wing down and left rudder input, the student reduced power to flight idle. Approximately 5 seconds later the IP pulled back on the control column. The student matched the IP's pull and kept the same control input until the landing.

According to FDR data, the aircraft touched down at approximately 1412 hrs with a pitch attitude of 8° and an indicated airspeed of 114 kts. The crew initiated the "go" portion of the touch-and-go and became airborne shortly after. The control tower then notified the crew that it appeared that they had struck the aircraft's tail on the runway.

The IP took control, called for the post-take-off checklist, and elected to keep the flaps at 50%. The IFE inspected the rear area of the aircraft but detected no visible signs of damage. The IP then proceeded to carry out a right-seat flap 50 landing, after which the aircraft was taxied off the runway and onto taxiway "P" in preparation for an external visual inspection by the flight engineers.

The IFE and FE had some initial difficulty exiting the aircraft, as the crew door could not be opened. A communications cord was discovered wedged between the door and its frame and could not be removed. Both flight engineers exited through the left paratroop door and began their inspection of the aircraft's tail.

Following their inspection, the flight engineers were able to re-enter the aircraft through the crew door from the outside and resumed their original positions on the flight deck. The IP decided to taxi to the ramp and shut down the aircraft after some scratches were detected on the skid plate.

The initial damage was assessed as "D" category however further examination of the aircraft's structure resulted in the damage being upgraded to "C" category.

1.2 Injuries to Personnel

	Crew
Fatalities	0
Injuries	0

1.3 Damage to Aircraft

The right skid plate sustained extensive wear, as did the surrounding skin. The bulk of the structural damage was discovered inside the aircraft after the floorboards were removed. The RH lower fuselage longeron splice fitting between the cargo floor bulkheads was wrinkled and cracked. The bulkhead lower cap was buckled, and the "C"-shape stiffeners were cracked at the lower attachment point. The repair required a special engineering disposition, as this damage is not covered in the repair manuals. See Annex A for photos of the damage.

1.4 Collateral Damage

The accident occurred on Crown property, and there was no collateral damage.

1.5 Personnel Information

	Instructor Pilot	Student Pilot	Student Flight Engineer
Rank	Capt	Capt	Sgt
Currency/Category valid as of	May 2001	Dec 2000	N/A
Total Flying Time	2950	315	6500
Flying hours on type	2680	11	20
Flying hours last 30 days	19	11	20
Duty time last 24 hrs	6	6	6

1.6 Aircraft Information

The CC130H-30 is 180 inches longer and is about 3000 lbs heavier than the standard CC130E or CC130H. Certain operational restrictions have been imposed upon the aircraft due to its extra length.

1- The aircraft is not to exceed 7° pitch on take-off until airborne;

2- Maximum effort take-offs are not permitted; and

3- Flapless landings shall not be practiced.

TRSET message 021717Z FEB 00 outlines these restrictions as well as the aircraft's tail strike potential and increased ground manoeuvring requirements.

1.7 Meteorological Information

METAR

CYTR 121746Z 27012G17KT 15SM –SHRA BKN035 BKN045 RMK SC6SC2 CU EMBDD

CYTR 121800Z 29012G17KT 15SM SCT022 BKN033 18.6/10.8 A2989 RMK CU3SC4 SLP122

CYTR 121818Z 29011G18KT 15SM –SHRA SCT022 BKN033 RMK CU3SC4

TAF

CYTR 121144Z 121212 28010KT P6SM SCT 120
FM1400Z 30010G20KT P6SM BKN040 TEMPO 1618 P6SM –SHRA
FM0000Z 29008KT P6SM SCT040 BECMG 080 BKN040
RMK NXT FCST BY 18Z

1.8 Aid to Navigation

N/A

1.9 Communications

All pertinent internal and external communications were recorded. ATC tapes were impounded and copied by DFS staff.

