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TOWARDS AN EFFECTIVE AIRWORTHINESS PROGRAM FOR THE DEPARTMENT OF NATIONAL DEFENCE AND THE CANADIAN ARMED FORCES

Maj J.P.G. Doré

JCSP 40

Exercise *Solo Flight*

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Introduction

Introduced in 1985, the Aeronautics Act legally assigns the joint responsibility for "all matters connected with aeronautics"[1] in Canada to the Minister of Transport and the Minister of National Defence (MND). Together, they – and the departments they oversee – are responsible for developing and enforcing regulations aimed at ensuring the safety and effectiveness of aviation operations in the country. The concept requires that the departments regulate and supervise aviation operators while being supported by an independent investigator to inquire into the circumstances of aeronautical accidents or alleged contraventions. In the case of civil aviation, the Department of Transport acts as regulator for commercial operators – e.g. airlines, aircraft manufacturers, Nav Canada, aerodrome owners – and the Canadian Transportation Accident Investigation and Safety Board acts as independent investigator. However, for military aviation, the Department of National Defence and the Canadian Armed Forces (DND/CAF) perform the three functions simultaneously, having been assigned a self-regulating and self-investigating responsibility through the Aeronautics Act.[2] The goal of DND's Airworthiness Programme is therefore to achieve the objectives of the Aeronautics Act by regulating aviation safety for aircraft registered by DND.[3] The complete scope of the program, from the design, manufacture, maintenance, and support of aeronautical products, to the

[1] Aeronautics Act, R.S.C., c. A-2, s. 4.2 (1985).

[2] Department of National Defence, A-GA-005-000/AG-000, *Department of National Defence/Canadian Armed Forces Airworthiness Programme* (Ottawa: Chief of the Defence Staff, 2011), 1-1-9.

[3] *Ibid*., 1-1-4.

training, licensing, and employment of aviators, can be shown in Figure 1 and the program is based on the four core principles that "airworthiness activities are: completed to accepted standards; performed by authorized individuals; accomplished within accredited organizations; and done using approved procedures."[4] As the programme's regulator, DND develops policies and oversees their implementation in all functional areas. As its implementer, DND/CAF conducts aeronautical operations in support of its defence mandate while complying with the airworthiness rules that it established. Finally, as investigator, DND assesses its regulatory and implementation performance by reviewing accidents and incidents and issuing recommendations.

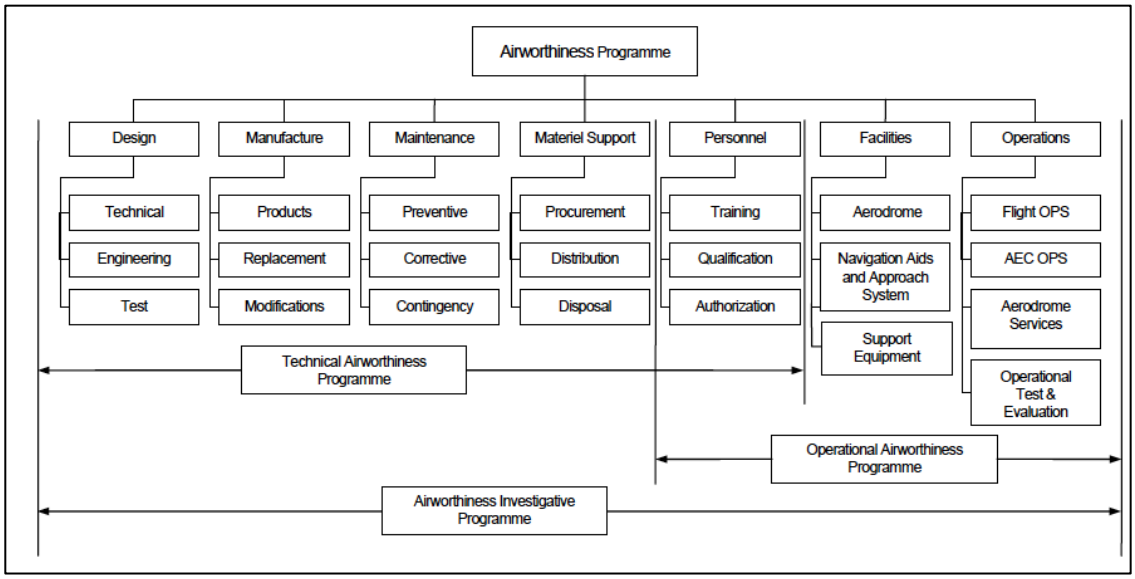

Figure 1: Scope of the DND/CAF Airworthiness Programme

Source: A-GA-005-000/AG-001, 1-1-4.

