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Annual Report on Flight Safety



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DIRECTOR COMMENTS

This report provides a synopsis of the activities carried out by the Directorate of Flight Safety and gives an analysis of the FS information collected during 2007. Our data collection and analysis efforts support an evidence-based approach to prevention and risk management, and therefore this function is vital to the maintenance of the safety program.

The Canadian Forces Flight Safety program continues to meet its aim of preventing the accidental loss of aviation resources. It is a mature program and has been made more effective through its continued development and its strong linkage to the overall airworthiness program. Its success may be judged by the results - accident rates have been low and relatively consistent for the past 10 years. Regardless, improvements need to be made as our vital air resources become fewer and more expensive.

The theme for the 2007 DFS Briefing Tour, "Stress in Air Operations," resonated well with the airmen and airwomen in the line units. It is an almost universal observation that the level of experience at the coalface is dropping, while the operational tempo remains as high as ever. New capabilities are being introduced with great rapidity, and this trend will continue for the foreseeable future. Adherence to the principles of flight safety will be more important than ever if we are to make the transitions demanded of us safely. We have had cause to closely examine our risk management methodology, and some important improvements have been the result. We need to be proactive in examining other elements of our airworthiness system and make the necessary improvements to maintain an acceptable level of safety in the challenging years to come.

Feedback on this document is solicited and would be greatly appreciated. Comments should be forwarded to DFS 3, Jacques Michaud at Michaud.jc@forces.gc.ca.



C.R. Shelley
Colonel
Director of Flight Safety

EXECUTIVE SUMMARY

This report provides a synopsis of the activities carried out in 2007 by the Directorate of Flight Safety (DFS) and details the actions of the Airworthiness Investigative Authority (AIA). Analysis of flight safety occurrence data collected is also provided.

Overall, the air accident rate for 2007 was 0.40 per 10,000 flying hours, which represents no significant change from the previous year's rate of 0.41. The 2007 rate is within the 10-year average.

The AIA initiated twenty-three investigations on fourteen accidents (Seven category 'A', three category 'B', and four category 'C') and nine incidents (four category 'D' and five category 'E'). The number of outstanding preventive measures (PMs) continues to decrease, and with the exception of two PMs dating back to 1997, all PMs raised as a result of accidents prior to 2001 have been actioned.

There continues to be an increase in the number of occurrences related to survival and safety equipment in several fleets. This analysis reinforced a concern noted in a number of recent Flight Safety Investigation Reports (FSIRs) in which Aviation Life Support Equipment (ALSE) was found to be deficient. DFS staff is actively investigating this issue with the Operational Airworthiness Authority (OAA) and the Technical Airworthiness Authority (TAA) staffs.

The DFS annual briefing and unit visits were again employed as a major mechanism to promote flight safety. This year the briefing was presented with a theme of "stress," with a focus on maintenance operations. The briefing also drew lessons from an Australian Sea King accident in 2005 and highlighted accidents and significant incidents of 2007. The presentation was offered to all Wings in addition to the Canadian Contingent at Tinker AFB, for a total of 21 bases. DFS published three issues of *Flight Comment* magazine and three issues of the electronic flight safety newsletter *Debriefing*. One issue of the single-topic-focus *On Target* magazine was published with a focus on ground icing.

DFS conducted flight safety surveys at three contractor sites (Cascade Aerospace, Bell Helicopter Textron Canada Ltd., and Field Aviation Company Inc.) as part of the DFS continuous contractors visit program. 1 Canadian Air Division Flight Safety, augmented with DFS personnel, completed surveys at 1 Wing, 5 Wing, 9 Wing, 16 Wing, 17 Wing, 19 Wing, 22 Wing, and 440 Squadron.

1 Canadian Air Division Flight Safety staff conducted 5 Basic Flight Safety Courses qualifying 150 students as Unit Flight Safety Officers/NCMs. This included six DND contractor staff, 14 Air Cadet Instructor Cadre personnel, one Foreign Military member and three Land Force personnel. The Air Division conducted one Advanced Flight Safety Course of 18 students, which included one DND contractor. A total of 54 Flight Safety award submissions for individuals or groups were forwarded to DFS, resulting in the granting of seven *Good Show* and 41 *For Professionalism* awards.

The A-GA 135-001/AA-001, *Flight Safety for the Canadian Forces*, was published in March 2007. The document has been reformatted to become a practical handbook for the conduct and administration of a comprehensive Flight Safety program across the full spectrum of CF activities.

The Cockpit Voice Recorder (CVR) / Flight Data Recorder (FDR) Working Group developed a CVR/FDR policy and completed a gap analysis to assess current capability against this policy. The Working Group continues to work toward the policy implementation deadline of 31 Dec 2010. A recommendation was made to the Airworthiness Review Board to establish an omnibus project strategy that would raise the visibility of the CVR/FDR policy, assure consideration of compatibility factors, and ease the management of the group of projects.

2007 FLIGHT SAFETY ANNUAL REPORT

AIRWORTHINESS PROGRAM

1.1 AIRWORTHINESS INVESTIGATIVE AUTHORITY (AIA) ACTIVITIES

1.1.1 Amendment to Aeronautics Act (Bill C-7)

After Parliament was prorogued during the summer of 2007, the Bill C-6 was re-instated as Bill C-7 on 29 October 2007. Bill C-7 will, if adopted, address several Department of National Defence (DND) airworthiness concerns, including additional powers for AIA appointed investigators, better procedures for accident investigations dealing with civilian companies and the next of kin of personnel killed in CF aircraft accidents, confirmation of the privileged status of flight safety information, processes to enhance the conduct of Department of National Defence/Transportation Safety Board (TSB) -coordinated investigations and the ability to sub-delegate airworthiness authorities.

1.1.2 Airworthiness Investigative Manual

The AIA is tasked to issue airworthiness instructions and standards and to assign investigative authority to organizations and individuals. Staffing has started on the production of an AIA Manual (AIM) to formalize the AIA processes. It is anticipated that the first version of this document will be produced by the fall of 2008.

1.1.3 Surveys

Surveys are conducted to measure the effectiveness of the Flight Safety Program, to identify deficiencies that would otherwise have gone undetected, and to make recommendations for enhancements to this program with the intent of contributing to the production of an airworthy product. DFS conducted Flight Safety surveys at three contractor sites (Cascade Aerospace in Abbotsford, BC; Bell Helicopter Textron Canada Ltd. in Ste-Thérèse, QC; and Field Aviation Company Inc. in Calgary, AB) as part of the DFS continuous contractors visit program.

1 Canadian Air Division Flight Safety, augmented with DFS personnel, conducted surveys at 1 Wing, 5 Wing, 9 Wing, 16 Wing, 17 Wing, 19 Wing, 22 Wing, and 440 Squadron.

1.1.4 CVR/FDR Working Group

The CVR/FDR Working Group continued its activities during the reporting period. Following the development of a coherent CF Cockpit Voice Recorder (CVR) / Flight Data Recorder (FDR) policy, the Working Group completed a gap analysis to compare the current CVR/FDR capabilities of each fleet and the required technical standards detailed in the CVR/FDR policy.

The next step will consist of the development of an implementation plan that will identify the activities, and associated timelines, that are technically and financially possible to implement by the CVR/FDR policy implementation deadline of 31 Dec 2010. The lack of dedicated personnel for the implementation of the CVR/FDR policy limits the ability to conduct the required planning, management, and oversight of the implementation. Furthermore, the uncertainty of

funding sets the stage for limited buy-in by those involved in the CVR/FDR policy implementation. To address this situation, a recommendation was made to the Airworthiness Review Board to establish an omnibus project strategy which would raise the visibility of the CVR/FDR policy, assure consideration of compatibility factors, and ease the management of the group of projects.

1.2 INVESTIGATIONS

1.2.1 Investigation Summary

During the calendar year 2007, the AIA initiated 23 investigations and closed 21. The new investigations were divided between fourteen accidents (seven category 'A', three category 'B', and four category 'C') and nine incidents (four category 'D' and five category 'E'). These figures include Air Cadet and UAV accidents. Table 1 outlines the investigations initiated during the year followed by a synopsis of each one.

#	DATE	ACCIDENT OR INCIDENT	OCCURRENCE CATEGORY	INJURY	AIRCRAFT	EVENT
FLIGHT SAFETY INVESTIGATION REPORTS						
1	04 Apr 07	Incident	D	2 Minor	Harvard	Inadvertent Ejection
2	05 May 07	Accident	B	2 Minor	Schweizer 2-33A	Premature Release
3	11 May 07	Incident	D		IL-76	Fence Contact on Go-Around
4	16 May 07	Accident	B		Hornet	Engine Fire In Flight
5	18 May 07	Accident	A	1 Fatality	Tutor	Aircraft Crash
ENHANCED SUPPLEMENTARY REPORTS						
6	11 Jan 07	Accident	A		Sperwer	Engine Failure In Flight
7	24 Jan 07	Accident	A		Sperwer	Loss of Control
8	08 Mar 07	Incident	E		Hornet	Near Miss
9	08 Apr 07	Accident	A		Sperwer	Loss of Control
10	29 Apr 07	Incident	E		Cormorant	#3 Engine Sprag Clutch Disengagement

#	DATE	ACCIDENT OR INCIDENT	OCCURRENCE CATEGORY	INJURY	AIRCRAFT	EVENT
11	7 May 07	Accident	C		Cormorant	Towing Damage
12	03 Jul 07	Accident	C		Sperwer	Propeller Failure
13	10 Jul 07	Accident	A		Sperwer	Parachute Failure
14	13 Jul 07	Accident	C		Cessna 172M	Hard Landing
15	24 Jul 07	Accident	B		Schweizer 2-33A	Aircraft Collision on Landing
16	21 Aug 07	Incident	E		Hornet	Laser-Guided Training Round Near Miss
17	30 Aug 07	Accident	C		Cormorant	Maintenance Rotor Head Damage
18	19 Oct 07	Incident	E		Hawk / Harvard	Near Miss
19	31 Oct 07	Accident	A		Sperwer	Parachute Failure
20	31 Oct 07	Incident	E		Cormorant	Excessive Wear
21	03 Nov 07	Incident	D		Griffon	FOD Blade Strike
22	17 Nov 07	Incident	D		Sperwer	Engine Malfunction
23	22 Nov 07	Accident	A		Sperwer	Engine Malfunction, Parachute Failure
24	06 Dec 07	Accident	B	4 Minor	Sperwer Launcher	Catastrophic Failure

Table 1 - List of 2007 AIA Initiated Investigations

1.2.2 Investigation Details

1.2.2.1 4 Apr 07, CT156112 Harvard II, Incident, Cat 'D', Moose Jaw, SK, Case ID # 130570



The incident involved a CT-156 Harvard II training aircraft, crewed by an instructor pilot in the rear seat and a student pilot in the front seat. After the engine was started, as the crew was completing the pre-taxi checks and was about to request taxi clearance, the student pilot inadvertently ejected from the parked aircraft. The student pilot landed at the edge of the parking ramp, under a fully deployed parachute. He sustained minor injuries from the detonation of the canopy fracturing system and the subsequent parachute landing on the concrete ramp. The instructor pilot, who remained in the aircraft, sustained minor injuries from the detonation of the front canopy and the fireball produced by the front underseat rocket motor.

The investigation has not found any pertinent technical deficiencies with the ejection system and has focussed on what actions the student pilot may have taken, which accidentally initiated the ejection sequence. Immediate preventive measures taken as a result of this incident include briefing all pilots on the requirement to meticulously adhere to the proper strap-in procedure. The investigation into the incident is on-going, however there are indications that a communications cord may have been routed through the student pilot's ejection seat handle during the strap-in process.

1.2.2.2 5 May 07, C-GCLJ Schweizer, Accident, Cat 'B', North Battleford, SK, Case ID # 130843



The glider was participating in the Spring Season familiarisation flying at the North Battleford Gliding Centre in North Battleford, SK. The glider was launched, but at approximately 150 feet above ground level (AGL) the winch operator observed a partially failed splice in the cable and cut power to the winch. The pilot hesitated prior to initiating the recovery procedure causing the glider to stall. The glider contacted the ground in a severe, nose-down, attitude 452 feet from the launch point.

