

**CANADIAN FORCES
FLIGHT SAFETY INVESTIGATION REPORT**

FINAL REPORT

FILE NUMBER: 1010-CF188798 (DFS 2-2-3)
DATE OF REPORT: 21 January 2005

AIRCRAFT TYPE: CF188 Hornet
DATE/TIME: 251214Z June 2003
LOCATION: Aalborg, Denmark
CATEGORY: "B" Category Accident

This report was produced under authority of the Minister of National Defence (MND) pursuant to Section 4.2 of the Aeronautics Act (AA), and in accordance with A-GA-135-001/AA-001, Flight Safety for the Canadian Forces.

With the exception of Part 1 – Factual Information, the contents of this report shall be used for no other purpose than accident prevention. This report was released to the public under authority of the Director of Flight Safety, National Defence Headquarters, pursuant to powers delegated to him by the MND as the Airworthiness Investigative Authority (AIA) of the Canadian Forces.

SYNOPSIS

The accident aircraft, CF188798, was part of a 10-aircraft detachment, which was deployed to Aalborg, Denmark in support of Exercise CLEAN HUNTER.

On 25 Jun 03 after completing a morning sortie, the accident aircraft required a recharge of the arrestor hook accumulator. The two Canadian technicians involved in the accident retrieved a nitrogen-servicing cart and with the assistance of a Danish technician proceeded to the aircraft. The senior of the two Canadian technicians connected a nitrogen hose to the aircraft and requested 3400 PSI from the Danish technician who was operating the nitrogen cart. When the requested pressure was reached, the senior technician opened the air charge valve and almost immediately thereafter the pressure accumulator of the hook actuator exploded due to a massive over-pressurization.

The aircraft suffered "B" category damage. All technicians escaped without injury.

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1. FACTUAL INFORMATION

1.1 History of the Aircraft

This Squadron was deployed to Aalborg, Denmark in support of Exercise CLEAN HUNTER. The 10 CF-18 aircraft arrived in theatre on 18 Jun 03 and commenced operations on 19 Jun 03. The exercise began on 23 Jun 03 with a scheduled launch rate of six AM and six PM sorties. The detachment scheduled two additional mornings launches for Dissimilar Air Combat Training (DACT) with the Danish Air Force.

On the day of the accident aircraft CF188798 completed a 1.6 hour mission and returned at 0932Z.

The aircraft was recovered by the oncoming shift and an After/Before flight (AB) check was carried out. During the check it was noted that the Maintenance Monitor Panel (MMP) was indicating a *code 916*. This code is associated with the arrestor hook actuator and denotes a servicing requirement.

This information was passed on to the line van technicians and subsequently relayed to Manpower (servicing desk). Manpower then directed the line van technicians to retrieve the Danish nitrogen-servicing cart from the storage area in anticipation of servicing the accumulator. As well, Manpower contacted the Squadron Operations Centre (SOC) and requested a Danish technician to assist in the operation of the nitrogen-servicing cart.

The Danish operator met the Canadian technicians at the storage area and the cart was towed to the aircraft. Once in position the senior Canadian technician proceeded to connect the hose from nitrogen cart to the air charge valve on the aircraft and asked for 3400 PSI from the Danish operator. The Danish operator then informed the technician that the nitrogen cart had reached the requested 3400 PSI.

Once aware of the cart pressure, the technician proceeded to open the air charge valve allowing nitrogen from the cart to fill the arrestor hook actuator. The technician saw the actuator gauge reach 600 PSI (max pressure on gauge) and immediately thereafter the pressure accumulator of the hook actuator exploded due to the massive over-pressurization.

The aircraft sustained "B" category damage.

1.2 Injuries to Personnel

Nil.

1.3 Damage to Aircraft

The aircraft received "B" category damage, (photos 1-4) which included damage to both engines, and primary and secondary structure in the region of the tail hook actuator. The most serious damage was sustained to the Y645 former. This former is critical to the structural integrity of the aft fuselage as it provides support for the horizontal stab spindle and actuator mechanism.

1.4 Collateral Damage

Nil.

1.5 Personnel Information

	Tech 1	Tech 2
Rank	MCpl	Cpl
MOC	514 (formerly 511 AE)	526 (formerly 524 CRS)
Experience	1 yr CF-18 (current) 9 yrs CC-130 6.5 yrs CF-18 (previous)	2 yrs CF-18 (current) 11 yrs communications/r adar Trenton
Total years as technician	17 yrs	13 yrs
Duty time - Day of incident	1 hr	1 hr

1.6 Aircraft Information

The aircraft was serviceable prior to the accident. However, at the time of the accident the MMP was displaying a code for low tail hook accumulator pressure.

1.7 Meteorological Information

Not applicable.

1.8 Aid to Navigation

Not applicable.

1.9 Communications

Not applicable.

1.10 Aerodrome Information

Not applicable.

1.11 Flight Recorders

Not applicable.

1.12 Wreckage and Impact Information

Not applicable.

1.13 Medical

Toxicology was not taken for this accident due to the amount of time that passed between the accident and the decision to begin the investigation.