This regulatory and investigative responsibility over military aviation is legally assigned to the MND and the Chief of Defence Staff (CDS) in the Aeronautics Act and

[4] Department of National Defence, C-05-005-001/AG-001, *Technical Airworthiness Manual (TAM)* (Ottawa: Chief of the Defence Staff, 2001): 1-1-1-4.

has been delegated by the latter through a series of orders. As a result of these orders, the Chief of the Air Force (C Air Force) was designated as Airworthiness Authority (AA) for the DND/CAF and assigned the responsibility of implementing, managing, and overseeing for the DND/CAF Airworthiness Programme with the aim of achieving the legal requirements of the Aeronautics Act.[5] The Director of Flight Safety (DFS), who reports directly to the C Air Force, was designated as the Airworthiness Investigative Authority (AIA) and assigned the responsibility to monitor and investigate aviation-safety-related matters, including conducting independent investigations of all accidents.[6] The CDS elected to split its regulatory airworthiness authority between the Commander of 1 Canadian Air Division (Comd 1 CAD) and the Director General of Aerospace Equipment Programme Management (DGAEPM), the former designated as the Operational Airworthiness Authority (OAA)[7] and the latter as the Technical Airworthiness Authority (TAA).[8] Given that the Aeronautics Acts does not specifically require this division of regulatory responsibilities, the following excerpt attempts to explain it:

> Within the [CAF], the operational staff is responsible for flying operations, aerospace control and operator training and qualification. Similarly, the technical staff is responsible for the design, manufacture, maintenance and materiel support of aeronautical products, as well as for the training and qualification of technical personnel. To accommodate these responsibilities, the Airworthiness Programme elements have been split into Operational and Technical areas. This division of responsibility has given rise to the Operational and Technical Airworthiness Programs.[9]

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[5] Chief of the Defence Staff, *Order: Airworthiness Authority* (Ottawa: NDHQ, 28 July 2008).

[6] Chief of the Defence Staff, *Order: Airworthiness Investigative Authority* (Ottawa: NDHQ, 28 July 2008).

[7] Chief of the Defence Staff, *Order: Operational Airworthiness Authority* (Ottawa: NDHQ, 17 December 2013).

[8] Chief of the Defence Staff, *Order: Technical Airworthiness Authority* (Ottawa: NDHQ, 20 December 2005).

[9] A-GA-005-000/AG-000, 1-1-8.

The programme also includes two specialist advisors, which are identified in Figure 2 along with the command relationship between the programme's airworthiness authorities.

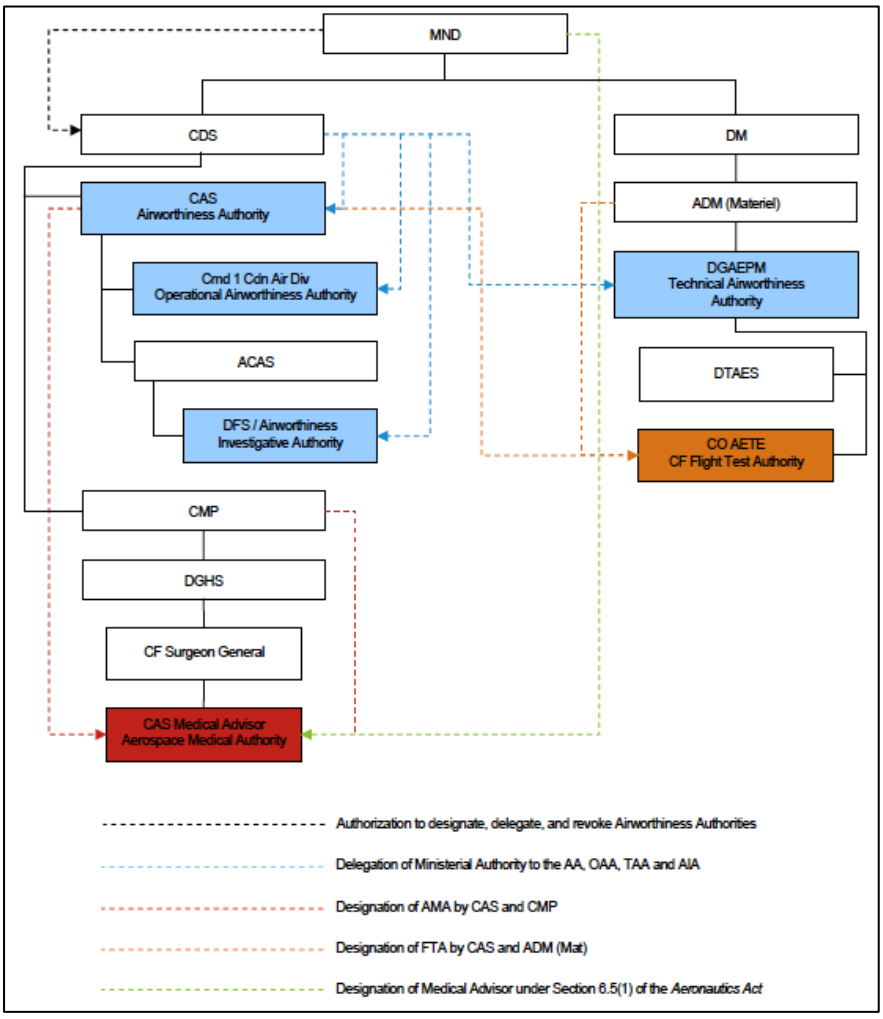

Figure 2: Command Relationship Between Airworthiness Authorities

Source : A-GA-005-000/AG-001, 1-3-6.

