

Dual Inspection Training Material

Canadian Aviation Regulations - Regulation 571.10 / 571.11

Maintenance Release

- **571.10 (1)** No person shall sign a maintenance release required pursuant to section 605.85 or permit anyone whom the person supervises to sign a maintenance release, unless the standards of airworthiness applicable to the maintenance performed and stated in Chapter 571 of the *Airworthiness Manual* have been complied with and the maintenance release meets the applicable requirements specified in section 571.10 of the *Airworthiness Manual*.
- **(2)** Except as provided in subsection (4), a maintenance release shall include the following, or a similarly worded, statement:
 - “The described maintenance has been performed in accordance with the applicable airworthiness requirements.”
- **(3)** No maintenance release is required in respect of any task designated as elementary work in the *Aircraft Equipment and Maintenance Standards* that is performed by
 - **(a)** in the case of a glider, a balloon or an unpressurized small aircraft that is powered by a piston engine and not operated pursuant to Part IV or VII, the pilot of the aircraft;
 - **(b)** in the case of an aircraft operated under Part IV or VII, a person who has been trained and authorized in accordance with the flight training unit's or the air operator's maintenance control manual (MCM), approved under Subpart 6 of Part IV or of Part VII, respectively; or
 - **(c)** in the case of an aircraft operated pursuant to Subpart 4 of Part VI, a person who has been trained in accordance with those sections of a private operator's operations manual that contain details of the operator's maintenance control system.
- **(4)** Where a person signs a maintenance release in respect of maintenance performed on an aircraft, the satisfactory completion of which cannot be verified by inspection or testing of the aircraft on the ground, the maintenance release shall be made conditional on the satisfactory completion of a test flight carried out pursuant to subsections 605.85(2) and (3), by the inclusion of the phrase “subject to satisfactory test flight”.
- **(5)** No person shall sign a maintenance release in respect of specialized maintenance unless the requirements of section 571.04 have been met.

- SOR/2000-404, s. 8;
- SOR/2003-154, s. 6(F).

Persons Who May Sign a Maintenance Release

- **571.11 (1)** Except as provided in subsections (2) and (7), no person other than the holder of an aircraft maintenance engineer (AME) licence issued under Part IV, specifying a rating appropriate to the aeronautical product being maintained, shall sign a maintenance release as required by section 571.10.
- **(2)** A person other than a person described in subsection (1) may sign a maintenance release if
 - **(a)** in the case of maintenance performed outside Canada,

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- **(i)** the person is authorized to sign under the laws of a state that is party to an agreement or a technical arrangement with Canada and the agreement or technical arrangement provides for such certification, or
 - **(ii)** if no agreement or technical arrangement provides for such certification, the person holds qualifications that the Minister determines to be equivalent to those of a person described in subsection (1);
 - **(b)** in the case of maintenance performed on an aircraft that is operated under a special certificate of airworthiness in the amateur-built classification, the person is an owner of the aircraft;
 - **(c)** in the case of maintenance performed on a part that is intended for installation on an aircraft, the person has been authorized to sign by the holder of an approved maintenance organization (AMO) certificate issued under section 573.02; and
 - **(d)** in the case of maintenance performed on an aircraft that is operated under a special certificate of airworthiness in the owner-maintenance classification, the person is a licensed pilot and an owner of the aircraft.
- **(3)** Except as provided in subsection (7), no person shall sign a maintenance release in respect of maintenance performed on an aircraft operated under Part IV or VII, or on parts intended to be installed on the aircraft, unless
 - **(a)** the person is authorized to sign in accordance with a maintenance policy manual (MPM) established by the holder of an AMO certificate issued under section 573.02 with a rating of a category appropriate to the work performed; or
 - **(b)** if the maintenance is performed outside Canada, the person is authorized to sign in accordance with a foreign document equivalent to an MPM, established by a maintenance organization approved under the laws of a state that is party to an agreement or technical arrangement with Canada and the agreement or technical arrangement provides for such certification.
 - **(4)** Except as provided in subsection (5), no person shall sign a maintenance release in respect of maintenance performed on a transport category aeroplane or a turbine-powered helicopter, unless the person
 - **(a)** has successfully completed a course of maintenance training that has been approved by the Minister and that is applicable to the type of aircraft, engine or system on which the maintenance is performed, in accordance with Appendix M of Chapter 571 of the *Airworthiness Manual*; or
 - **(b)** held a type rating applicable to the type of aircraft, engine or system on which the maintenance is performed, issued by the Minister before August 1, 1999.
 - **(5)** The holder of an applicable AME licence may sign a maintenance release in respect of maintenance performed on a transport category aeroplane or a turbine-powered helicopter that consists of any of the types of work set out in Schedule III without having successfully completed the course required by paragraph (4)(a) and without having held the type rating required by paragraph (4)(b).
 - **(6)** If a maintenance release is signed by a person in respect of work performed by another person, the person signing the maintenance release must personally observe the work to the extent necessary to ensure that it is performed in accordance with the requirements of any applicable standards of airworthiness and, specifically, the requirements of sections 571.02 and 571.10.