1.14 Fire, Explosives Devices, and Munitions

Not applicable.

1.15 Survival Aspects

Not applicable.

1.16 Test and Research Activities

Not applicable.

1.17 Organisational and Management Information

The accident technicians were from 4 Wing Cold Lake. They were deployed to Aalborg, Denmark in support of Exercise CLEAN HUNTER.

1.18 Additional Information

Nil.

1.19 Useful or Effective Investigation Techniques

The investigation team included a Training Development Officer as a specialist member of the team. His expertise was invaluable in reviewing factors associated with training and certification of technicians.

2. ANALYSIS

2.1 General

This accident occurred on 25 June 2003. Initially, the severity of the damage was not appreciated and it was believed that a Supplementary Report was all that was required. On 11 July 2003 information received from Director Aerospace Equipment Program Manager (Fighters and Trainers) (DAEPM (FT)) indicated that CF188798 had received "B" category damage which dictated that a Flight Safety Investigation Report (FSIR) was required. The FSIR investigation commenced in Cold Lake on 12 August 2003. All pertinent information had been preserved from the initial investigation, although no toxicology samples had been taken. The FSIR investigation determined that due to the length of time between the accident and investigation commencement toxicology samples would serve no useful purpose.

2.2 Aircraft

Aircraft CF188798 had returned from a 1.6 hour mission and it was determined that the tail-hook accumulator required servicing. The aircraft was not scheduled to fly for the remainder of the day. All remaining aircraft were serviceable.

2.3 Technicians

The MCpl technician arrived on Squadron in 2002 from the C-130 Hercules community. Prior to that, he had spent six and a half years as a CF-18 technician. The MCpl technician was the senior technician on this line crew. While holding a number of qualifications and authorisations on the CF-18, and having conducted tail-hook accumulator servicing numerous times before under supervision, he was neither qualified nor authorized to carry out this maintenance procedure.

The Cpl technician arrived on Squadron in 2001 after spending eleven years as a communications/radar technician in Trenton. This technician was not qualified to replenish the tail hook.

The two accident Canadian technicians were assigned to flight line monitor duty. Their duties included refuelling, parking, starting, and snags rectification. The Danish technician's role and responsibilities were limited to operation of the nitrogen cart.

2.4 The Accident

2.4.1 Pre-Conditions

Although not a problem unique to this Squadron, there was an extensive lack of qualified, experienced technicians. Apprentices posted to 4 Wing are required to be trained by the squadrons. This increases the workload of the squadrons, who were already heavily tasked. In addition, it was determined that this squadron had, for a variety of reasons, been working at a "surge" capacity since the events of 11 September 2001. This placed an extremely heavy workload on the aircraft maintenance section. Evidence suggests that technicians would occasionally conduct unsupervised, routine servicing and maintenance of aircraft for which they were not qualified. This was generally done because of perceived scheduling pressures and a lack of qualified technicians.

The operations tempo prior to the accident was hectic. In the month prior to this accident this Squadron was involved in both the first and second phase of Exercise MAPLE FLAG, as well as a deployment of 8 aircraft to Comox. From 22 May 2003 to 25 June 2003 the Squadron suffered 2 "B" and 1 "A" category accidents.

2.4.2 The Accident

When CF188798 returned from its first sortie, it was determined that the tail hook accumulator required servicing. When the Manpower section tasked the line crew to fix that aircraft, the Canadian MCpl was under the impression that the subject aircraft was required for an impending launch and therefore volunteered for the task. While he had performed this task before under supervision, he did not inform the Manpower section that he was not qualified to conduct the procedure. Consequently, the Manpower section assumed that the Canadian MCpl was qualified to perform that assigned task and let him proceed with its execution.

Upon arrival at the aircraft, the line crew (MCpl, Cpl, and Danish technician) connected the nitrogen cart to the tail hook accumulator. The MCpl then requested 3400 PSI instead of the required 300-400 PSI. He was aware of the correct pressure for the tail hook, yet he inadvertently asked for the incorrect pressure from the Danish technician who was working the nitrogen cart. This may have resulted from his previous Hercules experience as that aircraft has several accumulators that operate at high pressure (one in particular operates at 3000 PSI).

It is reasonable that the MCpl had a memory recall error. Memory errors may be reduced by reviewing the CFTOs prior to attempting a task, or by having pressure/quantity limits clearly marked on the airframe or gauge. In this case, the CFTOs were not reviewed, and the tail hook pressure gauge did not indicate the normal pressure range.

The Cpl technician was not qualified to replenish the tail hook. Although he was aware of the correct pressure requirements of the tail hook, he did not hear the

incorrect pressure being requested from the MCpl. Therefore, he could not stop this occurrence from happening.

The Danish technician's role was to operate the nitrogen cart. He did not question the request for 3400 PSI as Danish F-16s routinely use high-pressure nitrogen.

The investigation revealed that, unknown to the line crew, this aircraft was not required for the remainder of the day.