1.10 Aerodrome Information

8 Wing Trenton is a multi-mission airbase, hosting strategic, tactical, search and rescue, and training units. The airport has tower, ground and arrival/departure controllers, a WD1 (CFFC) weather office, full CFR response, and ATIS. The main runway, 24/06, is 10,000 feet long and serviced by PAR, ILS, NDB and PAPI. At the time of the accident all services were operational except for the PAR.

1.11 Flight Recorders

All flight recorders were operational at the time of the accident. The FDR data was successfully downloaded and the CVR removed from the aircraft by 8 Wing maintenance personnel and shipped to the National Research Council laboratory in Ottawa.

The CVR is of the solid-state type and records the last 30 minutes of crew communications. After the initial impact, the crew continued the touch-and-go, flew for approximately 8 minutes, landed and taxied off the main runway to assess the aircraft damage. This assessment took approximately 15 minutes, after which the crew taxied back to the ramp and shut down. The events leading up to the accident, and the accident itself, were therefore overwritten. The CVR recording begins just after the crew has been advised of a possible tail strike.

There is a program to replace the 30 minute CC130 CVRs with 2 hour CVRs. To date, seven 2 hour CVRs have been ordered. The remaining 30 minute CVRs will be replaced as they become time expired.

1.12 Wreckage and Impact Information

The aircraft landed approximately 1500 feet past the displaced threshold on runway 24, just prior to taxiway "H". The control tower staff inspected the runway for any debris that may have been deposited by the CC130. None was found and the runway remained in service.

1.13 Medical

Due to the six-day delay in determining the category of damage, no toxicological tests or medical examinations were performed. Interviews conducted one week after the accident revealed no medical preconditions or post-accident trauma.

1.14 Fire, Explosives Devices, and Munitions

N/A

1.15 Survival Aspects

1.15.1 Crash Survivability

The accident was survivable. The robust construction of the CC130, coupled with the aircraft's lower energy state on landing, minimized the potential for crew injury.

1.15.2 Life Support Equipment

N/A

1.15.3 Emergency Transmitters

Vertical and horizontal forces on contact were insufficient to activate the emergency locator transmitters.

1.16 Test and Research Activities

N/A

1.17 Organisational and Management Information

1.17.1 Determination of Accident Category

The accident occurred at approximately 1412 hrs on 12 July 2001. At 1900 hrs the aircraft was declared unserviceable with "D" category damage due to the tail strike, but the required Conditional Inspection 31 could not be carried out due to a lack of hangar space. It was not until 1400 hrs Friday 13 July 2001 that the Conditional Inspection 31 was completed and photographs sent to the Aircraft

Engineering Officer (AEO) for review. At 1600 hrs a decision was made by the AEO to have a SPAR engineer, who was expected to be in Trenton on Monday 16 July 2001 to conduct inspections of other CC130s, inspect the damage. He began the inspection of CC130344 on Tuesday 17 July 2001 at 0900 hrs, and at 1400 hrs the damage category was revised to “C” category. DFS was notified and an investigation team assembled in Trenton on 18 July 2001 to begin the investigation.

1.17.2 CC130H-30 Pilot Qualification Requirements

Ground Training

Ground training on the CC130H-30 is provided during the CC130 Basic Course conducted at 426 Squadron, 8 Wing Trenton. The aircraft’s increased ground manoeuvring requirements and different layout of cargo compartment equipment is the primary focus of this training. CC130H-30 prohibited manoeuvres are also discussed.

Flying Training

Following the accident, a review of applicable orders and training documents revealed no specific training or lesson plans for the subject aircraft. To be qualified to fly the CC130H-30, pilots must carry out two flap 50 and two flap 100 approach and landings. No specific lesson/training plans covering these or other manoeuvres (max effort landings, ground handling, performance take-offs with obstacle clearance climbs etc.) were available at the time of the accident, and the onus is on the individual and flying supervisors to determine and monitor the pilot’s capability to operate the CC130H-30.