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- **(7)** A person who is not the holder of an AME licence specifying a rating appropriate to the aeronautical product being maintained may sign a maintenance release if the person holds a restricted certification authority issued in accordance with subsection (8), in respect of a particular case specified on the restricted certification authority.
- **(8)** The Minister shall issue a restricted certification authority and specify therein its validity period and the scope of the work that may be performed, if
 - **(a)** an application is made in accordance with section 571.11 of the *Airworthiness Manual*;
 - **(b)** the applicant demonstrates to the Minister that there is no holder of an AME licence specifying a rating appropriate to the aeronautical product being maintained available within a geographical area accessible within one hour by surface transportation;
 - **(c)** the person to whom the restricted certification authority is to be issued has received the training and has the knowledge equivalent to that of a holder of an AME licence specifying a rating appropriate to the aeronautical product being maintained; and
 - **(d)** the level of aviation safety is not affected by the issuance of the restricted certification authority.
- SOR/2000-404, s. 9;
- SOR/2002-112, s.11.

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Canadian Aviation Regulations - Standard 571.10 / 571.11

571.10 Maintenance Release

Information Note:

Pursuant to section 605.85 of the CARs, where an aircraft has undergone maintenance, a maintenance release with respect to maintenance performed shall be completed prior to take off in the affected aircraft. It is a declaration that, with respect to the maintenance performed, the performance rules of section 571.02 of the CARs have been complied with and the applicable standards of airworthiness have been met.

(amended 2002/03/01)

(1) For the purpose of this section the following definitions apply:

“under the person’s supervision” – refers to the person who, by way of the organisation chart or assignment of responsibilities in an approved manual, exercises supervisory authority over a person making a maintenance release.

(amended 2007/12/30)

“similarly worded statement” - means any statement that can be interpreted as conveying the meaning of the maintenance release statement of subsection 571.10(2) of the CARs. This statement may be omitted when the Technical Record, established pursuant to section 605.92 of the CARs, clearly indicates that a signature in a specified signature block constitutes a maintenance release.

(amended 2007/12/30)

Information Note: *For example, a FAR 43.9 approval for return to service issued in compliance to an agreement between Canada and the USA constitutes a similarly worded statement and has the same meaning as a maintenance release.*

(amended 2007/12/30)

(2) Maintenance Release Record Keeping

(a) A maintenance release applies only to the particular maintenance task or tasks to which it relates. Therefore:

(i) it is acceptable to sign a maintenance release in respect of a single task or group of tasks, even if other work is outstanding on the aircraft, provided that the wording of the entry leaves no doubt as to the scope of work being certified; and

(ii) it is the responsibility of the person signing a maintenance release to ensure that the technical record is correct in respect of the status of any outstanding task.

(b) Each maintenance release must include the following information:

(i) product identification (aircraft registration marking, nomenclature, type/model number, name of manufacturer, part number, and serial number), unless the release is being made in an established Technical Record that contains this information;

(ii) a brief description of the work performed, including applicable reference data, when the reference data is not included in the maintenance publications of the manufacturer, and the work order number; and

(iii) where a part that has been accepted pursuant to [Appendix H](#) of this standard, a statement included in the certification documents, providing as follows:

(amended 2002/03/01)

“This part has been determined to conform to the approved type design, or to be acceptable under section 571.13 of the CARs”.

(c) The maintenance release shall contain a statement indicating when an airworthy part was removed from an aircraft.

(amended 2007/12/30)

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(d) Where a maintenance release is made using an "Authorized Release Certificate" (Form One), [Appendix J](#) would normally apply. (amended 2008/12/30).

Information Note:

[Appendix J](#) to this standard contains information to complete Form One, respecting certification of new and used aeronautical products, other than complete aircraft. (amended 2008/12/30)

(e) Where a maintenance release is made under the authority of an AMO it must include the identification of both the signatory and the AMO. Identification of the signatory may be either by AME licence number, or by other means that clearly identifies the signatory within that organisation.

(f) Where a maintenance release is made by a person holding a restricted certification authority (RCA) issued pursuant to section 571.11 of the CARs, the number of that authority must be entered. (amended 2000/12/01)

(3) Responsibility for compliance with airworthiness directives (ADs) is assigned to the owner of the aircraft in accordance with section 605.84 of the CARs.

Information Notes:

(i) Some inspection check sheets contain a check box with a statement to the effect that "...all applicable ADs have been complied with". Such a statement transfers this responsibility to the AME signing the maintenance release for the inspection, even though it may be impractical for the AME to undertake the level of research required. Since compliance with ADs are the responsibility of the owner, AMEs should strike out this item on the inspection check sheets that they sign.

(ii) If the owner wishes to have this research undertaken by the AME as a separate maintenance task, it can be raised as a separate item on the work order, work card, or other document detailing the maintenance arrangement.

(4) Notwithstanding the requirement to comply with the Performance Rules in accordance with section 571.02 of the CARs, the following additional standards of airworthiness, developed in conformity with section 571.10 of the CARs, apply with respect to the types of work indicated in the following table of Types of Work:

(amended 2010/12/01)

Types of Work

571.11 Persons Who May Sign a Maintenance Release

Information Notes:

(i) Section 571.11 of the CARs authorises the holder of an Aircraft Maintenance Engineer (AME) licence with a rating appropriate to the product being maintained to sign any maintenance release.

(ii) To establish what is an appropriate rating, consult [Standard 566](#).

(1) Maintenance performed in a State that is a party to an agreement with Canada, shall be certified by either the holder of a Canadian AME licence, a person who has been authorised under the laws of that State, or a person whose knowledge is determined to be equivalent to the holder of an AME licence pursuant to Subpart 403 of the CARs, as described in subsection (2). Where that work is performed by a foreign maintenance organisation, the maintenance release must be signed by persons qualified pursuant to the local regulations and authorised by the foreign maintenance organisation.