Aside from showing the complexity associated with the delegation and assignment of airworthiness authorities in the DND/CAF, Figure 2 also uncovers the difficult relationship that the programme's structure imposes on the control of military aviation resources in Canada. This relationship is further exacerbated by the fact that the DND/CAF Airworthiness Programme specifically excludes the power to:

> … control or expend departmental resources;
>
> … direct the actions of personnel within command and control structure of the DND/[CAF], unless the personnel are acting on behalf of one of the airworthiness authorities in a regulatory function;
>
> … specify the performance or configuration of equipment except for establishing an acceptable standard for aviation safety; and
>
> … control or direct the function associated with the normal operation of the DND/[CAF].[10]

This essay will demonstrate that the current implementation of the DND/CAF Airworthiness Programme is inefficient and causes ineffectual command of Canada's military aviation resources while failing to provide Government oversight of the department's compliance with the Aeronautics Act. The next section will use Pigeau and McCann's Competency – Authority – Responsibility (CAR) model to analyze the impact of the program on command effectiveness and will show that its current implementation is inefficient and causes ineffectual command. The following section will then discuss the lack of adequate oversight of the programme as a result of being joined with the CAF's Flight Safety program. A final section will propose a structural solution to these problems aimed at streamlining command and airworthiness relationships while capitalizing on existing auditing and investigative resources to increase Government oversight of DND/CAF's legislative compliance.

Command Effectiveness

After defining *command* as "the creative expression of human will necessary to accomplish the mission" and *control* as "those structures and processes devised by

[10] *Ibid*., 1-2-7.

command to enable it and to manage risk,"[11] Pigeau and McCann proceed with describing a command capability model that can be used to analyze command effectiveness. Under this model, effective command requires a balance between a commander's competency, acceptance of intrinsic and extrinsic responsibility, as well as legal and personal authority as shown pictorially in Figure 3. Thus, effective command is possible at all rank levels, provided that the commander's competency and authority levels are commensurate with the responsibility that he has accepted over the resources assigned to him as well as mission accomplishment. Consequently, an assessment of the effectiveness of any organizational structure – such as the one generated by the current implementation of the DND/CAF Airworthiness Programme – can be accomplished by examining the relationship between the authority and responsibility capabilities at any rank level.

While a complete CAR analysis of the DND/CAF Airworthiness Programme is beyond the scope of this essay, Pigeau and McCann's definitions of *ineffectual command* and *dangerous command,* derived from the relationship between authority and responsibility, are relevant to the current discussion. Found in situations where a commander lacks formal authority, ineffectual command renders a commander "powerless to properly accomplish the mission [while feeling] responsible for not having done so."[12] Similarly but at the other end of the spectrum, dangerous command is encountered when commanders are given authority for which they are not willing to accept responsibility, leading to the potential for abuses.

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[11] Ross Pigeau and Carol McCann, "Reconceptualizing Command and Control," *Canadian Military Journal* 3, no.1 (2002): 56

[12] *Ibid*., 60.

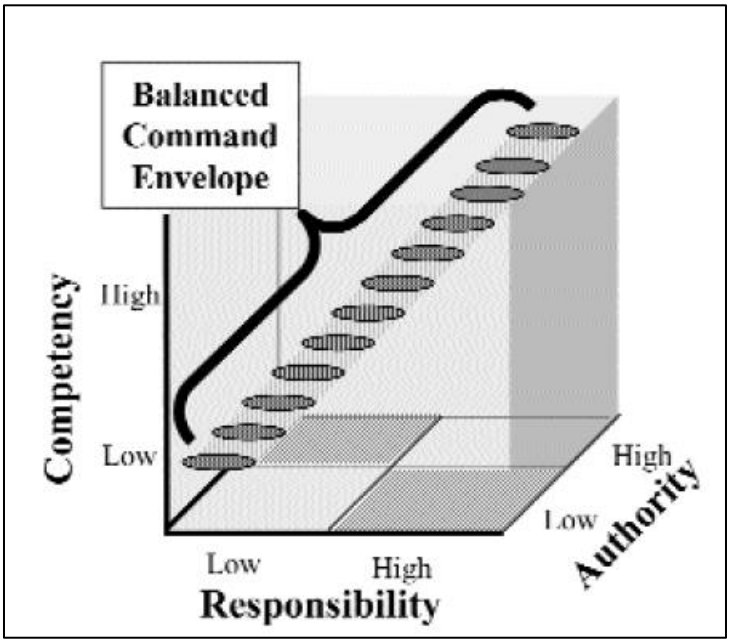

Figure 3: Pigeau and McCann's Balanced Command Envelope

Source: Pigeau and McCann, 60.