1.17.3 CC130 Operational Flight Trainer

At the time of the accident, the CC130 simulator was configured to represent only the standard CC130. Its software has since been modified to represent the CC130H-30’s increased length and ground manoeuvring requirements. The CC130 simulator’s aerodynamic model continues to reflect the standard CC130H (non-stretch).

2. ANALYSIS

2.1 Instructor Pilot

2.1.1 Experience, Training, and Proficiency

<u>Experience</u>

The accident Instructor Pilot is an experienced CC130 pilot. At the time of the accident he had accumulated over 2600 hours on the CC130 and was slated to take over the 426 Sqn Pilot Standards cell in a few months time. He is described by his peers as being a stickler for proper procedure.

Training

His instructional training consisted of the 426 Sqn-provided Flying Instructor Course and, with respect to the CC130H-30, two 50% flap and two 100% flap take offs and landings to qualify him on that aircraft model. He was given a 426 Sqn instructional check ride prior to his assuming the duties of an Instructor Pilot.

It was noted during the investigation that there is no specific recurrency training for pilots to fly the CC130H-30. As detailed in TRSET message 021717Z Feb 00, after initial check out, the onus is on the individual and his flying supervisor to determine and monitor the pilot’s capability to operate the CC130H-30. This can place the individual pilot in a conflict of interest, where he or she must pass judgement on his or her own flying ability. In most other flying operations an annual Proficiency Check, as well as an Instrument Rating Test determine a pilot’s flying ability. These tests provide an unbiased assessment of the individual’s flying ability.

Proficiency

The accident Instructor Pilot last flew the CC130H-30 in a non-instructional setting over a year prior to the accident. He did conduct a training mission with the CC130H-30 the day prior to the accident, but such missions are typically geared towards the training of the student, and the instructor’s Pilot flying time on this version, commonly referred to as “hands-on”, is limited.

While the currency of the 426 Sqn Instructor Pilots (IP) is never compromised, the proficiency of a 426 Sqn IP may be much lower than that of any other CC130 aircraft commander because students are at the controls for most of the training missions. An IP at 426 Sqn will typically perform two take-offs and landings as demonstrations during the seven Basic Course three-hour local training missions. A typical overseas training mission of 20 flying-hours involving an Aircraft Commander upgrade would permit the Instructor Pilot to perform either 1 take-off or 1 landing. The typical CC130 Instructor Pilot at 426 Sqn logs approximately 30-35 hours per month, with only 2 or 3 hours at the controls.

An informal survey of Aircraft Commanders at 429 Sqn, 436 Sqn, and 424 Sqn, all located at 8 Wing, revealed that the average AC logs about 33 hours per month of flying time. This time is divided between the AC and the FO, but the average non-instructional AC at 8 Wing still manages to perform 10-15 landings per month, and has significantly more hands-on time than his or her comrades at 426 Sqn.

There are opportunities for 426 Sqn pilots to perform non-training missions where they can maintain or increase their overall proficiency. For example, there are re-supply missions to CFS Alert or Bosnia, but compared to the other CC130 units at 8 Wing these missions are infrequently assigned to 426 Sqn pilots.

2.2 Student Pilot

The student pilot commenced the CC130 Initial Pilot Training Course 0102 in May 2001. His first simulator ride was on 25 May 2001, and his first CC130 training flight was on 04 July 2001.

He exhibited normal progression on the course, but was considered to be capable of better performance. His flying skills were assessed as Average by the 426 Sqn staff, with landings noted as inconsistent.

2.3 The CC130H-30

2.3.1 Differences from the Standard CC130

There are very few noticeable aerodynamic differences between a standard CC130 and the CC130H-30. Assuming identical pitch attitudes, the CC130H-30's main wheels will touch down approximately half a second earlier than a standard CC130's main wheels. The extra fuselage length of the CC130H-30 improves rudder effectiveness, thus lowering VMCA (velocity minimum control air) during engine-out manoeuvring. Flapless landings are not to be practiced due to increased tail strike potential. Flap 100 landings are to be used whenever possible. Finally, the CC130H-30 has a somewhat increased (+3 feet) turning radius imposed by the greater fuselage length.