Information Notes:

(i) In order to determine if a state is a party to an agreement with Canada, and to establish whether an agreement applies in a particular case, consult the following internet site:

<http://www.tc.gc.ca/eng/civilaviation/certification/menu.htm>

(ii) In addition to providing information concerning aircraft maintenance, some of these agreements also have territorial restrictions. For example, the *Bilateral Airworthiness Agreement between Canada*

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and the U.S., is only applicable to work performed in the United States, including Alaska, Hawaii, and Puerto Rico. Under the terms of the bilateral agreement, use of FAA Part 145 "foreign" Repair Stations located elsewhere is not authorised.

(2) For the purpose of executing a maintenance release on Canadian aircraft, bilateral agreements between Canada and another State only have effect within the territory of that State except where:

(a) the agreement specifically provides for such work;

(b) the person certifying the work is working for an organisation that is under the jurisdiction of the state with whom Canada has entered into the agreement; and,

(c) the work is not taking place within the boundaries of another State with whom Canada has entered into an arrangement.

(3) Application for a restricted certification authority (RCA) is to be made through the local Transport Canada Center (TCC).

(amended 2000/12/01)

Information Note:

The local TCC is the one having jurisdiction over the geographical area within which the applicant's approved organization is situated.

(amended 2000/12/01)

(4) On receipt of the application from the responsible TCC, and where the conditions set out in section 571.11 of the CARs have been met, the RCA shall be issued. The RCA shall include the validity period and the scope of work for which it is issued.

(amended 2000/12/01)

Information Note:

Unwillingness on the part of an RCA applicant to pay the remuneration requested by a suitably rated AME who is willing to certify the maintenance, does not constitute valid justification to grant an RCA. The fact that an AMO does not have a suitably endorsed AME on staff is not sufficient justification for issuance of an RCA, if a qualified AME is available in the area.

(amended 2000/12/01)

(5) For the purposes of these standards, the Minister has determined that, in respect of the certification of parts, persons authorised by members of the International Airlines Technical Pool have an equivalent knowledge to that of an AME licensed pursuant to Subpart 403 of the CARs.

Canadian Aviation Regulations - Standard 571.10 TYPES of WORK

Types of Work

(amended 2010/12/30;)

(refer to [section 571.10](#) of the standard)

Types Of Work	Applicable Standards Of Airworthiness
(a) Work for which a personal qualification or training standard has been established.	That the work has been performed by a person who holds the personal qualifications or training standards, required by subsection 571.02(3) of the CARs.
(b) Specialized Maintenance	That the work was performed under the control of an organisation approved for the applicable category pursuant to section 571.04 of the CARs. (amended 2002/09/01)
(c) Nondestructive Testing (NDT) Information Note: <i>Where NDT has been performed, but where the inspection findings have not yet been assessed against the published limits, a maintenance release shall not be signed in respect to the NDT requirement. Hence, a maintenance release is only required where disassembly and</i>	That the inspection findings have been analysed and any defect or discontinuity noted in the inspection findings, supplied by the person performing the NDT, is within the manufacturer's published limits for that aeronautical product.

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Types Of Work	Applicable Standards Of Airworthiness
<p><i>reassembly were involved to provide the access necessary for the inspection.</i></p>	
<p>(d) Work that disturbs engine or flight controls</p>	<p>That the system has been inspected for correct assembly and correct locking of any parts disturbed by the maintenance performed, including an operational check for proper sense and range of motion of the engine or flight controls has been accomplished, by at least two persons, and the technical record contains the signatures of both persons. (amended 2010/12/30)</p> <p>Information Note:</p> <p><i>One of the signatures required by this section may be that of the person who has signed the maintenance release.</i></p>
<p>(e) Functional, Operational or other Ground Test (i.e. Where specified in the quality procedures of the organization performing the work, or where the person signing the maintenance release determines that a functional, operational, or other ground test is required to verify</p>	<p>A test shall be performed prior to signing a maintenance release or conditional maintenance release, demonstrating that the aeronautical product is functioning in accordance with the applicable design standards.</p>

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Types Of Work	Applicable Standards Of Airworthiness
satisfactory completion of the work).	
<p>(f) Test Flights & Conditional Maintenance Releases (i.e. Where specified in the quality procedures of the organisation performing the work, or where the person signing the maintenance release determines that a test flight is required to verify the system operation).</p> <p>Information Note:</p> <p><i>Conditional Maintenance Releases are not to be used in those instances where maintenance personnel require additional information as to system operation or other operational characteristics (e.g. report on the range of a navigational system, cabin temperature control, etc.)</i></p>	<ol style="list-style-type: none"> 1. (i) That all applicable ground testing has been satisfactorily completed; and, 2. (ii) That the Journey Log provides details which describe the verification test required by the pilot, including any specific test requirements. <p>Information Note:</p> <p><i>Subsection 605.85(3) of the CARs addresses the pilot's requirements for log entries following a test flight.</i></p>
<p>(g) Maintenance performed with respect to an Airworthiness Directive (AD).</p>	<ol style="list-style-type: none"> 1. That the record made with respect to the AD includes: <ul style="list-style-type: none"> (i) the identification code or number used by the issuing authority for that AD