As described previously, the Aeronautics Act's regulatory responsibilities over military aviation activities have been divided between the TAA and the OAA, who are both accountable to the AA on airworthiness matters. In practice however, given that the OAA is subordinate to the AA while the TAA reports to the Deputy Minister through the Assistant Deputy Minister for Materiel, this regulatory division has the effect of breaking the military chain of command over aviation resources. The programme attempts to justify this breakage as a design characteristic aimed at enforcing an independent relationship between implementers – i.e. the military chain of command acting pursuant to the National Defence Act – and regulators – those individuals delegated specific airworthiness authorities pursuant to the Aeronautics Act.[13] Ignoring for the moment the

[13] Department of National Defence, C-05-005-001/AG-001, *Technical Airworthiness Manual (TAM)* (Ottawa: Chief of the Defence Staff, 2001): 1-1-1-5.

fact that, under the current implementation, the OAA normally commands most of DND/CAF's military aviation resources, it is worth noting that the independence requirement does not originate in the Aeronautics Act and is instead a by-product of the civilian regulatory framework whereby the regulator does not itself operate aeronautical products or facilities.[14] Furthermore, DND/CAF's self-regulation under the Aeronautics Act was designed to facilitate "the accomplishment of military missions or tasks assigned by the government"[15] by allowing military commander to determine "how best to apply the airworthiness rules and standards within the context and risks of the assigned mission requirements and the urgency of the situation."[16] As noted previously, command is enabled by one's control over the structures and processes. However, the decision to separate the control of technical airworthiness activities from the operational chain of command is preventing commanders at all levels from managing risks by balancing operational and technical airworthiness requirements in order to achieve military objectives.

Nowhere is this separation more impactful than on aircraft maintenance and logistic support activities for which the TAA has considerable responsibilities as shown in the following excerpt from the CDS's delegation of technical airworthiness authority:

> … issuing technical airworthiness instructions and standards that will result in the safe operation of military aeronautical products and that satisfy the aviation safety requirements of the Aeronautics Act;

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[14] It is worth noting that the Minister of Transport is responsible for the operations of several Crown Corporations who manage Canada's airports and the Department has permanent seats on Nav Canada's Board of Governors. In this context, the Minister of Transport acts as a regulator and implementer for civilian aviation in a similar manner as the MND for military aviation.

[15] C-05-005-001/AG-001, 1-1-1-5.

[16] *Ibid*.

> … assigning technical airworthiness responsibilities to *organizations and individuals involved in airworthiness-related design, manufacture, maintenance, materiel support* [emphasis added] of military aeronautical products and the performance of technical airworthiness functions;
>
> … ensuring that airworthiness-related activities and technical airworthiness functions are controlled and monitored through the *approval and audit of processes and procedures used in organizations that have been assigned technical airworthiness responsibilities*; [emphasis added]
>
> … ensuring that technical airworthiness-related activities are performed in compliance with established aeronautical regulations and orders, and technical airworthiness instructions and standards;
>
> … ensuring that only qualified and competent individuals are authorized to perform technical airworthiness-related activities and technical airworthiness functions;
>
> … ensuring that organizations that have been assigned technical airworthiness responsibilities employ the required facilities, equipment and qualified personnel to perform airworthiness-related activities and technical airworthiness functions;
>
> … ensuring that military aeronautical product design, manufacture, *maintenance and material support* [emphasis added] are in compliance with the applicable aeronautical regulations and orders and technical airworthiness rules and standards, and in conformity with the applicable aeronautical product approved type design; …[17]

The deliberate use of the verbs *ensuring*, *issuing*, and *assigning* places a control responsibility on the TAA over airworthiness activities conducted by personnel under the command of the OAA. Furthermore, considerable ambiguity was created by the duplication of oversight responsibilities between the OAA and the TAA, as can be seen in the following excerpt from the OAA's terms of accountability:

> … ensuring that *airworthiness-related activities* [emphasis added] and operational airworthiness functions are controlled and monitored through

[17] Chief of the Defence Staff, *Order: Technical Airworthiness Authority* (Ottawa: NDHQ, 20 December 2005).

> the approval and audit of processes and procedures used in organizations that have been assigned operational airworthiness responsibilities; …[18]

In practice, this has resulted in the duplication of regulations, standards, and audits for aircraft maintenance and logistic support activities. In order to satisfy its accreditation and oversight mandate, the TAA has put in place regulations documented in the Technical Airworthiness Manual (TAM)[19] and DGAEPM's Engineering Processes Manual (EPM)[20] and conducts accreditation and surveillance audits of units performing maintenance and logistic support functions for DND/CAF aircraft, even though these activities are actually performed by personnel and organizations under the command of the OAA. Similarly, to satisfy its airworthiness oversight responsibilities, the OAA has put in place its own set of maintenance policies[21,22,23,24,25,26,27,28,29,30] that amplify upon the TAM and are also audited on a regular basis. Using Pigeau and McCann's formulation for command and control, effective command is enabled by effective control over

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[18] Chief of the Defence Staff, *Order: Operational Airworthiness Authority* (Ottawa: NDHQ, 17 December 2013).