The investigation is focusing on human factors, training issues and regulatory discrepancies. The accident is under investigation.

1.2.2.3 11 May 07, 4K-AZ41 IL-76, Incident, Cat 'D', Trenton, ON,
Case ID # 131655

The IL-76 was cleared for an Instrument Landing System (ILS) approach to runway 24 at Trenton. During the overshoot the aircraft struck the airfield perimeter fence with its lower fuselage and landing gear and then briefly touched down short of the runway before becoming airborne again. The aircraft held in the vicinity for 1.5 hours waiting for the weather to improve, then diverted to Ottawa.

The incident is under investigation.

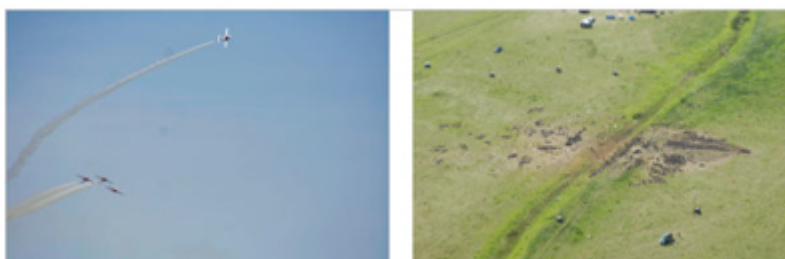
1.2.2.4 16 May 07, CF188720 Hornet, Accident, Cat 'B', Bagotville, QC,
Case ID # 130948



A formation of two CF-18s was carrying out some pre-briefed air-to-ground training in the Bagotville training area during a return flight from 14 Wing, Greenwood, after participating in a monthly armament training session for technicians. After 20 minutes of air-to-ground training the wingman advised the lead that he was experiencing an "engine left" warning. An engine fire, confirmed by the lead, followed this indication. The wingman secured the left engine in accordance with the checklist. Damage sustained by the aircraft caused flight control problems and led to operation in MECH mode.

The focus of the ongoing investigation is to conduct detailed laboratory analysis of the engine and its components to determine the cause of the catastrophic failure. Also, ground searches are underway to locate the missing fragments of the low-pressure turbine disk. The accident is under investigation.

1.2.2.5 18 May 07, CT114159 Tutor, Accident, Cat 'A', Malmstrom AFB, Montana,
Case ID # 130974



On Friday, 18 May 2007, the Snowbirds had completed a transit from Moose Jaw, Saskatchewan to Great Falls, Montana. At approximately 22 minutes into the show, as Snowbird 2 was rolling inverted for the Inverted Photo Pass, the aircraft was seen to dip low, waver, and then depart the formation. Still inverted, the aircraft climbed, then subsequently rolled upright. Upon reaching a nearly wings level attitude, at approximately 750 feet above ground level, the aircraft nosed over. The aircraft impacted the ground approximately 45 degrees nose down. The pilot did not eject and was killed on impact.

Initial analysis has determined that the pilot's lapbelt became unfastened when Snowbird 2 rolled inverted, causing the pilot to fall out of his seat and lose control of the aircraft. The investigation is focussing on how the lap belt became unfastened. Preventive measures taken to date include modifications to the pilot restraint system, as well as enhanced training for aircrew and passengers. New procedures as well as changes to the Aircraft Operating Instructions have been implemented to reduce the likelihood of a recurrence. The accident is under investigation.

1.2.2.6 11 Jan 07, CU161010 Sperwer, Accident, Cat 'A', Kandahar, Afghanistan,
Case ID # 129825

The CU-161 sustained an engine failure in flight following an operational mission in Kandahar, Afghanistan. Approximately 30 km west of Kandahar, after commencing a return to base, the Air Vehicle Operator (AVO) indicated to the Mission Commander (MC) that the fuel flow was at zero. The fuel gauge, however, indicated sufficient fuel to return to base. The MC initiated a climb, as this is the initial response to a fuel pump problem. Shortly thereafter the engine failed. The air vehicle (AV) continued in a glide towards KAF where an emergency parachute recovery was initiated at 140 metres AGL. Locals scavenged the crash site before the AV could be recovered or destroyed by International Security Assistance Force (ISAF) personnel. There is nothing left of the AV.

1.2.2.7 24 Jan 07, CU161014 Sperwer, Accident, Cat 'A', Kandahar, Afghanistan,
Case ID # 129933



Immediately following launch, the AV entered an un-commanded steep left turn, descended and crashed approximately 250 metres from the launcher. There were no injuries and the AV was destroyed.

A series of human factors contributed to this occurrence. The crew was using a modified and unapproved checklist, condoned by supervisory personnel, in order to cope with perceived time pressures. Additionally, at the precise moment when the Hybrid Navigation System (HNS) was to be selected to alignment, the MC was distracted by a radio call. The MC was not directly referencing the checklist; rather, the checklist was being actioned by memory and the step was consequently missed. Additionally, a red thematic page warning that showed the HNS was still in standby mode, was available to the crew; however, neither the AVO nor MC checked it prior to launch as this check was not an explicit checklist requirement.

1.2.2.8 8 Mar 07, CF188744/749 Hornet, Incident, Cat 'E', Homestead AFB, Florida,
Case ID #130347

The incident aircraft were deployed on a three-week detachment at Homestead Air Reserve Base in Florida, USA. The weather consisted of small cumulus clouds and visibility out to 10 miles. After a normal brief and slightly delayed departure, the aircraft arrived at the training area South of the Florida Keys, and set up for their engagements. The two corrected by turning South West at roughly the same time that lead called for "Out left". This resulted in the lead and the two being set on converging flight paths at the same altitude, with the potential for a collision. After some initial manoeuvring, which did not de-conflict their rapidly converging flight paths, both pilots rolled their aircraft to place their lift vectors away from each other in an attempt to avoid a collision. The lead's aircraft passed in front of the two's at a distance of approximately 130 ft at the same altitude. After the miss, both aircraft rolled level and a "Knock it off" was called. Both of the aircraft returned to base without incident.

1.2.2.9 08 Apr 07, CU161018 Sperwer, Accident, Cat 'A', Kandahar, Afghanistan,
Case ID # 130585

While enroute to the operations area at 6500 ft above sea level, the AV departed controlled flight and landed approx 30 km west of Kandahar. Initial indications were that the AV had experienced an alternator failure and completed an autorecovery. Multiple audible and visual warnings were presented during the descent. During the occurrence, the AVO lost the ability to enter commands into his station. Attempts to take control from the MC station were unsuccessful. The AV's last known location was passed to Task Force Afghanistan (TFA) headquarters and a search was

established. The wreckage of the AV was discovered and retrieved by a TFA unit dispatched to the area.

1.2.2.10 29 Apr 07, CH149902 Cormorant, Incident, Cat 'E', Prince George, BC,
Case ID # 130785

As collective was increased through 35% for take off, the No. 3 engine disengaged from the transmission. Power was reduced, the No. 3 engine was brought to ground idle, and aircraft taxied to park and shut down without further incident.

1.2.2.11 7 May 07, CH149910 Cormorant, Accident, Cat 'C', Gander, NL,
Case ID # 130855



On 07 May 2007, the CH-149 was being towed onto the ramp when, after a turn was initiated, the tow crew heard a loud bang followed by a hissing sound. The towing evolution was stopped and the tow crew found the tow bar entirely disconnected from the aircraft.

The investigation revealed that the safety feature of the tow bar did not preclude damage to the landing gear. A review of the technical publications revealed that there are no torque specifications for the tow bar safety bolt and shear bolts. The analysis of the occurrence suggests that the torque of the safety bolt, in all probability, delayed the shearing of the shear bolts.

1.2.2.12 3 Jul 07, CU161021 Sperwer, Accident, Cat 'C', Kandahar, Afghanistan,
Case ID # 131376

Following a normal C check, the AV was launched at 07:07 local time on 3 July 2007. Immediately following launch, witnesses observed pieces departing the AV. A change in engine noise was also noted, and the AV faltered in its climb, levelling at approximately 60 m AGL. At this point the ground crew lost communications with the AV and it commenced an auto recovery. Due to its altitude, the parachute extraction was incomplete and one airbag did not inflate. The AV impacted the ground in a level attitude and stayed upright. Considerable damage was done to the nose of the AV, with further damage to the wing surfaces. The payload was destroyed.

1.2.2.13 10 Jul 07, CU161020 Sperwer, Accident, Cat 'A', Kandahar, Afghanistan,
Case ID # 131425

Upon completion of the operational mission, the crew brought the AV back to the recovery area at Kandahar. The crew elected to complete a manual recovery sequence. Upon reaching the initiation point, the crew sent the recovery command to the AV. The engine stopped as normal,

and the payload retracted. The AV started a rapid descent, and witnesses state that the parachute did not deploy until approximately 75 feet above the ground. Witnesses describe the parachute at two-thirds to three-quarters inflated when the AV struck the ground. The AV impacted right wing first, in a tail low attitude, and bounced approximately 5 paces to its final position. The right wing was fractured and the wing assembly separated from the fuselage.

1.2.2.14 13 Jul 07, C-GFVE Cessna 172M, Accident, Cat 'C', Waterville, NS,
Case ID # 131463



A solo student on an Air Cadet Power Flying Scholarship had a hard landing while flying a non-CF aircraft, Cessna 172 C-GFVE. The aircraft had bounced hard on the runway several times and on one of the bounces the prop contacted the runway. Overshoot was ordered and the solo pilot landed the aircraft without further incident.

With no other evidence available to explain the student performance, the occurrence is attributed to poor technique, compounded by inexperience – a recognized risk inherent in ab-initio pilot training.

1.2.2.15 24 Jul 07, C-FBJH Schweizer, Accident, Cat 'B', Debert, NS,
Case ID # 131584

During glider training operations at the Regional Gliding School (Atlantic) in Debert, a solo pilot landing on the tertiary landing area, flying C-FBJH, collided with a dual glider that had just landed in the secondary landing area, C-GCLN, and had encroached on the tertiary area. The left wing of the solo glider contacted the right wing of the dual glider. No injuries to any personnel were reported.

1.2.2.16 21 Aug 07, CF188794 Hornet, Incident, Cat 'E', Shilo, MB,
Case ID # 131837

During a Close Air Support training mission at night, at approximately 22:05 local time, a Laser Guided Training Round impacted over 850 meters short of the intended target and 400 meters left of the bomb-target line and landed 5 feet from the Ground Laser Target Designator which was mounted on a tripod between two Light Armoured Vehicles and being operated by dismounted personnel. Following the occurrence, the two CF-18s involved with the mission ceased the exercise and returned to base without further incident.

1.2.2.17 30 Aug 07, CH149903 Cormorant, Accident, Cat 'C', Greenwood, NS,
Case ID # 131965

During the Swash Plate Friction Check, Out-of-Phase Maintenance (OPM) 62-12, hydraulic

power was applied to the aircraft with the Main Rotor Head (MRH) Pitch Change Links disconnected. The Swash Plate moved upward pinching the Pitch Links between the Swash Plate and the MRH damaging the Daisy Wheel.

1.2.2.18 19 Oct 07, CT156115 Hawk/Harvard II, Incident, Cat 'E', Moose Jaw, SK,
Case ID # 132518



A Harvard II and a Hawk narrowly avoided a collision while flying in the Moose Jaw Flying Area (MFA). The weather was clear with blue sky against dark ground. The Harvard dual aircraft was in straight and level flight when the instructor pilot (IP) saw a “sudden dark flash” at his 8:30 position. The Hawk solo pilot had just engaged in a rapid descent via a “barrel down” manoeuvre and was in a 20-degree nose down attitude at 320 KIAS. As he rolled back in the upright position he saw the Harvard aircraft going from left to right for a split second. Separation was estimated to be 100-200 feet.