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Types Of Work	Applicable Standards Of Airworthiness
	<p>(where an organisation uses internal document bearing an alternative identification code or a number to control the compliance with the requirements of an AD, that number must also be shown in the maintenance release);</p> <ol style="list-style-type: none"> 2. (ii) where the AD specifies alternative requirements, the identification of the alternative used; 3. (iii) where the AD is a multi-part AD, the identification of the parts of the directive that have been complied with; and, 4. (iv) where an AD requires an inspection, the findings resulting from that inspection have been noted in the technical record.
(h) Weight & Balance (W&B):	<ol style="list-style-type: none"> 1. (i) The revised empty weight and

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Types Of Work	Applicable Standards Of Airworthiness
<p>(i) Change to empty weight or centre of gravity (C of G) position, including lateral C of G where limitations are published;</p> <p>(ii) W&B Report.</p>	<p>C of G position shall be calculated, and the weight & balance report, established pursuant to section 605.92 of the CARs shall be reissued or amended.</p> <p>2. (ii) The report meets the standards established in conformity with section 571.10 of the CARs and contained in Appendix C.</p>
<p>(i) Opening & Closing Pressure Systems (positive or negative pressure), other than opening by means of</p> <ul style="list-style-type: none"> - a quick-disconnect, - a self-sealing drain valve; - an oil or fuel fill/servicing cap 	<p>1. (i) The pressure system is tested, inspected, and found to be properly connected and within leakage tolerances specified in the regulations, standards, or the aeronautical product manufacturer's specifications, as applicable; and,</p> <p>2. (ii) Where the work is performed on an altimeter or pitot-static system, the leak</p>

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Types Of Work	Applicable Standards Of Airworthiness
	<p>check outlined in Appendix B shall be complied with in conformity with section 571.10 of the CARs.</p> <p>Information Note:</p> <p><i>In the case of the pitot-static system, only a leak check is required at this time. The full calibration cycle tabled in Appendix B is only required at the 2 year interval tabled in the Aircraft Equipment and Maintenance Standards (625).</i></p>
(j) Work affecting performance of a Magnetic Direction Indicator (MDI), including installation of a replacement indicator.	The MDI shall be calibrated and, in the case of non-stabilised direction magnetic compasses, a new correction card installed.
(k) Propeller Inspection	The standards of airworthiness specified in Appendix D shall be complied with in accordance with section 571.10 of the CARs.
(l) Wooden Component Inspection (excluding wooden propeller)	The standards of airworthiness specified in Appendix E shall be complied with in accordance with section 571.10 of the CARs.
(m) Work affecting	The standards of

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Types Of Work	Applicable Standards Of Airworthiness
performance of Transponder or Altitude Reporting Systems	airworthiness specified in Appendix F shall be complied with in accordance with section 571.10 of the CARs.
<i>(n)</i> Work affecting performance of Emergency Locator Transmitter (ELT)	The standards of airworthiness specified in Appendix G shall be complied with in accordance with section 571.10 of the CARs.
<i>(o)</i> Cockpit Voice Recorder (CVR) & Underwater Locator Device (ULD) Maintenance	The standards of airworthiness as specified in Standard 625 Appendix C. (amended 2007/12/30)
<i>(p)</i> Flight Data Recorder (FDR) & Underwater Locator Device (ULD) Maintenance	The standards of airworthiness as specified in Standard 625 Appendix C. (amended 2007/12/30)
<i>(q)</i> Recurring Defect Rectification	The person signing the Maintenance Release has reviewed the methodology used in previous repair attempts, to determine if the current rectification methodology is appropriate.
<i>(r)</i> Cycles, landings or hours since new of a life-limited part.	The cycles, landings or hours recorded on the maintenance release represent the total accumulated cycles, landings or hours since the time of manufacture of the part.

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Types Of Work	Applicable Standards Of Airworthiness
(s) Cockpit Voice Recorder intelligibility check.	<p>A test procedure shall be established which, when completed under operational conditions, will enable verification of intelligible recorded audio information from all the various input sources required by the regulations:</p> <ol style="list-style-type: none"> 1. (i) at intervals specified in the applicable maintenance standards; or, 2. (ii) upon initial installation. <p>Information Notes:</p> <ol style="list-style-type: none"> 1. i) <i>Care must be exercised when determining running hours. Some systems are such that the CVR is on at any time power is applied to the aircraft; in this case the factor identified in the manufacturer's specifications shall be applied to determine the running time. As an example, one CVR manufacturer recommended a factor of 1.7 times flight hours.</i>

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Types Of Work	Applicable Standards Of Airworthiness
	<p style="text-align: center;"><i>Where no factor is provided, each installation will have to be evaluated individually paying due regard to such details as running time meters, etc.</i></p> <p>2. (ii) <i>The escalation of the maintenance times is permitted when proposed as an amendment to an air operator's maintenance schedule and when substantiated with reliability statistics.</i></p>
<p>(t) Work affecting static ports, pitot tubes and flight control surfaces. (amended 1998/06/01)</p>	<p>That the work has been performed and inspected to ensure:</p> <ul style="list-style-type: none"> - critical sensors such as static ports or pitot tubes, which may affect aircraft flight characteristics, are not blocked; - movement of flight control surfaces is not impeded. <p>(amended 1998/06/01)</p> <p>Any installation of control locks, gear pins, static port covers and pitot tube covers are to be</p>