[19] C-05-005-001/AG-001.

[20] Department of National Defence, C-05-005-P-12/AM-001, *Engineering Process Manual (EPM)* (Ottawa: Chief of the Defence Staff, 2008).

[21] Department of National Defence, C-05-005-P02/AM-001, *Aerospace Engineering and Maintenance Program Management* (Ottawa: Chief of the Defence Staff, 2010).

[22] Department of National Defence, C-05-005-P03/AM-001, *CF Maintenance Activity Authorizations and Training Standards* (Ottawa: Chief of the Defence Staff, 2010).

[23] Department of National Defence, C-05-005-P04/AM-001, *Aircraft Maintenance Record Set* (Ottawa: Chief of the Defence Staff, 2011).

[24] Department of National Defence, C-05-005-P05/AM-001, *Verification of Maintenance* (Ottawa: Chief of the Defence Staff, 2010).

[25] Department of National Defence, C-05-005-P06/AM-001, *Maintenance Program Implementation – Servicing* (Ottawa: Chief of the Defence Staff, 2010).

[26] Department of National Defence, C-05-005-P07/AM-001, *Maintenance Program Implementation – Corrective Maintenance* (Ottawa: Chief of the Defence Staff, 2010).

[27] Department of National Defence, C-05-005-P08/AM-001, *Maintenance Program Implementation – Preventive Maintenance* (Ottawa: Chief of the Defence Staff, 2010).

[28] Department of National Defence, C-05-005-P09/AM-001, *Maintenance Program Implementation – Support Activities* (Ottawa: Chief of the Defence Staff, 2010).

[29] Department of National Defence, C-05-005-P10/AM-001, *General Aircraft Maintenance Safety* (Ottawa: Chief of the Defence Staff, 2010).

[30] Department of National Defence, C-05-005-P11/AM-001, *A Quality Standard for Aerospace Engineering and Maintenance (QSAEM) AF9000 Plus* (Ottawa: Chief of the Defence Staff, 2008).

structures and processes. This explains the need for the OAA, as commander of DND/CAF's aviation resources, to issue its own maintenance and logistic support instructions, standards, and policies and monitor compliance through regular audits of its subordinate formations and personnel. Consequently, the artificial duplication of regulatory functions between the TAA and the OAA, and the convoluted assignments of airworthiness authorities that it generated, resulted in an ambiguous oversight structure of aircraft maintenance and logistic support activities and an ineffectual command structure for personnel and organizations under the command of the Comd 1 CAD.

Beyond this partial CAR analysis, Okros stated that "the focus of command is on: … risk assessment[,] … directing and controlling multiple concurrent, interrelated activities[, and] … creating the conditions for subordinates to exercise discretion."[31] In this context, risks can take the form of operational threats (e.g. enemy actions, time constraints), technical issues (e.g. design flaws, manufacture defects, maintenance deficiencies), or logistical concerns (e.g. supply chain disruptions, financial limitations). The commander must therefore have the ability of balancing these risks and allow subordinate commanders to do the same. For obvious reasons, this is only possible with access and control of engineering, operational, and logistical advisors at all command levels. However, a side-effect of separating technical and operational airworthiness activities is that the vast majority of engineering and logistical staff is not under the control of the operational commander. Thus, despite the fact that airworthiness risk

[31] Alan Okros, *Leadership in the Canadian Military Context* (Kingston: Canadian Forces Leadership Institute, 2010): 9.

acceptance theoretically belongs to the operational command authority,[32] in practice this cannot be accomplished without resorting to resources that are under the command and control of the TAA and using processes put in place by the TAA, as shown in the following TAM excerpt:

> The [Record of Airworthiness Risk Management (RARM)] process shall be initiated … by individuals within a Technical Airworthiness Authority (TAA) Accredited Organization whenever it is perceived that there is the potential for a technical airworthiness related risk situation at a risk index greater than the Accepted Level of Safety. The Accepted Level of Safety is determined during the certification of a new aircraft type design and is formally defined in the approved Basis of Certification (BoC) for that type design.
>
> …
>
> An airworthiness risk management procedure acceptable to the TAA is provided in the Director General Aerospace Equipment Program Management (DGAEPM) AF9000 Plus Manual of Aerospace Procedures (MAP) (DG01.003). Each TAA-accredited technical organization shall adapt this procedure and tailor it tot heir organization structure, personnel and authorities.[33]

Government Oversight

While the separation of the technical and operational components of the airworthiness program is not a legal requirement for the program, the combined effect of the National Defence Act, the Federal Accountability Act, the Financial Administration Act, and the Aeronautics Act places very specific investigative and Government accountability requirements on the DND/CAF Airworthiness Programme. In particular, the Financial Administration Act holds the Deputy Minister (DM) accountable to Parliament for:

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[32] C-05-005-001/AG-001, 5-1-2-1.
[33] *Ibid*.