Despite efforts on education and awareness briefs, near miss occurrences have been increasing in Moose Jaw. Shortly after this incident, 2 CFFTS published an Aircrew Information File (AIF) to help manage congested areas, limiting the maximum number of aircraft in a specific area. The investigation recommended using common frequencies as part of the airspace management AIF, and providing clear guidance regarding airspace safety prior to executing rapid descents. The investigation recommended that TCAS/ACAS I be implemented in both Harvard and Hawk fleets to increase traffic awareness. This measure has proven itself in similar flying training operations in other countries. It was also recommended that the current paint scheme be changed to a two tone (dark and reflective) to optimize aircraft conspicuity.

1.2.2.19 31 Oct 07, CU161023 Sperwer, Accident, Cat 'A', Kandahar, Afghanistan,
Case ID # 132651

At around 17:55 local Kandahar time, the AV crashed just outside the Kandahar secure perimeter. During the final recovery leg on autonomous mode at the normal recovery point, the engine shut down as predicted for a normal autonomous recovery. Initial indication from the recovery team is that the AV parachute did not open. The AV kept gliding on autonomous mode until impact. No explosion or fire was reported.

1.2.2.20 31 Oct 07, CH149902 Cormorant, Incident, Cat 'E', Comox, BC,
Case ID # 132661

While carrying out a daily inspection on aircraft 902 the maintenance crew discovered extensive damage to the rotating swash plate and scissors.

1.2.2.21 03 Nov 07, CH146437 Griffon, Incident, Cat 'D', Calgary, AB,
Case ID # 132699

An army vehicle was driving by the helicopter on static display with blades folded, and the vehicle's left hand tarp cover struck the leading blade and dislodged it from the blade folding kit. Damage was noticed on the blade's trailing edge for approx 10 inches from the tip of the blade towards the first trim tab.

1.2.2.22 17 Nov 07, CU161017 Sperwer, Incident, Cat 'D', Kandahar, Afghanistan,
Case ID # 132817

Flying at 7000 ft, one hour and twenty minutes into the flight, the engine suddenly quit. Engine RPM and fuel flow fell to zero with 45 litres of fuel remaining. The AV was turned to land within a friendly area. Around 5500 ft before losing communication with the AV, an emergency recovery was initiated.

1.2.2.23 22 Nov 07, CU161088 Sperwer, Accident, Cat 'A', Kandahar, Afghanistan,
Case ID # 132888

The AV was in autonomous mode heading for recovery. At time of recovery, the engine stopped, the payload retracted, and the parachute door opened but the parachute failed to deploy. The AV crashed and a post-impact fire commenced.

1.2.2.24 6 Dec 07, CU161000 Sperwer Launcher, Accident, Cat 'B', Kandahar, Afghanistan,
Case ID # 133003



At 08:45 local time during post launch activities with a cylinder pressure of 152 bar, both launch cylinder rods came out of their tubes when the trolley was approximately 12 inches from the launch lock. Extensive damage to the launcher and to all major components resulted. Two ground personnel were rushed to the hospital and two others made their way to the MIR.

The design of the launcher is such that hydraulic and pneumatic forces oppose each other in a manner that requires the precise alignment of two pairs of large piston rods. At the time of the occurrence, the alignment was compromised which resulted in an explosive release of pneumatic pressure and the expulsion of numerous components. The investigation concluded that the

launcher's design did not adequately and consistently ensure that the required alignment is maintained.

1.2.3 Joint Investigations

The AIA is participating in two coordinated investigations with Transportation Safety Board (TSB) for occurrences that took place in May and October 2007. The first occurrence investigation, led by DFS, involved an IL-76 aircraft that struck a perimeter fence on overshoot near runway 24 in Trenton, then subsequently landed safely at Ottawa. The second investigation, led by TSB, also involved an IL-76 that struck a group of trees on approach to runway 24 in Trenton.

1.2.4 Supporting Organizations

DFS continues to receive support and to work closely with Aerospace Engineering Test Establishment (AETE), Quality Engineering Test Establishment (QETE), National Research Council (NRC), and Defence Research and Development Canada (Toronto) DRDC(T).

1.2.5 Canadian Joint Helicopter Safety Analysis Team (JHSAT)

DFS continues to work with the Canadian Joint Helicopter Safety Analysis Team, established by Transport Canada in 2007, to conduct analysis of Canadian civil and military accidents, and provide mitigation strategies for the Joint Helicopter Safety Implementation Team. Their goal is to provide a prioritized assessment of the most safety critical hazards to commercial, private and military rotorcraft in Canadian operations in order to identify intervention strategies to be shared with the International Helicopter Safety Team in support of the international safety initiative and the Canadian Joint Helicopter Safety Implementation Team (JHSIT(C)) that will maximize the likelihood of reducing worldwide helicopter accident rates by 80 percent by 2016.

1.2.6 Investigation Report Status

Table 2 outlines the status of ongoing investigations up to 31 Dec 2007.

DATE	AIRCRAFT	DESCRIPTION	ACTIVITIES
14 May 04	CT155202	Bird strike on touch and go – Moose Jaw, SK	Final FSIR completed
02 Feb 06	CH12438	Ditching (approximately 30 NM off the Denmark Coast) – Denmark	Final FSIR completed
19 Jun 06	C-FZIQ	Glider was upset by wind gust while being towed – St Jean, QC	Draft FSIR being prepared
13 Jul 06	CH149914	Cormorant crashed while conducting night training – Canso, NS	Final FSIR completed
11 Jan 07	CU161010	UAV Fuel starvation –Kandahar,	Draft ESR being

DATE	AIRCRAFT	DESCRIPTION	ACTIVITIES
		Afghanistan	prepared
08 Mar 07	CF188744/ CF188749	Near miss – Homestead, Florida	ESR completed
04 Apr 07	CT156112	Ejection on ramp – Moose Jaw, SK	Final FSIR being prepared
08 Apr 07	CU161018	Parachute failed to deploy – Kandahar, Afghanistan	SR being prepared
29 Apr 07	CH149902	#3 engine sprag clutch disengagement – Prince George, BC	ESR being prepared
05 May 07	C-GCLJ	Glider stalled during winch launch – North Battleford, SK	Final FSIR completed
11 May 07	IL-76	Aircraft contacted perimeter fence during low approach – Trenton, ON	ESR being prepared
16 May 07	CF188720	Uncontained turbine failure – Bagotville, QC	Draft FSIR being prepared
18 May 07	CT114159	Snowbird #2 crash during show practice – Malmstrom, Montana	Draft FSIR being prepared
03 Jul 07	CU161021	UAV crashed during launch due to propeller breakage – Kandahar, Afghanistan	ESR being prepared
10 Jul 07	CU161020	Main parachute and airbags failed to deploy during recovery – Kandahar, Afghanistan	SR being prepared
24 Jul 07	C-FBJH	Cadet solo pilot landed and struck a parked glider during the landing roll-out – Debert, NS	ESR being prepared
21 Aug 07	CF188794	CF-18 dropped laser guided training round which landed approximately 1 meter from Forward Air Control personnel – Shilo, MB	ESR being prepared
30 Aug 07	CH149903	Main rotor head damaged during ground maintenance – Greenwood, NS	ESR being prepared
31 Oct 07	CU161023	Parachute failed to deploy during autonomous recovery – Kandahar, Afghanistan	Report format undetermined
31 Oct 07	CH149902	Extensive wear damage on swashplate	ESR being prepared

DATE	AIRCRAFT	DESCRIPTION	ACTIVITIES
		found on daily inspection – Comox, BC	
03 Nov 07	CH146437	Army truck struck parked helicopter – Calgary, AB	ESR being prepared
17 Nov 07	CU161017	Main gearbox failure – Kandahar, Afghanistan	ESR being prepared
22 Nov 07	CU161008	Parachute failed to deploy during recovery – Kandahar, Afghanistan	ESR being prepared

Table 2 - Investigation Report Status

FLIGHT SAFETY ACTIVITIES

1.3 PROMOTION

The DFS annual briefing and unit visits were used as a major mechanism to promote flight safety. This year the briefing was presented with a theme of “stress,” with a focus on maintenance operations. Lessons were drawn from an Australian Sea King accident in 2005 in addition to highlighting accidents and significant incidents of 2007. The presentation was offered to all Wings in addition to the Canadian Contingent at Tinker AFB, for a total of 21 bases. The Canadian Contingents at NATO AWACS Geilenkirchen and Elmendorf AFB cancelled planned briefings due to competing operational pressures. DFS published three issues of *Flight Comment* magazine and three issues of the electronic flight safety newsletter *Debriefing*. One issue of the single-topic-focus *On Target* magazine was published with a focus on ground icing.

1.4 AWARDS

A total of 54 flight safety award submissions for individuals or groups were forwarded to DFS, resulting in the granting of seven *Good Show* and 41 *For Professionalism* awards. Six individuals were recommended for Squadron or Wing level awards. When compared to the previous reporting period, this represents an increase of 108% in total submissions. The number of *Good Show* awards granted increased by 133% and the number of *For Professionalism* awards granted increased by 127%.

1.5 TRAINING

During the calendar year, 1 Canadian Air Division Flight Safety staff conducted five Basic Flight Safety Courses qualifying 150 students as Unit Flight Safety Officers/NCMs. This included 6 DND contractor staff, 14 Air Cadet Instructor Cadre personnel, one Foreign Military member and three Land Force personnel. The Air Division conducted one Advanced Flight Safety Course of 18 students, which included one DND contractor. The Division Flight Safety Officer also presented flight safety related briefings to the Flying Supervisor’s Course, and the Commanding Officer’s Course.

1.6 PUBLICATION OF NEW EDITION OF A-GA-135A-GA-135-001

The A-GA 135-001/AA-001, *Flight Safety for the Canadian Forces*, was published in March 2007. The document has been reformatted to become a practical handbook for the creation, conduct, and administration of a comprehensive Flight Safety program across the full spectrum of CF activities.

1.7 FLIGHT SAFETY OCCURRENCE MANAGEMENT SYSTEM WORKING GROUP

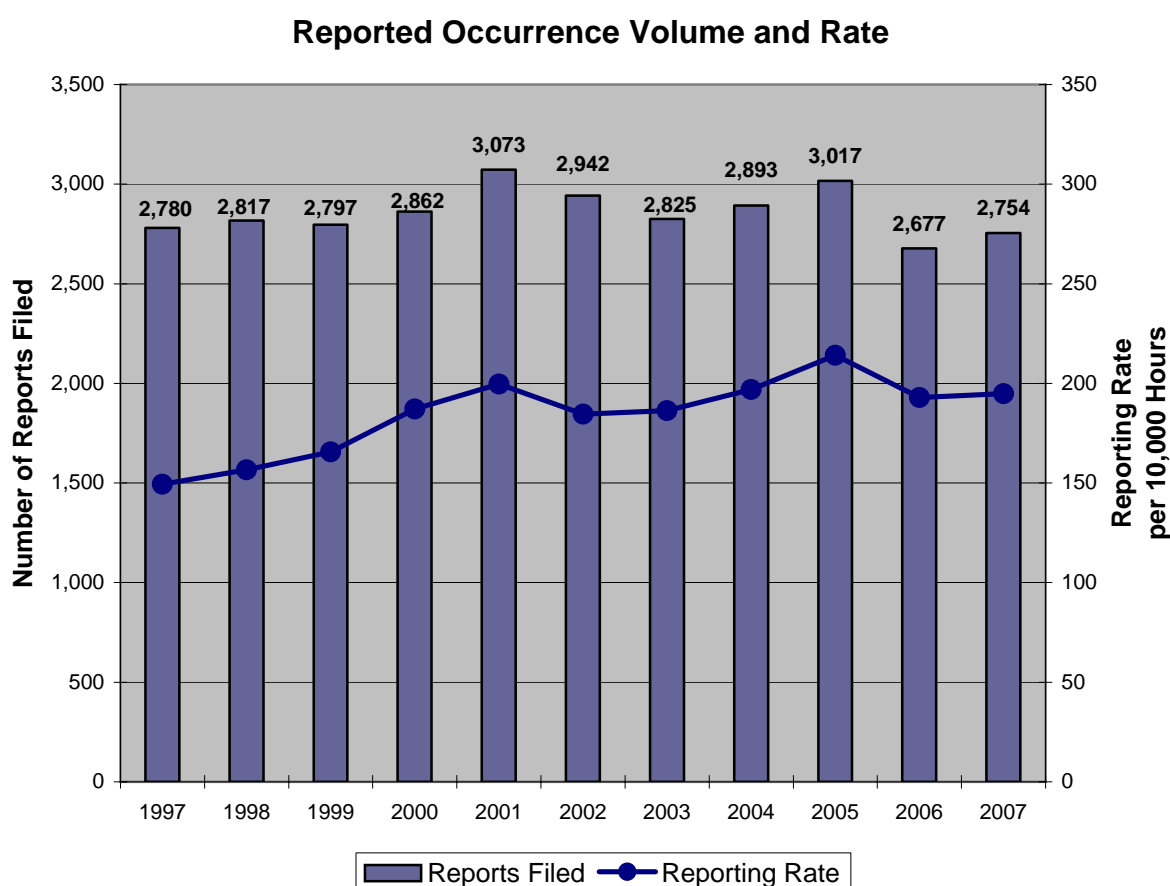
The Flight Safety Occurrence Management System (FSOMS) Working Group (held in Ottawa in late March 2008) recommended a list of initiatives aimed at improving the functionality and usability of the application. The transfer of the application support from Aerospace and Telecommunications Engineering Support Squadron (ATESS) to Information Management (IM) Group promises to expedite the development of FSOMS V4.0, as proposed by the Working Group.