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Types Of Work	Applicable Standards Of Airworthiness
	<p>marked, or identified, by a high visibility colour, and that warning flag has been securely attached. (amended 1998/06/01)</p>
<p>(u) Certification of undocumented parts. (amended 2002/03/01)</p>	<p>That the work has been performed under the control of an approved maintenance organization holding a certificate that specifies the applicable category for which pertinent ratings have been issued, indicated in section 573.02 of Standard 573, in accordance with the process outlined in Appendix H of this standard. (amended 2002/03/01)</p>
<p>(v) Liquid penetrant inspection. (amended 2002/09/01)</p>	<p>ASTM E 1417 - <i>Standard Practice for Liquid Penetrant Examination</i>. (amended 2002/09/01)</p>
<p>(w) Hydrostatic testing of pressure vessels. (amended 2002/09/01)</p>	<p>National Standards of Canada: CAN/CSA B339-96; and CAN/CSA B340-97 Testing to be performed in accordance with the Canadian Standards listed herein by a Canadian organization approved under the <i>Transportation of Dangerous Goods - Regulations</i>. (amended 2002/09/01)</p>

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Aviation Safety Letter TP 185e 1-2007 - Transport Canada

Independent Check of Flight Controls

by Steve MacNab, Regional Manager, Aircraft Maintenance and Manufacturing, Prairie and Northern Region, Transport Canada

During recent oversight activities involving aircraft operators and aircraft maintenance organizations (AMO), it was noted that there has been an increase in findings pertaining to independent checks of flight and engine controls. The records reviewed show an inconsistency in performing checks, as well as errors in documenting activity.

All of us should note several things:

The maintenance release cannot be signed until after any required independent check has been completed and the technical record contains the signature of both persons who conducted the independent check. The regulatory chain is clear on this:

- *Canadian Aviation Regulation* (CAR) 571.10(1) requires that all requirements specified in section 571.10 of the *Airworthiness Manual* be met before the maintenance release is signed.
- Subsection 571.10(4) of the CARs Standard, item "d" of the "Types of Work" table, requires an independent check and completion of the technical record with both signatures.
- Every technical dispatch system should ensure that flight crews know if maintenance has been done, and if it has, a reasonable outline of what maintenance was done. The journey logbook is the most common source of maintenance information to flight crew. However sophisticated the technical dispatch system, the logbook makes information available to flight crew if they are to satisfy the regulatory requirements.
- The flight crew has an obligation to make note of the maintenance done, just like they have an obligation to make note of deferred defects. An understanding of what was done, and an awareness of control systems, either directly affected or potentially affected by the access and egress involved in the maintenance, will assist the flight crew if there are unexpected observations during subsequent flight segments. This obligation is imposed by good airmanship, if by nothing else.
- The meaning of "potentially affected" is subtle, but significant. Maintainers generally recognize the need for an independent check when they disturb a control. But if disturbing the control system was not the object of the maintenance task, the fact that it was disturbed may be forgotten and a proper independent check not done. Examples include installation of rigging pins, control locks or clamps, to facilitate work. Wire bundles and flexible lines could be pushed into controls (to provide access for a task), but not returned to a proper configuration when the aircraft is closed up at the end of the job. Tools or material could also be left behind.
- If control system involvement was either necessary to the maintenance, or possible while gaining access or closing up, flight crew should be especially vigilant in verifying satisfactory control functions.
- Complacency is the enemy; it is easy to assume that modern aircraft are so reliable that the next flight segments will be uneventful...

Consequently, this is a reminder to aircraft maintenance personnel to continue to emphasize the importance of good technical records, independent checks and maintenance releases; and for pilots to review recent maintenance, deferred defects and minimum equipment list (MEL) items, as a routine part of pre-flight preparation. Someone, some day, will be glad they did.

Spring Review-Best to Avoid Misrigged Flight Controls!

As the spring and summer flying seasons will soon be upon us, annual inspections, float changeovers and commercial aircraft maintenance will be carried out at many airports and seaplane facilities. After maintenance, an aircraft may require a test flight to ensure the system or systems are performing to

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the required specifications. Hopefully, the pressure of a test flight combined with the rustiness of seasonal pilots does not force them to become test pilots going beyond their competency.

Aircraft maintenance engineers (AME), or the persons performing maintenance on those aircraft to be test flown, must take the time to ensure entries into technical records and logbooks are written in a clear and concise manner. Prior to the test flight, AMEs should make every effort to review the work completed on the subject aircraft with the pilot.

The pilot who will test fly the aircraft must also decide whether they are qualified and competent for the task at hand. If any doubt exists as to the pilot's qualifications or currency, a different pilot with the proper experience should perform the flight. The pilot must be briefed thoroughly on the extent of the work done on the aircraft.

This is important not only for private pilots and AMEs who perform work outside an approved maintenance organization (AMO), but also for commercial pilots and AMEs who work within an AMO. Several accidents and incidents have taken place over the past few years. These were the result of inadequate pre-flight inspections after maintenance was carried out. At the time the inspections were carried out, it seemed that everything was done to the best of the maintenance and flight personnel's abilities. However, by looking back on these accidents and seeing where and what errors were made, we are able to incorporate some suggestions into our own pre-flight inspection methods-both with regards to maintenance and flying.

The following occurrences involved misrigged flight controls and are documented on the Transportation Safety Board of Canada (TSB) Web site at <http://www.tsb.gc.ca/>: a Convair 340/580, TSB report number A97O0077, at Hamilton, Ont.; a Cessna 172, TSB report number A00Q0043, at Maniwaki, Que.; and a Piper Cherokee, TSB report number A01Q0009, at Mascouche, Que. Misrigged flight controls occurrences are not uncommon, and unfortunately, odds are that they will happen again.



What's wrong with this picture?

Would you want to see this during your run-up?