> …the measures taken to organize the resources of the department to deliver departmental programs in compliance with government policies and procedures;
>
> …the measures taken to maintain effective systems of internal control in the department;[34]

In the context of a self-regulated and self-investigated aviation safety program for the DND/CAF, this means that the DM is not only accountable to Parliament for the management of the department, but also for the department's compliance with the Government's aviation safety laws, policies, and regulations. There is no civilian equivalent to this requirement, since for civil aviation, the responsibility of regulating aviation safety rests with the Minister of Transport while the responsibility for investigating occurrences and aviation safety concerns belongs to the Director of Investigations (Air) of the Canadian Transportation Accident Investigation and Safety Board.[35] Whereas the civil aviation regulatory structure provides inherent independence, this feature must be specifically built into the military airworthiness program.

However, the DND/CAF Airworthiness Programme specifically shares the responsibility for aviation safety between the OAA, TAA, and AIA who are each charged with the duty to "[inform] the Minister of National Defence, through the Airworthiness Authority and Chief of the Defence Staff, of any significant airworthiness matters concerning military aviation" and who are each expected to "[take] immediate appropriate action if any circumstance, practice or procedure causes doubt as to the

[34] Financial Administration Act, R.S.C., c. F-11, s. 16.4 (1985).
[35] Canadian Transportation Accident Investigation and Safety Board Act, S.C., c. 3, s. 4.10 (1989).

airworthiness of a military aeronautical product."[36] Furthermore, the AIA is given the responsibility of "informing the Minister of National Defence, through the Airworthiness Authority and the Chief of Defence Staff, of any apparent, potential or real interference with the execution of the powers, duties or functions under this order.[37] Unfortunately, this delegation of authority completely ignores the DM from the accountability chain for airworthiness matters.

Additionally, the order assigning AIA to the Director of Flight Safety (DFS) includes the following responsibilities that add to the overall confusion regarding the relationship between the AIA, OAA, and TAA:

> … monitoring airworthiness activities and functions to ensure they comply with established regulations, standards and orders to identify any deficiencies in the Airworthiness Program for the Department of National Defence and the Canadian Forces, and reporting them to the Airworthiness Authority;
>
> … conducting audits of processes and procedures with a view to recommending preventive measures to correct deficiencies it identified in the Airworthiness Program for the Department of National Defence and the Canadian Forces or if aviation safety is suspected of being compromised.[38]

The AIA, despite being a direct subordinate to the AA, has therefore been given an overall program monitoring responsibility that one would expect to reside with the DM. Moreover, and more significantly, the AIA is given the responsibility to conduct airworthiness audits in addition to its Flight Safety (FS) responsibilities under the

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[36] Chief of the Defence Staff, *Order: Operational Airworthiness Authority* (Ottawa: NDHQ, 17 December 2013).

[37] Chief of the Defence Staff, *Order: Airworthiness Investigative Authority* (Ottawa: NDHQ, 28 July 2008).

[38] *Ibid*.

Canadian Forces Flight Safety Program. Oddly enough, this overlap of competing responsibilities is actually used as justification for assigning the AIA to the DFS.[39]

This approach's primary weakness is that the CAF's FS program is based on the *just culture* principle and cannot assign blame to personnel involved in occurrences. The program is also implemented by the chain of command and relies on every personnel involved with military aviation operations and support activities to self-report occurrences and risks.[40] Consequently, the integration of the AIA's auditing and monitoring responsibilities within the DFS creates a significant risk of diluting the just culture principle, which is a critical element of institutional continuous improvement for military aviation safety and mirrors the civil aviation legal investigation requirements.[41] Therefore, in practice, DFS has not been auditing the DND/CAF's Airworthiness Programme, relying instead on the OAA and TAA to fill this void with their own increasingly complex regulatory auditing programs within the chain of command and not linked to Government oversight requirements. It is also worth noting that, as was shown in Figure 2, the AIA (i.e. DFS) and the OAA (i.e. Comd 1 CAD) are both direct subordinates of the AA (i.e. C Air Force), which creates a command relationship that can hardly be described as *independence*. When coupled with the rank difference (i.e. DFS is normally a Colonel while Comd 1 CAD is normally a Major-General) between the positions, independence is dubious under most circumstances.

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[39] Department of National Defence, A-GA-135-001/AA-001, *Flight Safety for the Canadian Forces* (Ottawa: Director of Flight Safety, 2007): 1-4/9.

[40] *Ibid*., 1-5/9.

[41] Canadian Transportation Accident Investigation and Safety Board Act, S.C., c. 3, s. 31 (1989).