STATISTICS AND TREND ANALYSIS

1.8 REPORTING LEVEL

Some 2,784 occurrences were reported in the Flight Safety Occurrence Management System, which is down from the 10-year mean value of 2,900 per year.

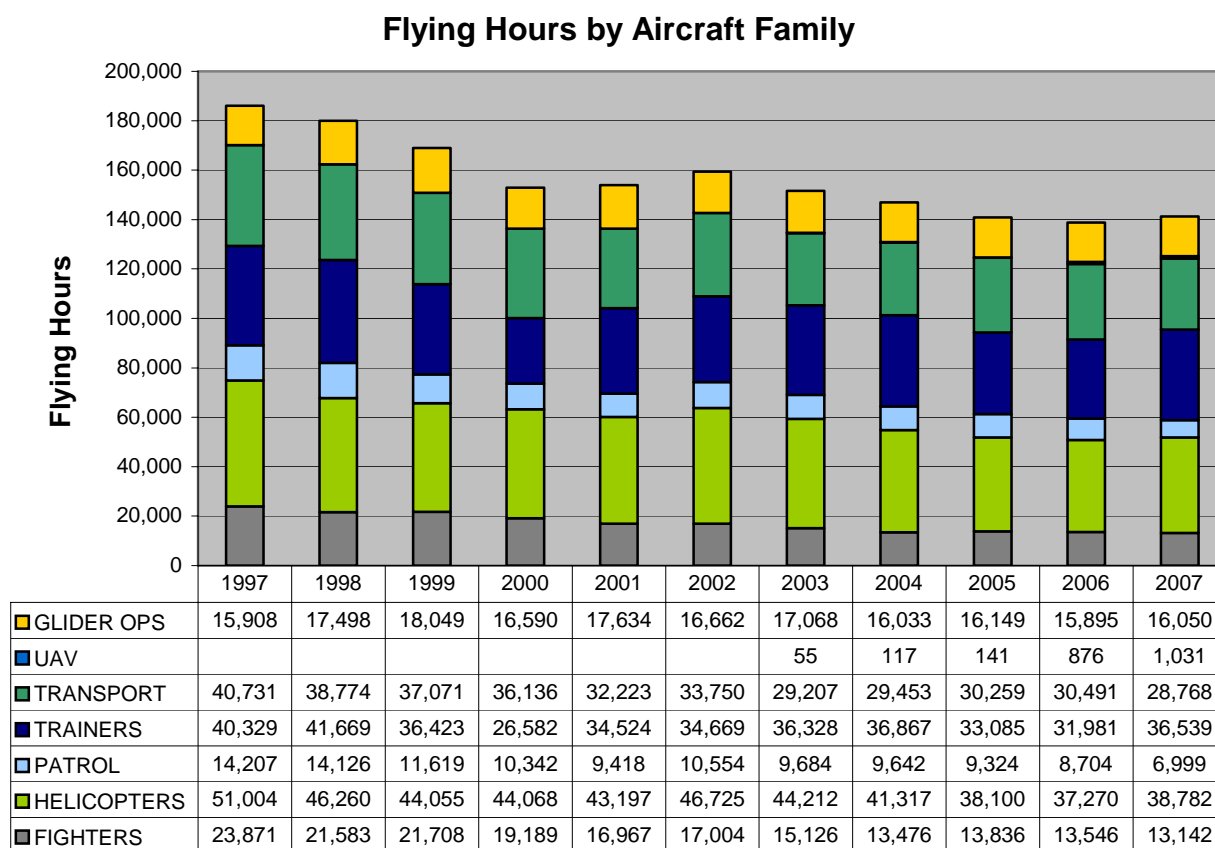
The rate of occurrences reported per 10,000 flying hours for 2007 (194.9 per 10,000 hours) was comparable to the average over the last six years (of 195.7 per 10,000 hours). Approximately 60% of the reported occurrences were classified as air occurrences and the remaining 40% were classified as ground occurrences.



Graph 1 – Reported Occurrence Volume and Rate

1.9 FLYING HOURS BY FAMILY

CF flying hours (exclusive of UAVs and Air Cadets) have been steadily decreasing over the last 10 years. Transport, patrol, and fighter aircraft flew less in 2007 than in any other year, while the other fleets' flying hours increased slightly.

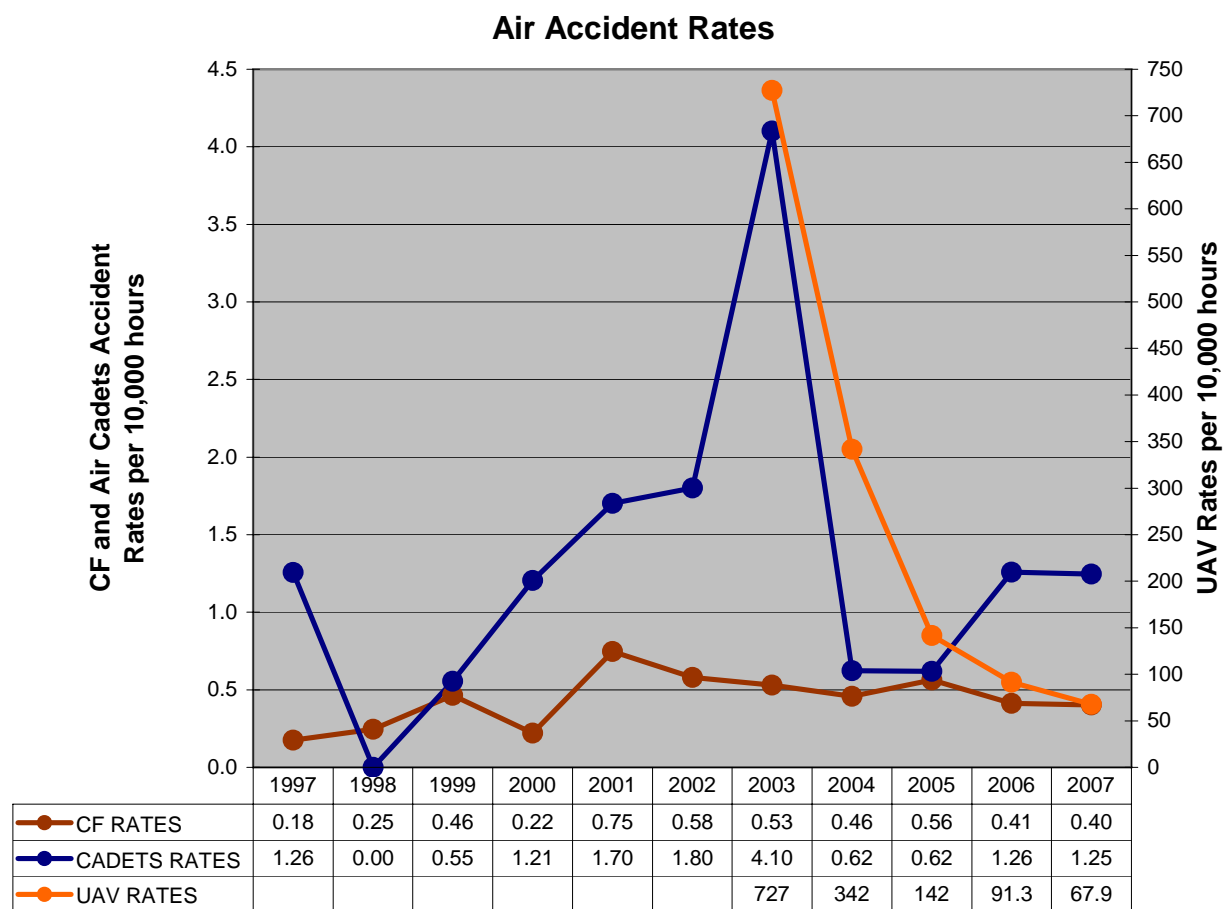


Graph 2 - Flying Hours by Aircraft Family

1.10 AIR ACCIDENT RATE

The air accident rate for 2007 was 0.40 per 10,000 flying hours, which is consistent with the 2006 rate of 0.41. The 2007 air accident rate is comparable with the 10-year CF average of 0.44. Apart from the CT-114 Cat 'A' occurrence; there was a Cat 'B' CF-18 engine fire and three Cat 'C' helicopter accidents.

UAV and Cadet accidents were not included in the CF rates quoted above. The accident rate for UAVs (67.9 per 10,000 hours) continued to decline as UAV operations mature. The Air Cadet accident rate levelled off at 1.25 per 10,000 hours and is within the historical norms for Air Cadet flying. As Air Cadet flying, particularly glider operations, involves a very large number of flights of very short duration, an elevated rate in comparison to other fleets is not unexpected.



Graph 3 – Air Accident Rates

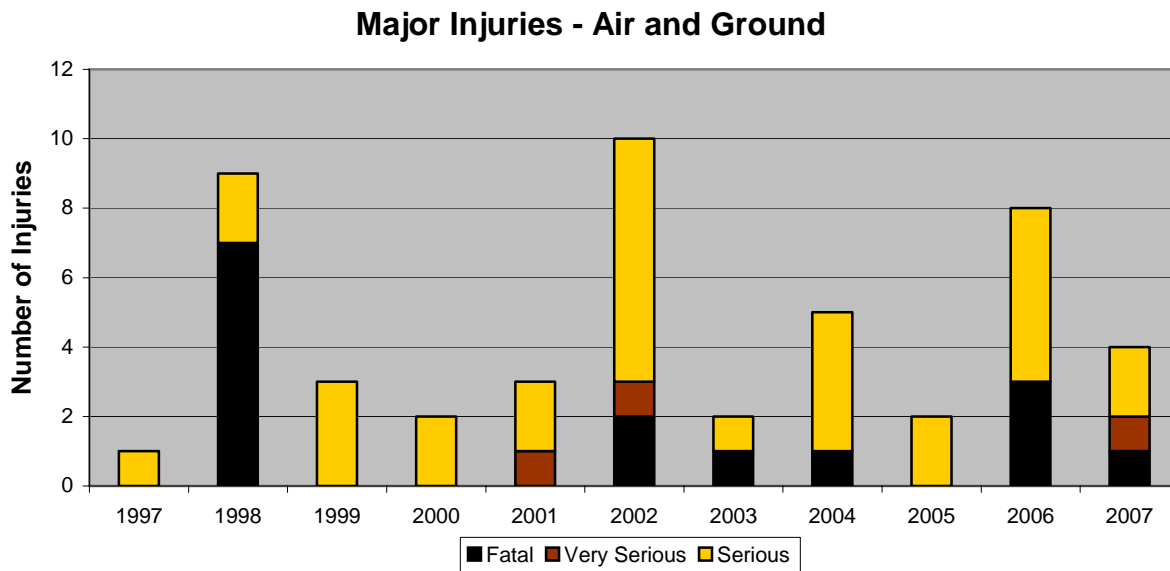
1.11 AIRCRAFT DESTROYED/WRITTEN-OFF

Seven aircraft were destroyed or written-off in 2007: one CT114 Tutor and six Sperwer UAVs. The TUAV write-off rate is significantly worse than last year's since six CAT 'A' UAV accidents occurred in 2007. For comparison, the TUAV write-off rates for 2006 and 2007 were 0.23 and 0.58 per 100 TUAV flying hours, respectively.