Transport Canada issued *Airworthiness Notice No. C010, Edition 2*, dated 10 October 2001, entitled "Inspection of Control Systems," which explains the regulations applicable to the maintenance of engine and flight controls, and outlines the applicable standards for control systems maintenance. (see Notice at <http://www.tc.gc.ca/eng/civilaviation/standards/maintenance-aarpc-ans-c010-557.htm>). The document emphasizes the requirement that the person performing the dual inspection be independent of the original work and that the inspection include a verification of the range of operation of the control system.

In *Aviation Safety Maintainer* 4/1997, the article "Exploring the Problem of Misconnected Controls" used the circumstances of a DHC-2 Beaver occurrence to raise the question of why so many people might miss such an important item as the integrity of flight controls. The article concluded by urging the reader to develop a methodology that uses all available tools to avoid lapses that might result in misrigged controls.

Here are some examples of what AMEs and pilots can do to manage some risks:

- be uncompromising in ensuring correct logbook entries and signatures;

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- perform thorough visual inspections;
- follow all of the manufacturer's recommended procedures to the letter;
- establish and review emergency procedures **before** getting in the air.

Flying, just as driving a car, is an activity that involves distinct risks. From the time the aircraft is prepared for a flight, to the time the pilot walks away after the flight- risk control (or risk **management**) must always be our top priority.

Airworthiness Notice AN C010 Edition 2 (10 October 2001) Transport Canada

Inspection of Control Systems

(This Airworthiness Notice supersedes AN No. C010 Edition 1 dated 10 October 1997)

Purpose

Despite widespread educational efforts and the introduction of special inspection requirements, incidents of faulty control rigging continue to occur. In an effort to eliminate such occurrences, this notice is issued to explain the regulations applicable to the maintenance of engine and flight controls and to outline the applicable standards for control system maintenance. The current revision of the notice is in response to incidents that occurred since the original notice was published. The information in this notice may in future be incorporated into Standard 571 of the *Canadian Aviation Regulations* (CARs), at which time the notice will be withdrawn. For the purposes of this notice "flight and engine controls" includes all controls by which the propulsive force or flight path of an aircraft can be altered, and includes both primary and secondary controls.

Background and Principles

In Canada, the maintenance of engine and flying controls has traditionally been treated differently to other maintenance activities. The specific requirements have undergone several changes in recent years, but all the various developments have had one feature in common—the requirement for a "second set of eyes" to check the work after a control system has been disturbed. This additional inspection is often referred to as "the dual inspection" or "the independent check". The most recent changes, introduced with the *Canadian Aviation Regulations* (CARs) are intended to retain the benefits of this additional inspection, while at the same time reducing any tendency for complacency that might be introduced by the knowledge that another inspection will take place. To this end, while the current requirements still call for two signatures, the roles of the two signatories are quite distinct.

The primary signature is the maintenance release. This is a certification, issued pursuant to CAR 571.10, attesting that the described maintenance has been performed in accordance with the applicable airworthiness requirements. One of those requirements is outlined in a table of section 571.10 in Standard 571 of the CARs. It calls for the system to be inspected for correct assembly, locking and sense of operation, by at least two persons, both of whom must sign in the technical record. For simplicity, the maintenance release itself may constitute one of these signatures. The maintenance release may not be signed until the dual inspection has been completed and signed for, unless a suitable procedure is in place to ensure that the aircraft cannot be released until this has occurred.

The person signing the maintenance release assumes full responsibility for the satisfactory completion of the work. The responsibility is not "shared" with the other signatory. As a maintenance release, it can only be made by an appropriately rated AME

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(or, in the case of work performed abroad, by an equivalent person recognized under a bilateral agreement). In addition to ensuring that all the relevant regulatory and technical requirements have been met, the AME must also be satisfied that the person conducting the independent check is qualified to do so.

The signature of the person performing the independent check attests to the satisfactory completion of a quality assurance inspection. In keeping with the CARs principles of focused accountability and independent quality assurance, this activity forms no part of the direct performance or certification of the work. It is not a final approval of the work, as a traditional quality control signature would be. Instead, it indicates that an independent review of the work has been completed, and that no deficiencies have been found. It differs from other quality assurance activities in only one respect—it must be completed before the maintenance release can take effect. Since this signature is not a maintenance release, it is not restricted to licensed AMEs. However, the person undertaking this responsibility must be suitably qualified to do so. Where the work is being done under the control of an Approved Maintenance Organization (AMO) this qualification may be restricted to holders of full Aircraft Certification Authority (ACA). Alternatively, it may be granted to individuals who do not hold a full ACA on type but who have qualified for control system authority after completion of an applicable training program approved under CAR 573.06.

Where no AMO is involved, the AME signing the maintenance release must directly assess the qualifications of the person performing the independent check. In making an assessment of these qualifications, the AME must take into account the individual's training and experience. Completion of a Transport Canada approved course in aircraft maintenance, followed by documented proof (such as entries in an AME logbook) of satisfactory participation in similar control work would be acceptable. In the case of a pilot, an entry in the pilot's logbook by an AME, attesting that the pilot had satisfactorily completed similar control inspections under supervision, would also suffice. The AME may also consider other forms of proof that provide an equivalent level of assurance. These qualifications must, however, be assessed and accepted before the work in question takes place. It is not satisfactory for the AME signing the release to show the person performing the independent check how to perform the inspection at the time the work is completed. Such a procedure would not provide sufficient confidence that the person performing the independent check was capable of independently detecting errors overlooked by the AME.