Finally, another weakness of selecting DFS as the AIA is the lost synergetic opportunity to capitalize on existing departmental resources to meet Government oversight requirements. Specifically, the Review Services (RS) organization in DND, which reports directly to the Deputy Minister (DM) and is designed to meet the Government's Financial Administration Act requirements, is already responsible for "[promoting] improvements in DND/CAF policies, programs, operations and activities…" as well as to monitor the department's compliance with governmental legislation.[42] Thus, placing auditing and monitoring responsibilities on the AIA, OAA, and TAA unnecessarily duplicated functions across the department, reducing efficiency without satisfactorily addressing Government oversight requirements, which is the reason for having audits.

The Next Step

While there may be countless ways of structuring an airworthiness program for the DND/CAF, Figure 4 depicts a structure that is aimed at addressing the command effectiveness, efficiency, and Government oversight shortcomings of the current DND/CAF Airworthiness Programme. This structure combines the OAA and TAA within the chain of command and maximizes the use of existing auditing and investigative resources in the department by relocating the AIA under the DM. In actuality, the integration of the OAA with the TAA would essentially discontinue both programs, which would have to be replaced by a comprehensive program comprised of all elements found in Figure 1. Finally, the Flight Test Authority is relocated from the

[42] Department of National Defence, "Assistant Deputy Minister (Review Services)," accessed 23 May 2015, http://www.crs-csex.forces.gc.ca/index-eng.aspx.

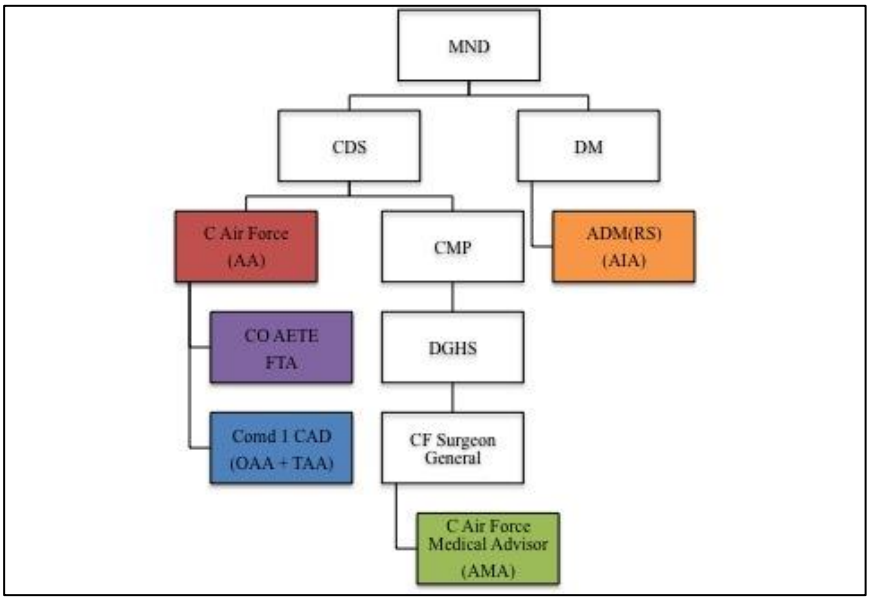

Figure 4: Proposed Airworthiness Framework and Command Relationship

Materiel Group to the C Air Force in recognition of the fact that flight-testing is an inherent part of airworthiness risk management and should therefore be regulated and controlled by the AA.

The foremost feature of this restructure is the combination of the OAA and the TAA, which is intended to provide Comd 1 CAD complete control over the supply chain, from acquisition to disposal of aeronautical products. This would not necessarily result in the elimination of DGAEPM, but would entail the movement of all Weapon System Management organizations to 1 CAD, including the Directorate of Technical Airworthiness and Engineering Support (DTAES). Project and contract management activities, especially important in this era of In-Service-Support Capability Framework for newer aerospace weapon systems, would continue to be performed by DGAEPM under the Materiel Group, but support requirements would be managed and controlled by the operational commander.

As noted previously, the assignment of investigative authority to ADM(RS) is intended to capitalize on existing investigative and auditing resources while facilitating Government oversight through the DM, outside the chain of command, and in line with legal requirements. This move would also eliminate any confusion between the FS and airworthiness programs.

Conclusion

Command cannot function in a vacuum. It must be supported and enabled by policies, procedures, and structures that allow a commander to control the assigned resources. Through the application of its four core principles, the DND/CAF Airworthiness Programme is currently designed to control the activities of personnel performing airworthiness functions on DND/CAF aeronautical products. However, the decision to arbitrarily separate operational and technical aspects of DND/CAF's airworthiness regulatory framework, and most importantly, the decision to assign TAA to an organization outside the operational chain of command, led to ineffectual command and ambiguous responsibility and accountability, especially as far as maintenance and logistic support activities are concerned. This arbitrary division of responsibilities was intended to ensure independence between implementers and regulators, a feature that is however not legally required. On the other end, investigative independence and Government oversight of DND/CAF's operations are legal requirements that the current airworthiness framework fails to adequately address, assigning investigative authority to a subordinate organization of the AA who cannot implement a thorough auditing process without compromising CAF's FS just culture, and ignoring the DM's Parliamentary

accountability obligations.