1.12 FATALITIES AND INJURIES

1.12.1 Major Injuries

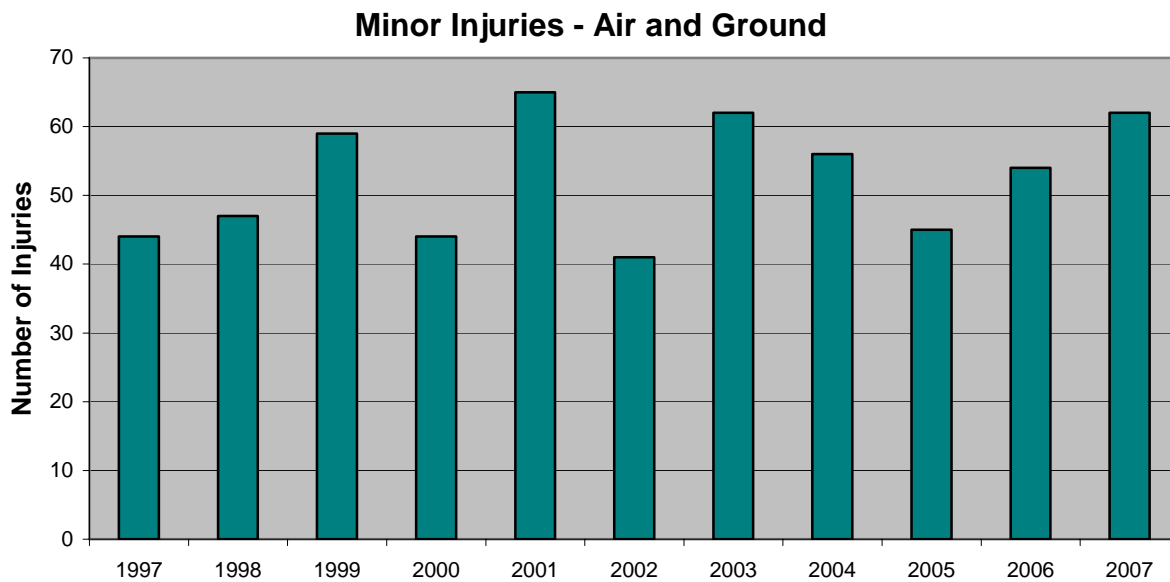
There was one fatal injury during the year due to an air accident (CT114159 – 18 May 07, aircraft destroyed). There was one very serious injury to a Sea King crewmember that developed blood clots following a hoisting evolution using the double-lift harness. Two serious injuries occurred: one during a Sea King hoisting evolution and another during Griffon towing operations.



Graph 4 – Major Injuries

1.12.2 Minor Injuries

A total of 62 of minor injuries occurred in 2007 up from 54 in 2006.



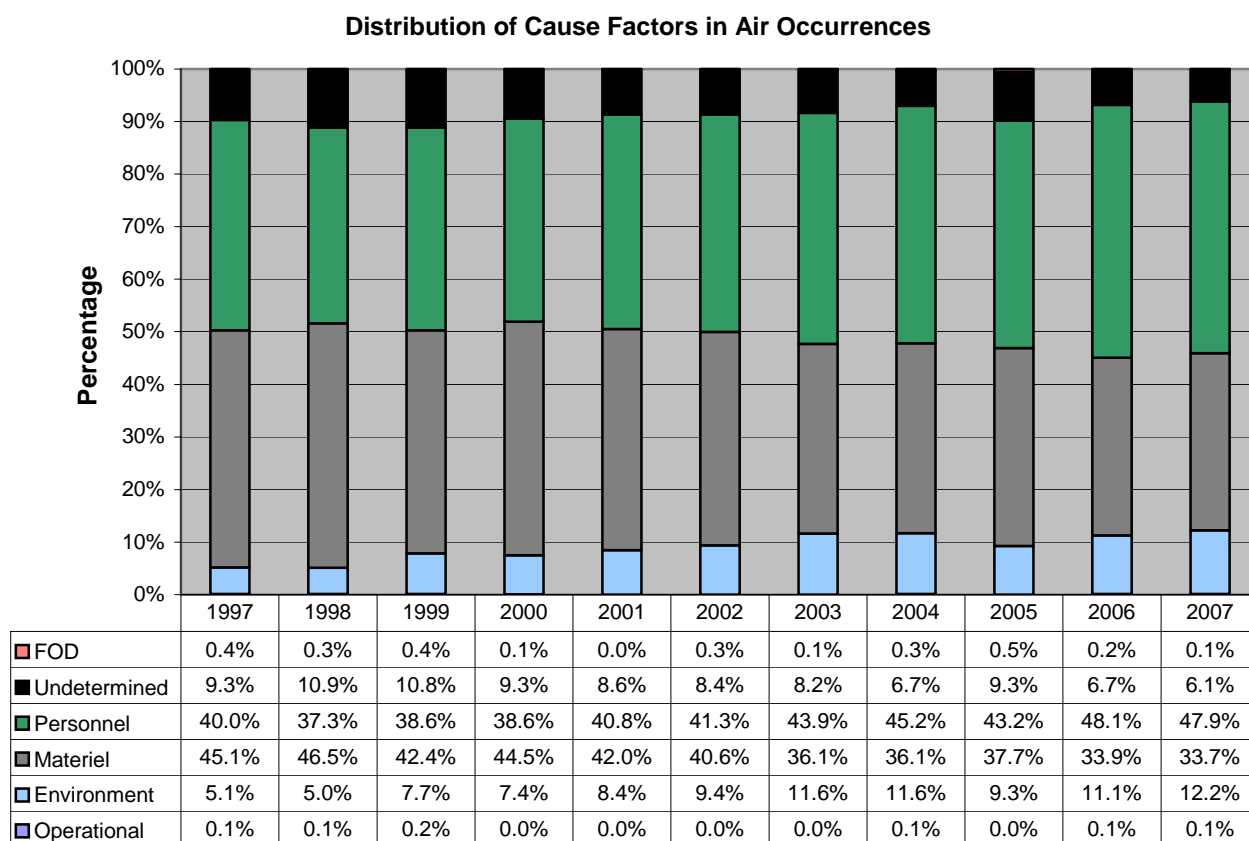
Graph 5 - Minor Injuries

1.13 CAUSE FACTORS ANALYSIS

1.13.1 Air Occurrences

There has been no significant change in the distribution of cause factors in air occurrences. The distribution for 2007 was the following in descending order:

- a. Personnel – 47.9%
- b. Materiel – 33.7%
- c. Environment – 12.2%
- d. Undetermined – 6.1%
- e. Operational – 0.12%
- f. Foreign Object Damage (FOD) – 0.06%

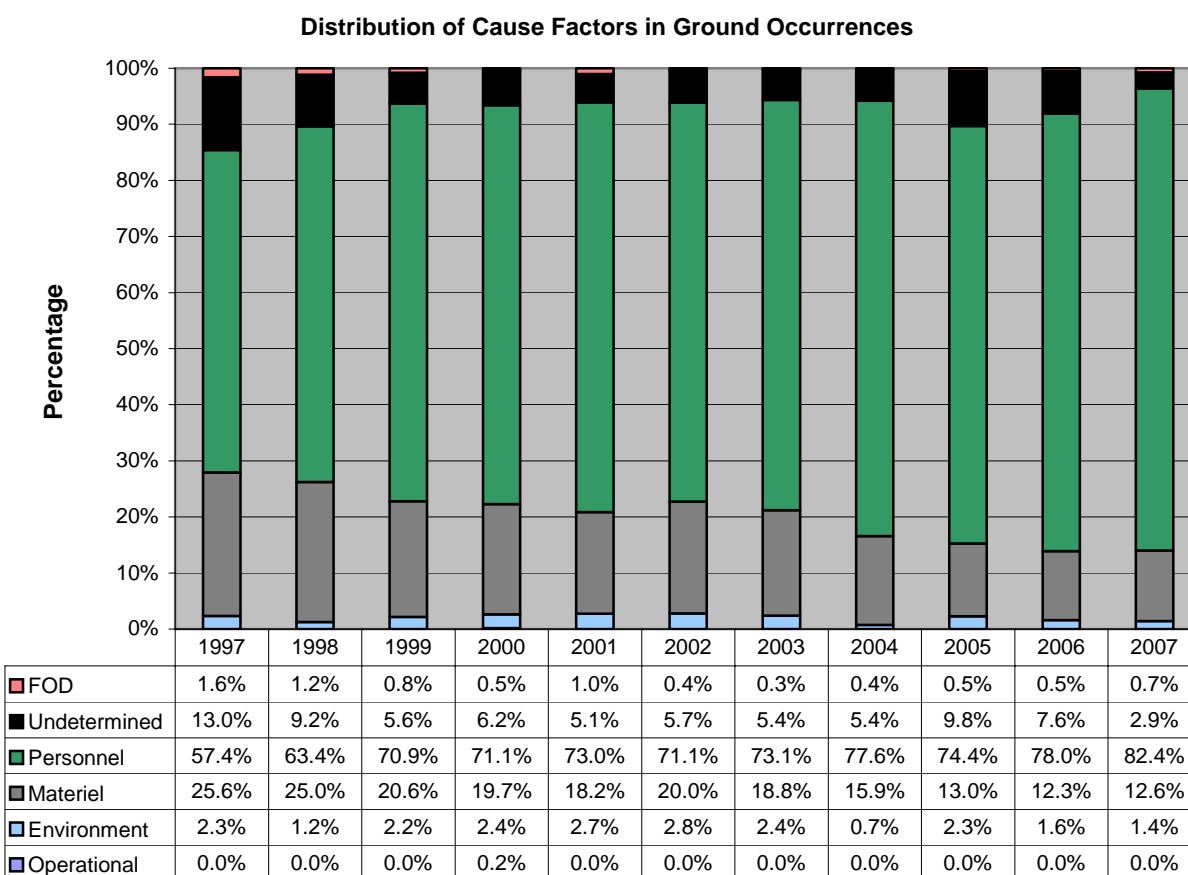


Graph 6 - Distribution of Cause Factors in Air Occurrences

1.13.2 Ground Occurrences

There has been no significant change in the distribution of cause factors in ground occurrences. The distribution for 2007 was the following in descending order:

- a. Personnel – 82.4%
- b. Materiel – 12.6%
- c. Undetermined – 2.9%
- d. Environment – 1.4%
- e. Foreign Object Damage (FOD) – 0.06%
- f. Operational – 0%