In the case of AMOs routinely performing heavy maintenance on large aircraft, the procedures for controlling independent checks must be documented and referenced in the MPM. This is especially true when several sub-tasks affecting the same control system may be performed over multiple shifts. To permit the controlled sequential closing of panels, the checks for assembly and locking of a system may be broken into separate sub-tasks, each signed-for individually, with a final check for sense of operation and range of travel of the system as a whole being done on completion of the work. The work record for each sub-task must cross-refer to the task card for the full system check.

Scope of Inspection

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Like all other maintenance, control system inspections must conform to the performance rules outlined in CAR 571.02. In particular, this applies to the requirement to follow the type certificate holder's Instructions for Continuing Airworthiness (ICA) paying attention to variations in wiring diagrams and component part number between aircraft serial numbers of a particular model. However, the type certificate holder's instructions are usually limited to the particular features of the aircraft type, and assume a level of basic knowledge and standard practice on the part of the AME. This section will attempt to summarize the main points to consider when inspecting aircraft control systems that have been disturbed by maintenance. This is not intended to be a comprehensive list. The technical standards and procedures outlined are general in nature, and are intended to supplement the ICA. Where these general procedures are in conflict with the ICA, the type certificate holder's recommendations shall prevail. When checking control systems that have undergone maintenance, the person signing the maintenance release and the person performing the independent check should consider the following points independently :

- All those parts of the system that have actually been disconnected or disturbed should be inspected for correct assembly and locking.
- The system as a whole should be inspected for full and free movement. This check should take into account the effects of airframe flexing in flight, the effects of occupants, cargo and baggage, and the full range of positions of other movable items (e.g. ensure that full rudder deflection does not interfere with elevator up travel, and vice-versa).
- With cables tensioned as specified in the ICA, and the primary control stops in contact, there should be adequate clearance at the secondary stops.
- Due to variations in design, rotary wing aircraft are extremely vulnerable to control system maintenance errors. In particular, vertical and lateral vibrations may have a critical effect on flight control clearances in flight. What may appear to be acceptable linear movement in a static position, may very well become unacceptable under certain high power, high torque conditions.
- The range of movement of the controls should be as specified in the ICA or on the aircraft type certificate, as applicable.
- The operation of the control system as a whole should be observed to make absolutely certain that the controls (including, in the case of flying controls, each individual control surface) are operating in the correct sense (i.e. that the devices concerned respond in a direction consistent with the desired intent of the control input). This check is the single most critical part of the entire procedure, and there can be no excuse for not completing it correctly.
- Some turbo-propeller-powered aircraft have a single control for the propeller and the fuel system, with the relationship between the two determined by electrically controlled trim devices. These controls should be checked through the full range of available trim.
- Some controls rely on the end stops for specific position settings. Others have the settings determined by adjustment of the control rod or cable length-make sure you know what kind of adjustment applies to the control you are dealing with.

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- Trim tabs, balance tabs, anti-balance tabs, spring tabs and servo tabs all have distinctly different characteristics. Make sure what kind of tab system you are dealing with and check that it operates as specified in the ICA. Remember to check that geared tabs operate in the correct relationship to the main control surfaces.
- Some control systems are duplicated to provide redundancy (i.e. the systems are in parallel, so that either system can operate alone). Check each system separately, as well as checking both systems together. Check the operation of the control disconnect devices, and ensure after the check that the devices are properly re-engaged. With some engine controls that employ an electrical system to provide redundancy for a mechanical system, checking the electrically operated system may involve disconnection of the mechanical system. Following reconnection, the check on correct assembly and locking must be repeated.
- Some control systems have units that are duplicated to guard against inadvertent operation (i.e. the units are in series, so that both must be serviceable for the system to work). Dual element elevator trim switches to protect against trim runaway are an example of this type of system. These systems must be checked to ensure that closure of a single switch will not cause the system to operate.
- Some duplicated systems are intended to allow input at one pilot station to cancel out input at the other in certain circumstances (e.g. runaway trim protection and some fly-by-wire systems). The operation of these features should be checked as specified in the ICA. In the case of fly-by-wire systems, the operation of the systems must be verified from each pertinent flight crew station by observing that the respective cockpit indication and actual system's output are the applicable responses. It is equally imperative to confirm that interaction between the flight crew stations is in accordance with the applicable standards for the type and model. If special test equipment is specified to verify the operation of the systems, precautions must be taken to ensure the equipment used is applicable to the aircraft configuration.
- Different control systems may be interconnected so that they affect each other. In helicopters, these include collective/cyclic control interaction and linkages between the collective and power controls. In aeroplanes, they include rudder/aileron and nose-wheel-steering/rudder interconnections. Flap position may be designed to alter the operation of spring tabs or spoilers, or to modify the range of aileron movement. All these interactions must be checked through the full range of the applicable controls.
- When working on systems that are equipped with position indicators, determine if the work has affected their operation and, if so, observe the operation of the indicators to ensure they correspond with the actual control positions.
- On completion of the independent check, all tools and measuring devices, including protractors, inclinometers, tension meters, rigging pins, and part-power stops, etc. should be removed and accounted for, and the area cleared of all foreign objects. All access panels should then be replaced, after which a final check for full and free movement should be carried out.
- Some control adjustments can only be checked completely by flying the aircraft. In such cases, the maintenance release may be made subject to the satisfactory

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completion of a test flight, pursuant to CAR 571.10(4). This type of release is only permitted where all checks that can be carried out on the ground have first been satisfactorily completed, and only those items that cannot be verified without flight are outstanding. When a test flight is required under these provisions, a total of three signatures will be involved. These must be completed in the following order:

1. Independent check.
2. Conditional maintenance release.
3. Pilot's acceptance signature (following successful test).

If the test is not satisfactory and further adjustments are required, then the whole procedure (including both inspections of the items affected) must be repeated.