There are certainly many options available that can address these deficiencies. This paper presented one such option (see Figure 4) that ensures alignment of the airworthiness authorities within the chain of command. This is one of the simplest methods of addressing command effectiveness, Government oversight, and efficiency issues while also providing a structure that can be scaled for use on domestic and expeditionary operations.

Ten years after its roll out, the DND/CAF's Airworthiness Programme has significantly strengthened the department's airworthiness processes and created thorough risk management and continuing airworthiness tools. It is now time for its next evolution so that it can enable the effective command of Canada's military aviation resources.

BIBLIOGRAPHY

Canada. Department of National Defence. "Assistant Deputy Minister (Review Services)." Accessed 23 May 2015. http://www.crs-csex.forces.gc.ca/index-eng.aspx.

Canada. Department of National Defence. A-GA-005-000/AG-001, *Department of National Defence/Canadian Forces Airworthiness Programme*. Ottawa: Chief of the Defence Staff, 2011.

Canada. Department of National Defence. A-GA-135-001/AA-001, *Flight Safety for the Canadian Forces*. Ottawa: Chief of the Defence Staff, 2013.

Canada. Department of National Defence. B-GA-104-000/FP-001, *Operational Airworthiness Manual (OAM)*. Winnipeg: 1 Canadian Air Division, 2013.

Canada. Department of National Defence. C-05-005-001/AG-001, *Technical Airworthiness Manual (TAM)*. Ottawa: Chief of the Defence Staff, 2012.

Canada. Department of National Defence. C-05-005-P02/AM-001, *Aerospace Engineering and Maintenance Program Management*. Ottawa: Chief of the Defence Staff, 2010.

Canada. Department of National Defence. C-05-005-P03/AM-001, *CF Maintenance Activity Authorizations and Training Standards*. Ottawa: Chief of the Defence Staff, 2010.

Canada. Department of National Defence. C-05-005-P04/AM-001, *Aircraft Maintenance Record Set*. Ottawa: Chief of the Defence Staff, 2011.

Canada. Department of National Defence. C-05-005-P05/AM-001, *Verification of Maintenance*. Ottawa: Chief of the Defence Staff, 2010.

Canada. Department of National Defence. C-05-005-P06/AM-001, *Maintenance Program Implementation – Servicing*. Ottawa: Chief of the Defence Staff, 2010.

Canada. Department of National Defence. C-05-005-P07/AM-001, *Maintenance Program Implementation – Corrective Maintenance*. Ottawa: Chief of the Defence Staff, 2010.

Canada. Department of National Defence. C-05-005-P08/AM-001, *Maintenance Program Implementation – Preventive Maintenance*. Ottawa: Chief of the Defence Staff, 2010.

Canada. Department of National Defence. C-05-005-P09/AM-001, *Maintenance Program Implemenation – Support Activities*. Ottawa: Chief of the Defence Staff, 2010.

Canada. Department of National Defence. C-05-005-P10/AM-001, *General Aircraft Maintenance Safety*. Ottawa: Chief of the Defence Staff, 2010.

Canada. Department of National Defence. C-05-005-P11/AM-001, *A Quality Standard for Aerospace Engineering and Maintenance (QSAEM) AF9000 Plus*. Ottawa: Chief of the Defence Staff, 2008.

Canada. Department of National Defence. C-05-005-P12/AM-001, *Engineering Process Manual (EPM)*. Ottawa: Chief of the Defence Staff, 2008.

Canada. Department of National Defence. *Chief of the Defence Staff Order: Airworthiness Authority*. Ottawa: National Defence Headquarters, 28 July 2008.

Canada. Department of National Defence. *Chief of the Defence Staff Order: Airworthiness Investigative Authority*. Ottawa: National Defence Headquarters, 28 July 2008.

Canada. Department of National Defence. *Chief of the Defence Staff Order: Operational Airworthiness Authority*. Ottawa: National Defence Headquarters, 17 December 2013.

Canada. Department of National Defence. *Chief of the Defence Staff Order: Technical Airworthiness Authority*. Ottawa: National Defence Headquarters, 20 December 2005.

Lagassé, Philippe. "Accountability for National Defence: Ministerial Responsibility, Military Command and Parliamentary Oversight." *IRPP Study*, no.4 (Mar 2010).

Okros, Alan. *Leadership in the Canadian Military Context*. Kingston: Canadian Forces Leadership Institute, 2010.

Pigeau, Ross, and Carol McCann. "Reconceptualizing Command and Control." *Canadian Military Journal 3*, no.1 (2002): 53-63.