Following the accident, ab initio pilot training on the CC130H-30 was suspended. To improve Operational Training Unit flexibility, an application has since been submitted by 426 Sqn to TRSET to allow unrestricted use of this aircraft now that tail strike awareness training has been instituted and modifications to the simulator have been made.

2.3.2 Accident Aircraft

At the time of the accident the aircraft weighed approximately 125,000 lbs. This is considered to be a medium to near-heavy weight, and was approximately 20,000 lbs heavier than any landings the student had previously completed. An aircraft weight of 125,000 lbs, and a flap 50 touch-and-go resulted in the following required airspeeds:

1-Approach Speed of 142 Kts.

2-Threshold Crossing Speed of 132 Kts.

3-Touchdown speed of 114 Kts.

A gust factor (up to 10 kts) is to be added to all above speeds when required. Gusts of up to 10 kts were reported during the Downwind and Base portions of the accident aircraft's circuit, but no gusts were reported once the aircraft was established on Final.

Aircraft Weight	125K
Flap Setting	50%
Gusts	10 knots initially, then 0 knots on Final
Approach Speed (+Gust)	142 (152)
Threshold Crossing Speed (+Gust)	132 (142)
Touchdown Speed (+Gust)	114 (124)

2.3.3 Rate of Descent and Fuel Distribution Limits

All CC130s are limited to a maximum of 300 feet per minute (FPM) on landing if there is more than 6,600 lbs of fuel in the outboard Main tanks. The 300 FPM limit also applies if the combined total fuel weight of all 4 Main tanks is in excess of 25,000 lbs. Both of these conditions applied at the time of the accident, so the aircraft was definitely limited to a maximum of 300 FPM on landing.

The actual rate of descent information is not recorded by the FDR; it must be extrapolated from RADALT and Time Index information. This analysis determined that, shortly after the student reduced power, at an altitude of approximately 100 feet AGL, the aircraft's rate of descent increased to approximately 460 FPM. The IP was aware that this rate of descent was beyond the aircraft's fuel distribution limits, and initiated corrective action by pulling back on the control column. This action will be further analyzed later.

2.4 426 Sqn Training and Supervision

2.4.1 Student Training

The student had been instructed by the 426 Sqn staff to reduce power slightly prior to the flare. At normal training weights of less than 110,000 lbs. this is an appropriate procedure, as it prevents the aircraft from floating in ground effect and thus increasing the landing distance required.

This technique should not be used with a heavy aircraft (approximately 130,000 lbs. or greater). When landing under heavy weight conditions, the aircraft's downward vertical velocity will quickly increase if power is reduced prior to the flare. The correct aircraft handling technique under these conditions is to co-ordinate the flare with the power reduction, in effect reducing power at the same rate that flare pitch is applied.

Heavy weight landings were performed by the student in the CC130 simulator, using the proper procedure. These landings were carried out under various environmental conditions, including gusts and crosswinds. The student's first exposure to an actual near-heavy weight landing was on the accident flight. During interviews, no members of the crew could recall any specific reference to heavy weight landing techniques during the pre-mission brief.

2.4.2 Instructor Training

As mentioned above, the Instructor Pilot (IP) completed the Flying Instructor Course (FIC) at 426 Sqn prior to assuming his duties as an IP. The FIC is best described as a course designed to prepare experienced line CC130 pilots to successfully instruct on the CC130. The students that a 426 Sqn IP will instruct have all achieved Wings standard, and many have previous operational or training experience. The teaching of basic aircraft handling and airmanship is not seen as a requirement, and more emphasis is given to CC130-specific issues such as systems operation, emergency procedures and handling, and crew co-ordination.