Extent of Inspection

Both the AME signing the maintenance release and the person performing the independent check must separately decide on the extent of the inspection required, depending on the type of control and the nature of the disturbance. The independent check need not cover the same range of detail as the check leading to the maintenance release. However, as a minimum, it must include an inspection for correct assembly and locking of any parts of the system disturbed by the maintenance performed, an operational check for proper sense and range of operation.

Checking Sense and Range of Operation (both inspections)

It is usually not possible for the person checking the range and sense of operation to observe both extremes of the system at the same time. It may be necessary to involve two persons working as a team, one in the cockpit operating the controls and one at the control surface or other device, observing the effects of the control input. Some AMEs have assumed that where the other person involved is the one responsible for the independent check, this team effort meets the requirement for both inspections. This assumption is risky, as it may not be possible for the person at the control surface to be certain what control input has been applied, neither is it possible for the cockpit occupant to be sure that the movements observed by the outside observer are the ones intended. There is a serious potential for errors in communication. To reduce the likelihood of such errors, after completion of the check the individuals should reverse their roles and carry out the check a second time, each now observing the other end of the system.

Exemptions to the Requirement for Second Inspection

The standards call for two separate signatures whenever an engine or flight control system is disturbed. In this context, "disturbed," means actual disconnection, adjustment or disruption of the system itself. It does not include adjustment of travel stops, and simple adjustments of this kind do not require a dual inspection. The removal and installation of co-pilot control wheels, and rudder pedals that have been designed for rapid replacement without the use of hand tools, is also exempt from the need for two inspections, as is the replacement of sidesticks, electronic flight control computers and

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full authority digital engine control computers, provided the electrical connectors include provisions to protect against incorrect assembly.

Recommended Practice

When checking for sense of operation, many technicians rely on mnemonic devices or rules of thumb to guard against errors. These aids should be used with caution, as they may not apply under all circumstances. For example, one common rule of thumb is to check that "the control surface rises to meet the stick". Unfortunately, with the rudder, the control surface does just the opposite-it moves with the pedals, not in opposition to them. Furthermore, with high-wing and high-tail aircraft, even the aileron and elevator surfaces move away from the control. An additional complication arises in aircraft that have servo controls, where the operation of the servo tab (often the only surface that moves) is in the reverse sense to the main control.

A better approach is to visualize the aerodynamic and other forces acting on the controls and mentally follow the resultant chain of events. In the case of an elevator control, this method would involve the following thought sequence "Let's see, stick back, control surface moves up, that will tend to push the tail down, which brings the nose up, so the aircraft climbs-OK". While this may seem simplistic, it has the very real advantage of reducing the task to its absolute basics, and may just detect an error that would be overlooked in a more sophisticated procedure.

Another important point to remember is to check all the surfaces affected. Cases have occurred where only one aileron was observed, and was found to be operating correctly, while the aileron on the other wing was rigged wrongly, and was moving in symmetry with its partner, instead of in opposition.

Legal Implications

Signing a maintenance release for an incorrectly assembled control system constitutes a direct violation of CAR 571.10, and may lead to suspension of the AME's license pursuant to 6.9(1) of the *Aeronautics Act*. The AME's supervisor, if aware that the proper procedures were not being followed, could also be liable under the same regulation. An AMO certificate holder who knowingly allowed employees to use unacceptable practices in the conduct of control inspections could also be proceeded against pursuant to 8.4(4) of the *Aeronautics Act*. The absence of an adequate training program or quality assurance program that addresses control checks could lead to suspension of an AMO certificate pursuant to 7.1(1) of the *Aeronautics Act*. Signing for an independent check of wrongly assembled controls is not an offence in itself, but may constitute evidence of incompetence, leading to suspension of a license pursuant to 7.1(1)(b) of the *Aeronautics Act*. Finally, where faulty control rigging results in an accident, all those involved could be open to charges of negligence.

Summary

While aircraft control systems themselves are often extremely complicated, the kinds of errors in the assembly of these controls that lead to accidents are often extremely simple, so much so that, with hindsight, it can be difficult to see just how the oversight could have occurred. These are simple human errors of the most basic kind, involving poor

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communication, inattention, distraction, faulty assumptions, and overlooking the obvious. Of all the problems encountered in aviation maintenance, these are among the most avoidable. If all of us involved in the maintenance of control systems were to simply resolve to treat the task with the attention it deserves, regardless of how simple it may appear, control-rigging accidents could be completely eliminated.

† Not all these points will necessarily apply in a given case - the AME should consider which ones are applicable, together with any other aspects not addressed here.

Dual Inspection (Independent Check) - Logbook Entry

Following the Independent check you are required to sign the Dual Inspection statement in the technical record. The statement will contain the system(s) that was (were) affected.

Required is your Signature, License No. and Date. This Dual Inspection is signed before the AME signs the maintenance release.

An Independent Inspection for correct assembly, range of travel, sense of operation and presence of all locking devices has been carried out for the following controls or systems: (System)

Signature: _____ **License:** _____ **Date:** _____