Graph 7 - Distribution of Cause Factors in Ground Occurrences

1.13.3 Comparison of Cause Factors for Air and Ground Occurrences

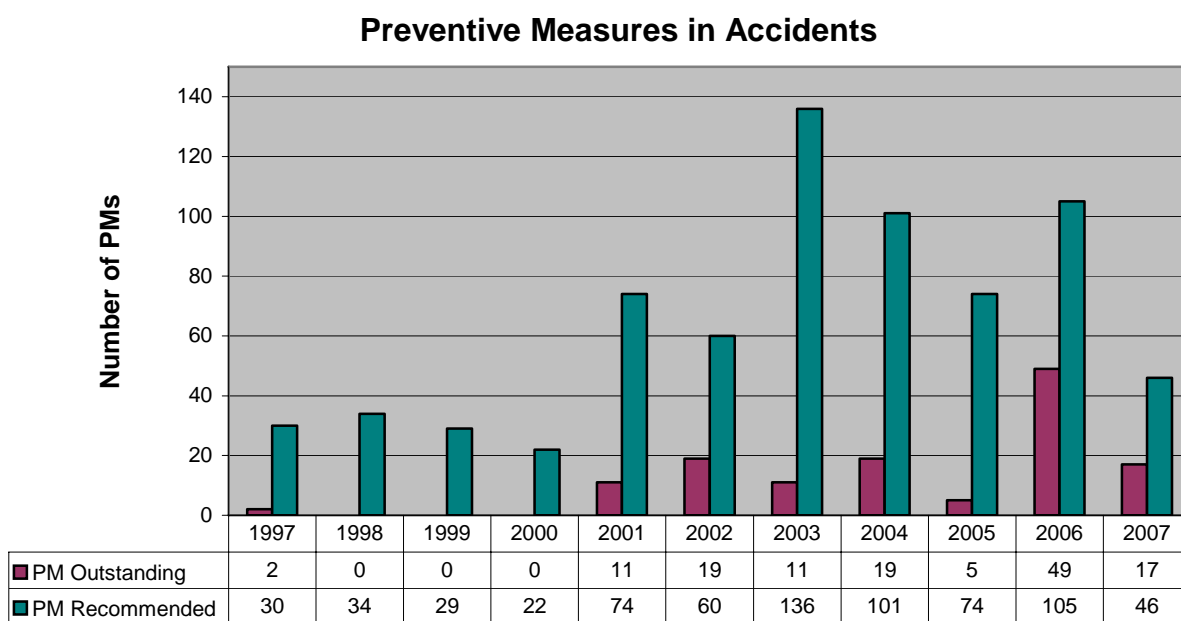
Cause for concern is the marked difference in cause factor attribution for air and ground occurrences, most notably for 'Personnel' as a cause factor. 82.4% of ground occurrences involve a personnel cause factor, compared to only 47.9% of air occurrences. DFS will investigate the cause of this marked difference.

1.14 PREVENTIVE MEASURES

Preventive Measures continue to be actioned in a timely manner. A total of approximately 670 PMs remain outstanding at the close of 2007, down from approximately 840 at the close of 2006.

1.14.1 Preventive Measures in Accidents

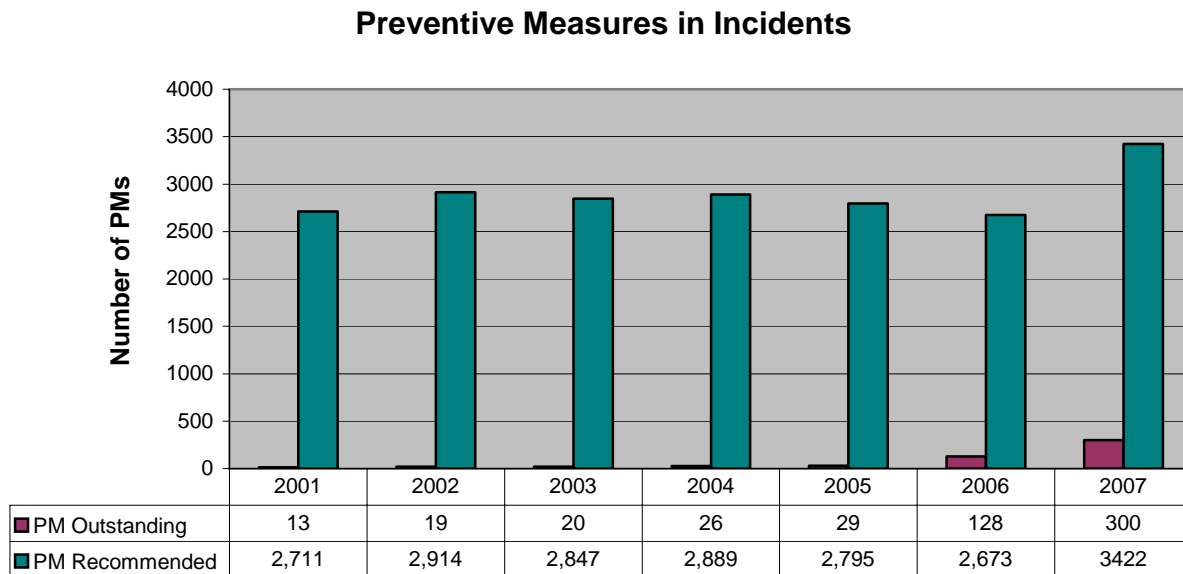
With the exception of 2 PMs in 1997, all PMs up to the year 2000 resulting from accidents have been actioned. The outstanding PMs of 1997 relate to a CT-114 bird ingestion (CASE ID # 28522). Note that for 2006 and 2007, some investigations are not yet complete and further PMs may be proposed as a result of the investigation conclusions (refer Table 2 for the status of ongoing investigations).



Graph 8 - Preventive Measures in Accidents

1.14.2 Preventive Measures in Incidents

The majority of PMs for incidents are actioned and closed at the unit level, and are thus closed relatively quickly. Most PMs for incidents are actioned within a year, and typically nearly all are actioned within 5 years.



Graph 9 - Preventive Measures in Incidents

DEFINITIONS

1.15 AIRCRAFT FAMILIES AND CLASSIFICATION CODE

The following outline the family classification and aircraft type in the CF.

FAMILY	CODE	DESCRIPTION
Fighters	CF188	CF18 Hornet
Helicopters	CH124A	Sea King
	CH139	Jet Ranger Bell 206B
	CH146	Griffon
	CH149	Cormorant
Patrol	CP140	Aurora
Trainers	CT102	Astra
	CT114	Tutor
	CT145	King Air
	CT146	Outlaw
	CT155	Hawk
	CT156	Harvard II
Transport	CC115	Buffalo
	CC130	Hercules
	CC138	Twin Otter
	CC142	Dash-8
	CC144	Challenger
	CC150	Polaris (Airbus 310)
	CC177	Globemaster III
UAV	CU161	Sperwer
	CU162	Vindicator
	CU163	Alatair
	CU167	Silver Fox
	CU168	Skylark

Table 3 - Aircraft Families

1.16 TERMINOLOGY

The following terms are condensed extracts from A-GA-135-001/AA-001 Flight Safety for the Canadian Forces.

1.16.1 Damage

Damage is defined as physical harm to an aircraft that impairs the value or normal function of the aircraft. Damage is said to have occurred when the aircraft or any portion of it is lost or requires repair or replacement as a result of unusual forces like a collision, impact, explosion, fire, rupture, or overstress.

1.16.1.1 Aircraft Damage Level (ADL)

The following damage level definitions are used to reflect the degree of damage:

Destroyed/missing: The aircraft has been totally destroyed, is assessed as having suffered damage beyond economical repair or is declared missing.

Very serious: The aircraft has sustained very serious damage to multiple major components requiring third-line maintenance.

Serious: The aircraft has sustained serious damage to a major component requiring third-line maintenance.

Minor: The aircraft has sustained minor damage or damage to non-major components requiring normal second-line maintenance repair.

Nil: The aircraft, including the power plant, has not been damaged.

1.16.2 Personnel Casualty Level (PCL)

The PCL is a colour-based categorization system used to identify the most severe casualty suffered by personnel in an FS occurrence. The PCL assigned for an occurrence is defined as follows:

Black: PCL level assigned when a fatality has occurred.

Grey: PCL level assigned when personnel is missing.

Red: PCL level assigned when personnel is very seriously injured or ill and the person's life is in immediate danger.

Yellow: PCL level assigned when personnel is seriously injured or ill. There is cause for immediate concern but the patient's life is not in immediate danger. Usually the person is non-ambulatory.

Green: PCL level assigned when personnel is moderately ill or injured in an occurrence for which medical attention is needed but there is no immediate concern. Usually the person is ambulatory.

1.16.3 Occurrence

An occurrence is any event involving the operation of an aircraft or to support flying operations where there is aircraft damage or a personnel casualty, or risk thereof. This definition excludes damage or injury caused by enemy action.

1.16.3.1 Air Occurrence

An air occurrence is an occurrence involving an aircraft between the time the first power plant start is attempted with intent for flight and the time when the last power plant or rotor stops (for a glider, from the time the hook-up is complete until the glider comes to rest after landing).

1.16.3.2 Ground Occurrence

A ground occurrence is an occurrence involving an aircraft when there is no intent for flight, or when there is intent for flight but no power plant start has been attempted, or after the power plants and rotors have stopped.

1.16.3.3 Occurrence Category

Occurrences are categorized according to the ADL or PCL; whichever is more severe, in the following manner:

‘A’: Destroyed/missing ADL or Black or Grey PCL.

‘B’: Very serious ADL or Red PCL.

‘C’: Serious ADL or Yellow PCL.

‘D’: Minor ADL or Green PCL.

‘E’: Nil ADL and no casualty.

1.16.3.4 Accident

An accident is defined as a category ‘A’, ‘B’, or ‘C’ occurrence. An accident involving more than one aircraft is counted as only one accident.

1.16.3.5 Incident

An incident is defined as a category ‘D’ or ‘E’ occurrence. An incident involving more than one aircraft is counted as only one incident.

1.16.4 Rate of Occurrences

The rate of occurrences is reported as the number of occurrences per ten thousand flying hours. For example, four accidents in 30,000 flying hours would result in a 1.33 rate.

1.16.5 Cause Factors

A cause factor is defined as any event, condition or circumstances, the presence or absence of which, within reason, increased the likelihood of the occurrence. Cause assessments constitute the basis for the creation and application of preventive measures. Listed below are the definitions for the six cause factors that are assigned to aviation occurrences in the Canadian Forces.

Personnel: Includes acts of omission or commission, by those responsible in any way for aircraft operation or maintenance or support to operations, and contributing circumstances that lead to a FS occurrence.

Materiel: Includes failures of all aircraft components, support equipment and facilities used in the conduct and support of air operations that lead to a FS occurrence.

Environmental: Includes environmental conditions that, if all reasonable precautions have been taken and applied, are beyond human control within the present state of the art that lead to a FS occurrence.

Operational: Includes operational situations that lead to a FS occurrence in which no other controllable circumstances contributed to that event. The CAS shall approve the specification of this cause factor.

Unidentified Foreign Object Damage (FOD): Includes occurrences caused by the presence of a foreign object not able to be identified that causes or is assessed as having the potential to cause aircraft damage or personal injury.

Undetermined: Includes occurrences in which there is not enough evidence to reasonably determine an exact cause.

1.16.6 Human Factors Analysis and Classification System (HFACS)

HFACS is a general human error framework used as a tool for investigating and analyzing the human causes of aviation occurrences.

1.16.7 Preventive Measures

A preventive measure (PM) is any step that can be taken to decrease the likelihood of an aircraft occurrence. When practical, one or more PMs are applied to each cause factor assigned to an occurrence.