2.5 Summary

The active failure occurred when 3400 PSI was asked for instead of 300 PSI. This was likely caused by an action error, and in particular a memory recall error. In addition, and more importantly, the technician knowingly performed a maintenance procedure without the required qualification or authorization. This being said, some latent pre-conditions existed at the time of this accident. These included the operations tempo at 4 Wing, as well as the number and experience levels of maintenance technicians.

3. CONCLUSIONS

3.1 Findings

- 3.1.1 The hook accumulator pressure was low and required servicing.
- 3.1.2 The aircraft was not scheduled to fly again that day, yet the technicians were under the impression that the aircraft was scheduled to fly in 20 minutes.
- 3.1.3 The accident technician took it upon himself to service the tail hook accumulator even though he was not qualified or authorized to do so.
- 3.1.4 The accident technician incorrectly requested 3400 PSI pressure.
- 3.1.5 The accompanying Danish technician operated the nitrogen cart correctly.
- 3.1.6 There is a shortage of qualified and experienced CF-18 technicians at 4 Wing Cold Lake.
- 3.1.7 4 Wing Cold Lake had been operating at surge capacity since the events of 11 Sep 2001.

3.2 Causes

The accident technician attempted to complete a task for which he was neither qualified nor authorized and in doing so requested the incorrect pressure for the accumulator.

3.3 Contributing Factors

Cold Lake had been maintaining an operations tempo that tacitly encouraged technicians to reduce the time required to perform maintenance actions and by-pass established maintenance procedures.

4. SAFETY MEASURES

4.1 Safety Action Taken

4.1.1 Wing leadership was briefed on the seriousness of the issues associated with this accident.

4.1.2 This Squadron has instituted two mandatory technician training days per month. These training days are used to cover any current or on-going issues. Topics include lectures on various subjects such as: airworthiness, the precedence of Canadian Forces Technical Orders (CFTOs) in the documentation hierarchy; and Maintenance Record Set (MRS) refresher training.

4.1.3 Due to the high number of incidents and accidents at this Squadron involving aircraft maintenance, an airworthiness accreditation audit was ordered. This audit was conducted from 02-07 November 2003. The audit results indicated that the Squadron was working at a level of risk that is normally unacceptable for a Canadian Forces maintenance organization. The unit was directed to develop both short term and long-term corrective actions and any associated risk assessments.

4.1.4 On 12 December 2003, this Squadron developed a risk mitigation plan, which addressed many of the issues raised in this report and identified in the airworthiness accreditation audit of November 2003. The risk mitigation plan incorporated 49 separate and positive procedures to strive for a safe maintenance practice.

4.1.5 A second airworthiness accreditation audit was conducted at this unit from 18-22 April 2004. It was noted that the Squadron had made significant progress in addressing all observations raised in the previous audit. The Director of Technical Airworthiness issued a formal accreditation letter to this Squadron on 9 June 2004.

4.2 Safety Actions Required

4.2.1 Critical accumulator limitations such as pressures and quantities should be stencilled on the airframe or marked on appropriate gauges.

4.2.2 The technical member of the next flight safety survey of 4 Wing should review the audits of 02-07 November 2003 and 18-22 April 2004, as well as the Risk Mitigation Plan of 12 December 2003 to ensure the procedures are still appropriate and effective.

4.3 Other Safety Concerns

Nil.

4.4 DFS Remarks

Canadian Air Force technicians are rightfully renowned for their ability to get things done. While this "can do" attitude is normally a tremendous asset, it can also be a huge liability if it is not tempered with solid airworthiness and safety programs. In this case, it appears that the culture at this particular unit had, over time and for seemingly good reasons, become too focussed on getting the job done at the expense of sound airworthiness principles. This was not a conscious decision that was implemented overnight but a gradual, insidious process that was only stopped by this and another maintenance related ground accident. The lesson to be learned here is that constant vigilance against the temptation to cut corners is required. The best defence against this problem is to routinely adhere to sound airworthiness practices.

This unit is to be applauded for taking the necessary actions to correct the situation and regain its airworthiness accreditation. This investigation and the concurrent audit process have confirmed the Squadron's commitment in achieving a high level of aviation safety.

A.D. Hunter
Colonel
Director of Flight Safety

Annex A
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PHOTOGRAPHS

Photo 1: Web 74A332537-2037



Photo 2: Arresting Hook Accumulator



Photo 3: Engine Damage



Photo 4: Critical Former



Annex B
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LIST OF ABBREVIATIONS

AA: Aeronautics Act

AB: After/Before Flight

AE: Aero Engine

AIA: Airworthiness Investigative Authority

CFTO: Canadian Forces Technical Orders

Cpl: Corporal

CRS: Communication Radar System

DACT: Dissimilar Air Combat Training

DAEPM(FT): Director Aerospace Equipment Program Manager (Fighters and Trainers)

DFS: Director Flight Safety

FSIR: Flight Safety Investigation Report

MCpl: Master Corporal

MMP: Maintenance Monitor Panel

MND: Minister of National Defence

MOC: Military Occupation Code

MRS: Maintenance Records Set

PSI: Pounds per Square Inch

SOC: Squadron Operation Centre