While there is some exposure on the FIC to recovering the aircraft after a mis-applied student input, knowing how far to let a situation progress before the IP must take control (commonly referred to as personal limits) is not specifically taught. This skill is taught during Flying Instructor Training at 3 CFFTS (Portage la Prairie) and 2 CFFTS (Moose Jaw). At these schools, instructors filling the role of students will make errors, some minor, some major. The prospective IP is taught how far to let the "student" go before he steps in and corrects the situation, either verbally or, if required, by manipulating the aircraft's controls. The reason for not immediately correcting a student's error is to allow the student the chance to realise and correct his error on his own, creating a much better learning experience. The key is that the situation must never be allowed to degrade beyond the instructor's comfort level or ability to recover the aircraft. OTU IPs do not normally receive such training, and in fact the accident IP had never been so trained.

2.4.3 Supervision

All aspects of the 426 Sqn supervisory chain with respect to this accident were examined. It was determined that the accident crew was adequately supervised, and that all required pre-flight considerations (duty time, crew rest, K1017, etc) were carried out.

2.4.4 Tail Strike

During the accident sortie, the IP allowed the student to make, and attempt to correct, several minor errors involving airspeed control and glide path capture. Probably the most significant of these was the student allowing the aircraft to descend well below the ideal glide path to the extent that there were 4 red PAPI lights visible. By itself, this was not an unsafe situation, given the location and the fact that the runway has a 1000' displaced threshold. The IP's decision to allow the approach to continue at this point was reasonable. However, the IP stated that he was in the process of making a mental note to debrief the glide path and other issues at the moment the student reduced power prior to the flare. The IP was now faced with a rapidly increasing rate of descent while the aircraft was close to the ground.

FDR data indicates that in the final 40 seconds of the approach the aircraft's airspeed was within 2 kts of all charted values. However, both pilots thought that the aircraft's airspeed was 5-10 kts high on short final, probably based on the fact that the aircraft had initially been up to 10 Kts faster than briefed. Under that supposition, the IP made the decision to trade perceived excess airspeed for a reduction in rate of descent by pulling back on the control column, rather than by applying power, to reduce the rate of descent. It should be noted that while the IP was manipulating the aircraft's control column, the student was still the pilot flying (PF). The command "I have control" was not given by the IP to the student.

The appropriate reaction to an increasing rate of descent and a decreasing airspeed in the landing phase, as taught by 426 Sqn, is to apply power to reduce rate of descent and either maintain or reduce pitch, as required, to maintain or increase airspeed. Another option is to carry out an overshoot. On the CC130, prop-driven air flowing over the wing creates lift, so an increase in power will result in an almost immediate reduction in rate of descent.

Data from the FDR indicates a steady increase in the aircraft's pitch attitude up to the point of ground contact. The main landing gear touched down at about the same time that the aircraft's increasing pitch attitude reached 8 degrees. In fact, it is reasonable to conclude from extrapolated FDR data that it was the aircraft's contact with the ground that prevented a further increase in pitch. Had the aircraft been slightly higher and the pitch gone beyond 8 degrees, the tail would have contacted the runway prior to the main landing gear touching the ground. This would have resulted in greater damage and possibly aircraft control problems as the landing forces would have been absorbed mostly by the tail section rather than by the landing gear. This of course only applies to the stretched model, as a regular CC130 tail and landing gear will make simultaneous contact with the ground at 12 degrees pitch.

Despite relatively minor glide path errors, the aircraft was operated safely until the power was reduced prior to the flare. It is important to note that the handling of the aircraft (after power reduction) was inappropriate for either model of

CC130. While there would have been no tail strike with a regular CC130, the reduction in power prior to the flare and then aft yoke movement without a corresponding increase in power was contrary to established procedures for this weight of aircraft. Had there not been a tail strike, the question would still remain as to why an experienced IP did not carry out the proper recovery for a relatively minor student error.