STATISTICAL DETAILS

1.17 FLYING HOURS BY AIRCRAFT TYPE

AIRCRAFT TYPE	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
TOTAL	162411	150876	136316	136329	142701	134612	130872	124745	122867	125235
CC115	2424	2492	2967	2316	2120	2439	1839	2533	2065	1762
CC130	22036	21556	20716	17902	19050	14945	15839	15442	16477	14863
CC138	2995	2550	2758	2455	1856	1923	1834	1962	1581	2166
CC142	4183	3499	2735	2259	2300	2328	2446	2660	2760	2483
CC144	4183	3499	2735	2259	2300	2328	2446	2660	2760	2483
CC150	3923	4154	4079	4328	5267	4760	4516	4847	4903	4483
CC177										593
CF188	21519	21536	19058	16851	16936	15108	13476	13836	13546	13142
CH124	9291	9068	9008	10576	10546	8226	8487	6857	6944	7479
CH139	5877	5602	6121	6527	6666	6070	6371	5024	4613	4852
CH146	25238	23319	22633	20489	22277	23384	21426	21632	21150	21458
CH149				239	3196	4906	4568	4586	4563	4939
CP140	14126	11619	10342	9418	10554	9684	9642	9324	8704	7000
CT102									2118	3805
CT114	25330	22983	12508	3477	4088	3894	3903	3757	4101	3912
CT146								38	93	67
CT155			592	5128	7342	8383	8446	9137	8806	8714
CT156			2213	13016	14474	15838	14942	13728	14722	16661
CU161						55	117	141	876	1031

Table 4 - Flying Hours by Aircraft Type

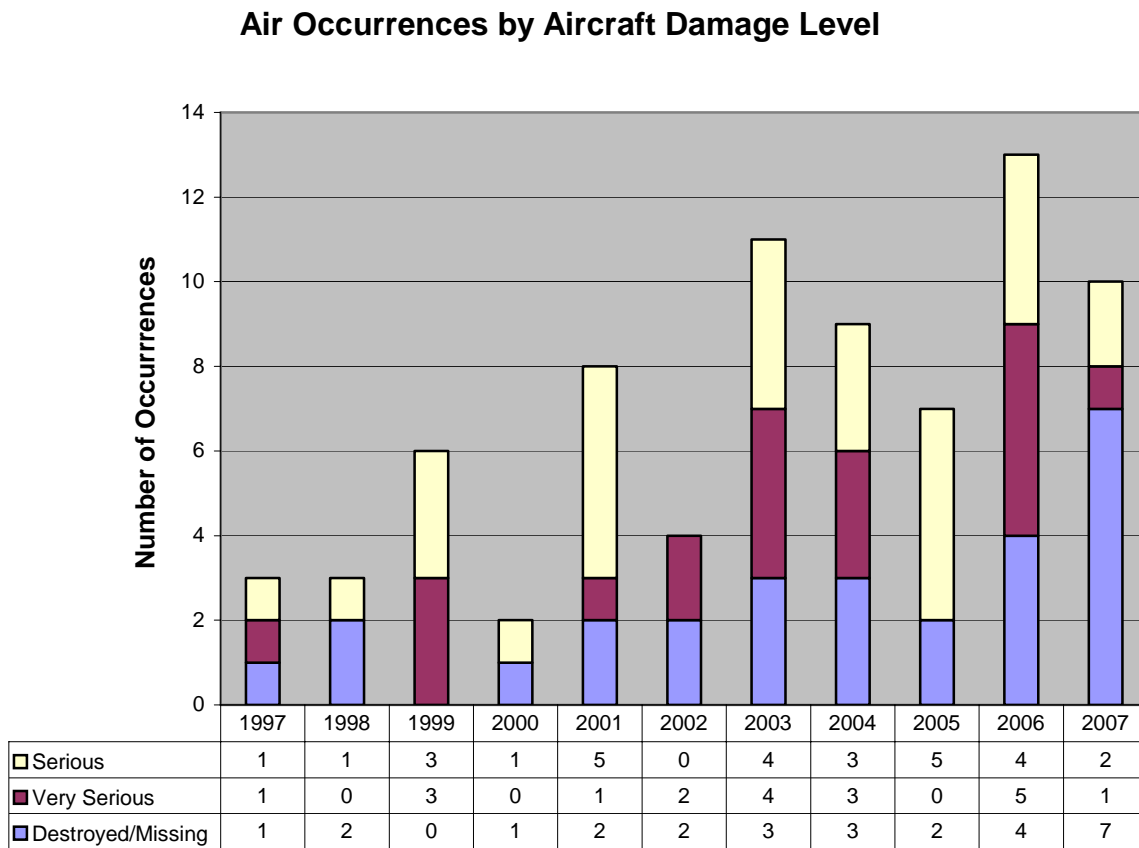
1.18 AIRCRAFT WRITE-OFF 10 YEAR SUMMARY

CASE ID	DATE	AIRCRAFT	TAIL #	LOCATION	DESCRIPTION
28522	25 September 1997	CT114	048	Moose Jaw Training Area, SK	Birdstrike
79005	02 October 1998	CH113	305	Marsoui, QC	In-flight break-up
28743	10 December 1998	CT114	156	Moose Jaw Training Area, SK	Mid Air
100494	23 June 2000	CH124A	422	At sea 150 NM South of Honolulu, Hawaii	Ditching
104593	21 June 2001	CT114	006	London, ON	Mid Air
106002	10 October 2001	CH139	320	Edmonton, AB	Auto-rotation training
108852	02 July 2002	CH139	308	Southport, MB	Auto-rotation training
109081	18 July 2002	CH146	420	40NM West of Goose Bay, NL	Tail-Rotor Failure
111359	27 February 2003	CH124A	401	At Sea 540 NM ESE of Halifax, Nova Scotia	Crash on take off
112191	26 May 2003	CF188	732	Cold Lake, AB	Crash
116524	14 May 2004	CT155	202	Moose Jaw, SK	Birdstrike
119527	10 December 2004	CT114	173	Moose Jaw Area, SK	Mid-Air
119527	10 December 2004	CT114	064	Moose Jaw Training Area, SK	Mid-Air
122639	16 August 2005	CF188	745	Bagotville, QC	Crash
122771	24 August 2005	CT114	120	Thunder bay, ON	Loss of thrust
125184	2 Feb 2006	CH124	438	30 NM East of Denmark	CFIT
127667	13 July 2006	CH149	914	Canso, NS	CFIT
130974	18 May 2007	CT114	159	Malmstrom, Montana	Loss of control

Table 5 - Aircraft Write Off 10-year Summary

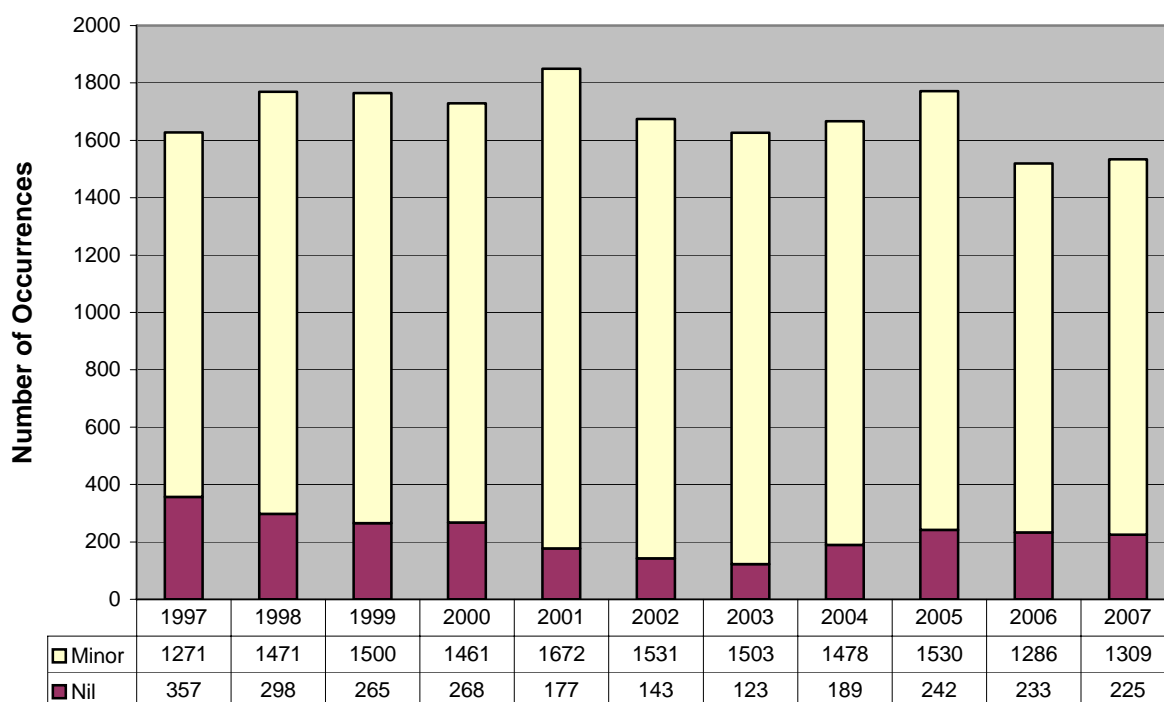
1.19 DAMAGE

1.19.1 Major Air Occurrences by Aircraft Damage Level



Graph 10 – Major Air Occurrences by Aircraft Damage Level

1.19.2 Minor Air Occurrences by Aircraft Damage Level

Air Occurrences by Aircraft Damage Level**Graph 11 – Minor Air Occurrences by Aircraft Damage Level**

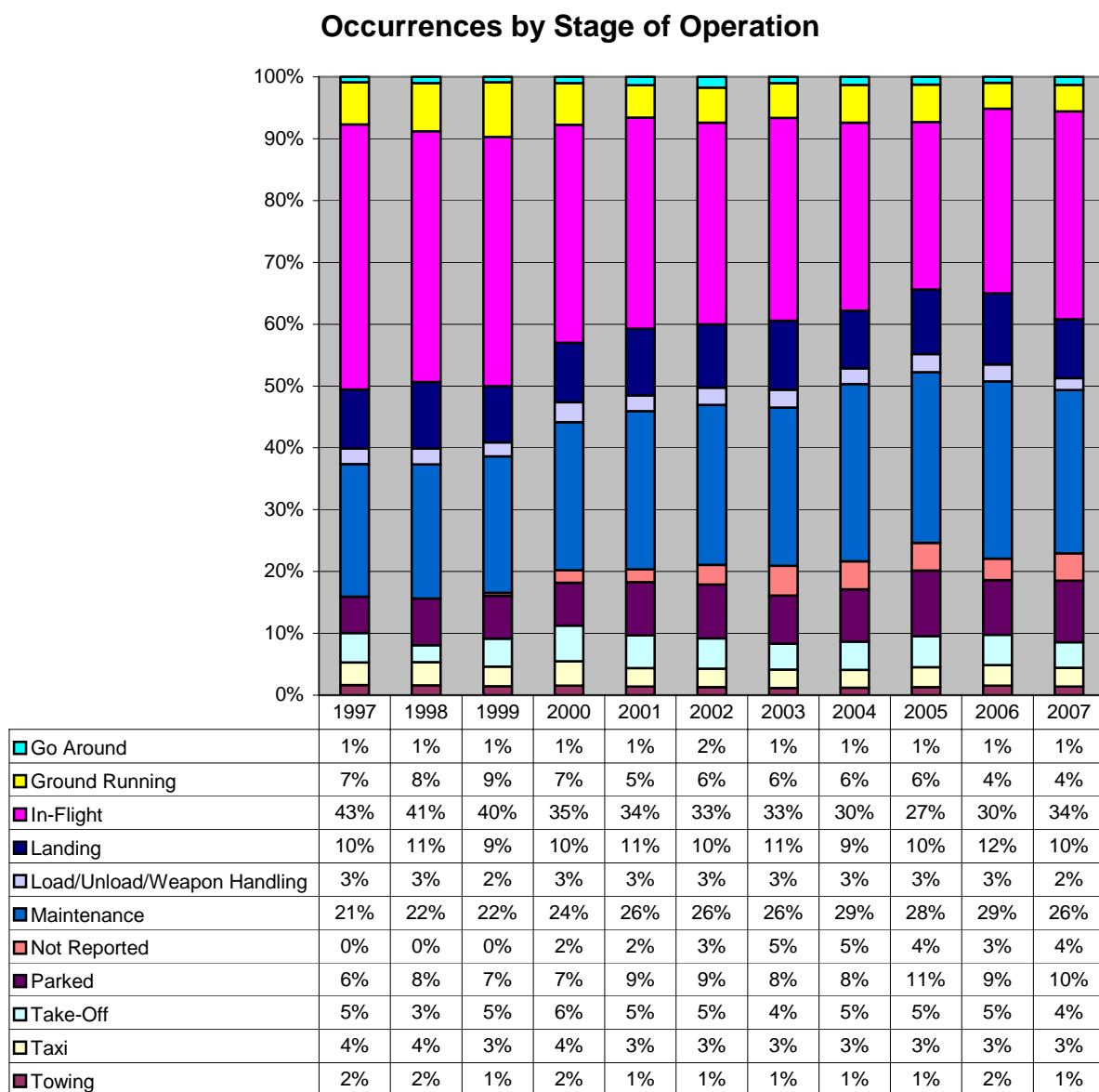
1.19.3 Ground Occurrences by Aircraft Damage Level