The IP's recent lack of time at the controls (see para 2.1.1) is assessed as a contributor to the inappropriate recovery action. Reaction times and decision-making skills can degrade if they are not exercised on a regular basis. Another factor is the IP's desire to allow the student to work though his own errors and thus learn from the experience. This is good instructional technique, provided the IP will recognize when a situation has degraded to the point where he must take over from the student.

To summarize, the student presented the IP with an aircraft at flight idle, close to the ground, with a rapidly increasing rate of descent. The student's premature reduction of power may have been averted had the pre-mission briefing covered this point. The IP's desire to allow the student to recognize and solve the error conflicted with the IP's immediate recognition that the aircraft was now outside of its fuel distribution limits. The IP's response - to reduce the aircraft's rate of descent by increasing the aircraft's pitch without an increase in power – may have been influenced by a misperception of airspeed as well as the mental process of preparing debriefing points. The IP was not proficient with the CC130H-30, thus his awareness of the CC130H-30's increased tail strike potential at high pitch angles was reduced. By attempting to return the aircraft to within one operating limit, he inadvertently exceeded another.

In the first few seconds following the student's power reduction, a verbal intervention ("Power") on the part of the IP would most likely have averted this accident. Following the proper recovery procedure (power + pitch, or a full overshoot) would also have averted this accident should verbal intervention have been unsuccessful.

3. CONCLUSIONS

3.1 Findings.

3.1.1 Toxicology examinations were not carried out due to the delay in determining the category of aircraft damage.

3.1.2 At the time of the accident, there were no restrictions to using the CC130H-30 during ab-initio training.

3.1.3 The crew was assigned a CC130H-30 for the Basic CC130 Conversion Course mission LP7, as it was the only serviceable aircraft available at 8 Wing.

3.1.4 While the IP had flown a stretch Herc the day before, his awareness of the CC130H-30's increased tail strike potential had degraded due to a lack of proficiency on that model of CC130.

3.1.5 At the time of the accident there were no specific lesson plans for the CC130H-30.

3.1.6 The accident aircraft had a landing weight of approximately 125,000 lbs at the time of the accident, about 15,000 lbs more than for normal student training trips.

3.1.7 This landing was the student's first above 105,000 lbs, and thus the first where his normal practice, reducing power prior to the flare, would have had such counterproductive results.

3.1.8 The IP's pre-mission briefing to the students did not address the landing technique for heavy or near-heavy weight landings as this was not a standard briefing item at the time of the accident.

3.1.9 The student flew the aircraft to a 'red over red' indication on the PAPI.

3.1.10 Both the student and the IP had a false perception of an extra 10Kts airspeed. This was due to the crew initially recognizing that they had an extra 10Kts IAS once the Tower revised the winds downward from 10Kt gusts to 0Kt gusts. The crew maintained their mental model of excess airspeed even though they were in fact on airspeed in the final 40 seconds of the approach.

3.1.11 The student reduced power towards flight idle prior to the flare. This increased the aircraft's rate of descent beyond the aircraft's fuel distribution limits.

3.1.12 The Instructor Pilot, without formally taking control, attempted to reduce the rate of descent by pulling back on the control column without adding power.

3.1.13 The increased pitch succeeded in decreasing its rate of descent to within fuel distribution based limits, but brought the aircraft attitude to the point of tail strike.

3.1.14 The aircraft struck the ground in a 3 degree right wing down attitude with a pitch attitude of 8°, an indicated airspeed of 114 Kts, and power at flight idle. The internal structures of the aircraft around the right side of the ramp hinge area sustained "C" category damage.

3.1.15 The crew did not notice anything unusual about the landing and continued the "go" portion of their touch-and-go manoeuvre.

3.1.16 The crew was notified of a possible tail strike by the control tower after the aircraft was airborne. The IP carried out an uneventful right-seat landing. The student then taxied the aircraft off the runway where the crew carried out a visual inspection of the aircraft.

3.1.17 The Flight Engineers were unable to exit the aircraft via the crew door, as a communications cord was jammed between the door and its frame. They exited the aircraft through the left paratroop door, and re-entered the aircraft through the crew door.