DAMAGE	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Destroyed / missing	0	0	0	0	0	0	0	0	0	0
Very serious	0	0	0	0	0	1	0	0	0	1
Serious	1	1	0	0	0	0	2	1	0	3
Minor	327	252	242	192	181	152	280	322	284	278
Nil	630	660	706	880	918	888	795	802	710	753

Table 6 – Ground Occurrences by Aircraft Damage Level

1.20 10-YEAR ANALYSIS OF CAUSE FACTORS

1.20.1 Occurrences by Stage of Operation



Graph 12 - Occurrences by Stage of Operation - Air and Ground (Air Cadets, NON-CF and UAVs excluded)

1.21 HFACS CAUSE FACTORS

1.21.1 Air Occurrences HFACS Cause Factor Breakdown

HFACS CAUSE FACTORS				CHANGE	
		2006	2007	±	%
TOTAL ACTIVE FACTORS		864	840	-24	-3%
Errors	Attention/Memory	327	319	-8	-2%
	Decision	138	118	-20	-14%
	Knowledge/Information	74	63	-11	-15%
	Perceptual	31	20	-11	-35%
	Technique-Based	251	279	28	11%
Deviations	Exceptional	27	23	-4	-15%
	Routine	16	18	2	13%
TOTAL LATENT FACTORS		803	880	77	10%
Conditions of Personnel	Mental State	402	457	55	14%
	Physical/Mental Limitation	15	13	-2	-13%
	Physiological State	8	9	1	13%
Working Conditions	Environment	31	28	-3	-10%
	Equipment	26	39	13	50%
	Workspace	20	19	-1	-5%
Practices of Personnel	Personal Readiness	3	3	0	0%
	Qualification	6	7	1	17%
	Resource Management	74	82	8	11%
	Training	44	50	6	14%
Supervision	Level of Supervision	73	79	6	8%
	Planned Activities	17	20	3	18%
	Problem Correction	11	9	-2	-18%
	Deviations	7	6	-1	-14%
Organizational Influences	Organizational Climate	13	9	-4	-31%
	Organizational Process	40	33	-7	-18%
	Resource Management	13	17	4	31%

Table 7 - Air Occurrences HFACS Cause Factor Breakdown

1.21.2 Ground Occurrences HFACS Cause Factor Breakdown

HFACS CAUSE FACTORS				CHANGE	
		2006	2007	±	%
TOTAL ACTIVE FACTORS		920	907	-13	-1%
Errors	Attention/Memory	409	377	-32	-8%
	Decision	109	92	-17	-16%
	Knowledge/Information	112	124	12	11%
	Perceptual	15	8	-7	-47%
	Technique-Based	172	200	28	16%
Deviations	Exceptional	64	72	8	13%
	Routine	39	34	-5	-13%
TOTAL LATENT FACTORS		870	1071	201	23%
Conditions of Personnel	Mental State	310	465	155	50%
	Physical/Mental Limitation	6	5	-1	-17%
	Physiological State	4	9	5	125%
Working Conditions	Environment	20	17	-3	-15%
	Equipment	41	39	-2	-5%
	Workspace	34	32	-2	-6%
Practices of Personnel	Personal Readiness	0	1	1	-
	Qualification	13	9	-4	-31%
	Resource Management	87	81	-6	-7%
	Training	41	67	26	63%
Supervision	Level of Supervision	139	137	-2	-1%
	Planned Activities	30	28	-2	-7%
	Problem Correction	22	25	3	14%
	Deviations	15	27	12	80%
Organizational Influences	Organizational Climate	14	24	10	71%
	Organizational Process	57	66	9	16%
	Resource Management	37	39	2	5%

Table 8 - Ground Occurrences HFACS Cause Factors Breakdown

1.22 SYSTEM DESCRIPTOR BY FLEET

Table 9 below shows the main trends detected for each aircraft in the CF. DFS is reviewing these fleet-specific trends to assess risk and determine mitigating actions.

AIRCRAFT TYPE	TREND DETECTED	10-YEAR MEAN RATE	2007 RATE	% CHANGE
CC115 Buffalo	Propeller	4.42	22.7	414.0
	Survival and Safety Equipment	32.0	51.1	59.5
	Weapons Systems	23.0	68.1	196.3
CC130 Hercules	Other	3.3	16.2	386.7
	Survival and Safety Equipment	9.6	18.8	96.5
	Weapons Systems	8.6	17.5	103.7
CC138 Twin Otter	Controls (Other)	2.8	4.6	64.6
	Undercarriage (Landing Gear)	6.1	18.5	200.8
CC142 Dash 8	Electrical Systems	4.0	16.1	306.9
	Other	6.0	124.9	1971.2
	Undercarriage (Landing Gear)	5.2	36.2	599.2
CC144 Challenger	Propeller/Engine Controls	1.2	8.1	584.0
	Survival and Safety Equipment	1.1	4.0	283.8
CC150 Polaris	Communications Equipment	0.4	2.2	442.3
	Navigation Equipment	0.2	2.2	907.4
CF188 Hornet	Pneumatics (Incl. Heat & Vent)	4.5	7.6	68.5
	Weapons Systems	60.2	94.4	56.8
CH124 Sea King	Flight Instruments	3.2	5.4	69.9
	Gearboxes/Accessories	9.9	17.4	76.0
CH139 Jet Ranger	Helicopter Flight Controls	1.1	6.2	489.2
	Lubrication Systems	3.0	10.3	243.9
	Other	0.5	2.1	278.2

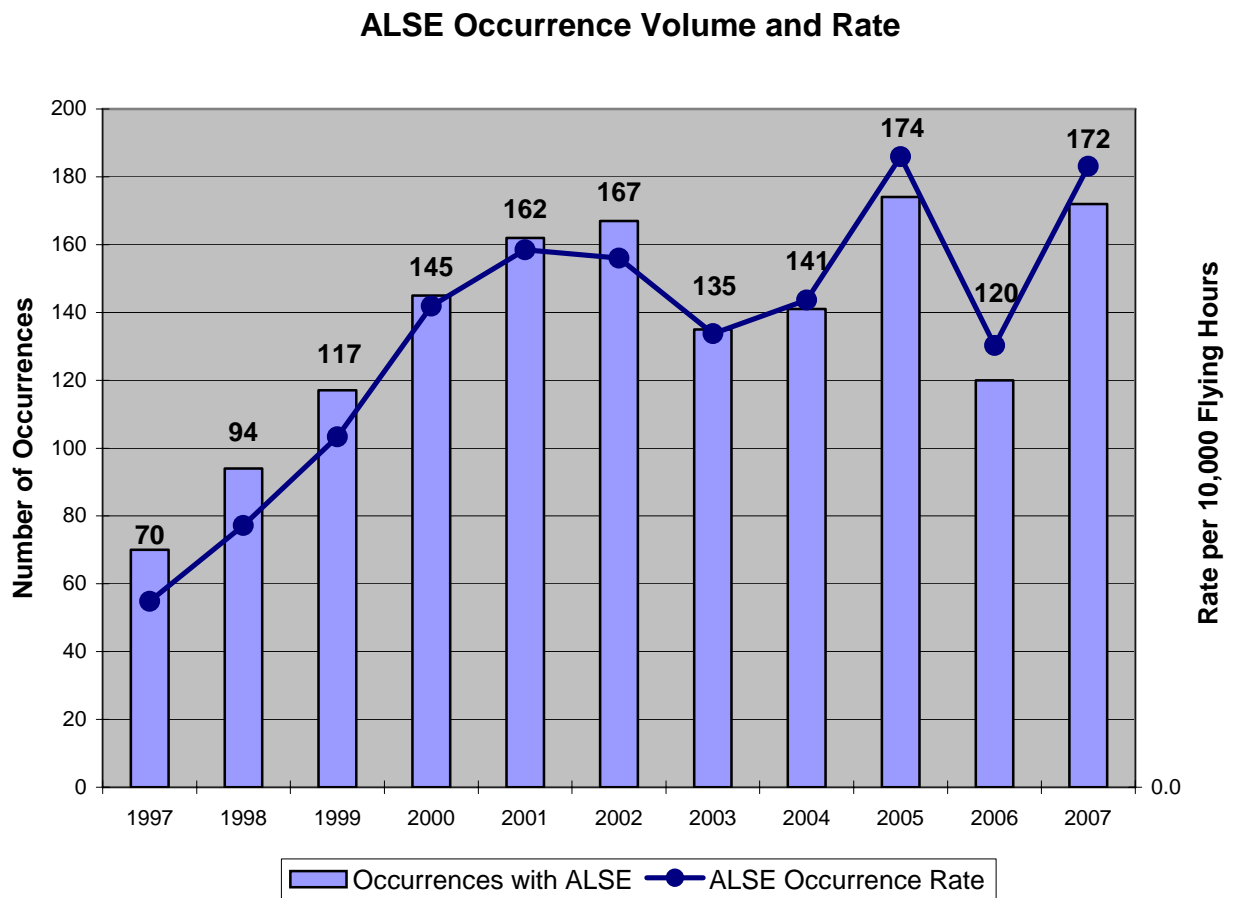
AIRCRAFT TYPE	TREND DETECTED	10-YEAR MEAN RATE	2007 RATE	% CHANGE
CH146 Griffon	Gearboxes/Accessories	5.1	7.9	55.5
	Survival and Safety Equipment	3.5	6.1	73.3
	Undercarriage (Landing Gear)	1.7	4.2	150.2
CH149 Cormorant	Communications Equipment	4.5	12.2	169.8
	Survival and Safety Equipment	9.9	24.3	145.9
	Undercarriage (Landing Gear)	4.7	16.2	245.4
CP140 Aurora	Anti-Icing/De-icing	3.0	7.1	141.6
	Hydraulics	3.1	10.0	226.5
	Survival and Safety Equipment	8.1	21.4	165.8
CT114 Tutor	Electrical Systems	6.4	20.5	219.6
	Flight Instruments	1.3	7.7	492.9
	Fuel Systems	7.4	17.9	143.0
CT145 King Air	Flaps	2.3	11.8	425.1
	Undercarriage (Landing Gear)	7.6	11.8	56.3
CT155 Hawk	Controls (Other)	4.5	8.0	77.5
	Flaps	7.3	14.9	105.5
CT156 Harvard II	Flaps	7.7	16.8	118.6

Table 9 - System Descriptor by Fleet

Notes

1. 10-year mean rate calculated for 1997-2006
2. Cormorant data analysis since years 2002
3. Tutor data analysis since 2001 (mainly Snowbird operations)
4. Hawk data analysis since 2000

One common theme was identified fleet wide: An increase in the number of occurrences related to survival and safety equipment in several fleets. This analysis reinforced a concern noted in a number of recent Flight Safety Investigation Reports in which Aviation Life Support Equipment (ALSE) was found to be deficient. DFS staff is actively investigating this issue with the OAA and the TAA staffs. This trend is shown over the last ten years at Graph 13.



Graph 13 - ALSE Occurrence Volume and Rate