3.1.18 The 426 Sqn Flying Instructor Course did not specifically address the issue of personal limits and when to take over aircraft control from a student.

3.1.19 At the time of the accident, 426 Sqn Instructor Pilots received much less hands-on time than other CC130 pilots at 8 Wing. As a consequence, their proficiency levels were estimated to be much lower than those of other CC130 pilots.

3.2 Causes and Contributing Factors

3.2.1 Causes

The student pilot, using techniques appropriate only for much lighter aircraft, reduced power prior to the landing flare and allowed the aircraft's rate of descent to increase beyond the aircraft's fuel distribution limits.

3.2.2 Contributing Factors

The Instructor Pilot's proficiency on the CC130 and CC130H-30 was low due to a lack of hands-on time caused by a dearth of non-instructional flying available to 426 Sqn pilots.

The landing techniques appropriate for a heavier aircraft did not get enough pre-mission attention to prevent the student from failing to use them.

The IP's channelized attention (thinking about the glide slope debriefing point) may have prevented him from recognizing that airspeed was no longer high.

4. SAFETY MEASURES

4.1 Safety Measures Taken

4.1.1 426 Sqn has instituted several restrictions with respect to utilizing the CC130H-30 on the CC130 Pilot Initial Course. CC130H-30 ground school lectures and simulator scenarios address limitations, differences, and preventative measures prior to the student's introduction to the H-30 aircraft. Student pilots will not conduct take-offs and landings on the H-30 aircraft until a proficiency level of 3 has been attained on these sequences in the regular CC130. Flap 50 landings in the H-30 are not to be performed until a level 3 has been attained in a Flap 100 configuration (H-30). Additionally, the maximum crosswind for student landings has been reduced to half of the maximum recommended.

4.1.2 The CC130 simulator's software has been modified to reflect some of the CC130H-30's unique characteristics. The Operational Airworthiness Authority has authorized the use of this new software for take-off, landing, and ground handling training. The software has been permanently loaded and is being employed for both conversion and continuation training.

4.1.3 A standardized training program has been developed for initial CC130H-30 qualification. The training consists of one ground school period, three H-30 simulator lesson plans and flying lesson plans as per para 4.1.1.

4.1.4 Flying Instructor personal limits training has been incorporated into Phase III of the Flying Instructor Course syllabus at 426 Sqn.

4.1.5 Quarterly staff route trainers have been implemented in order to provide 426 Sqn instructors more opportunities to maintain their operational skills.

4.1.6 Heavy weight landing training for First Officers has been added to the CC130 Basic Course as well as to the level 1 First Officer On Job Training Program (OJTP).

4.2 Further Safety Measures Recommended

It is recommended that:

4.2.1 Specific check ride requirements should be developed to independently verify an individual's ability to operate the CC130H-30.

4.2.2 TRSET message 021717Z Feb 00 should be incorporated into the CC130 AOI.

4.3 DFS Comments

As is almost always the case with accidents, it took a number of links in a chain of events to cause this one. Absent any one of the links, the accident would not have happened, but perhaps one to focus on here is variability in procedures or numbers based on variations in configuration, weight or aircraft model. Adjusting procedures is not instinctive when these variations are not obvious in the cockpit, so very positive methods of doing so must be used. These methods should include, but not be limited to, requiring that these variations be addressed in pre-flight briefings, and verbalizing the variations and the resultant procedures at times during the flight when they are important. This sort of procedural safeguard is even more important when experience levels are relatively low as they currently are. Certainly, improving IPs' proficiency would reduce the likelihood of them missing or misreacting to critical mistakes, as would increasing their awareness of intervention strategies, so taking steps toward those goals is warranted.

The decision to use or not use stretch Hercs for OTU training should consider not just the requirement for flexibility, but whether this is a complication that students fresh from earning their Wings can comfortably handle.

R.E.K Harder

Colonel

DFS

Annex A: Photographs