Date: June 11, 2015
Subject: 406 Megahertz (MHz) Emergency Locator Transmitter (ELT) Maintenance

Preliminary Issue & Consultation Assessment Form

I. OVERVIEW

1. Issue

Define the issue or problem.

► There are three (3) issues prompting a risk assessment and proposed amendments to the maintenance and installation standards of 406 Megahertz (MHz) capable (see *NOTE) Emergency Locator Transmitters (ELTs):

Issue 1) Increase in Maintenance Interval (Appendix C of Standard 625)

Transport Canada Civil Aviation (TCCA) has received a submission for a change to the *Canadian Aviation Regulations* (CARs), in particular Appendix C of Standard 625 made pursuant to section 605.85 of the CARs, suggesting an increase to the interval of the annual inspection requirement for performance test and corrosion inspection of 406MHz capable ELTs, in order to reduce maintenance costs to aircraft owners and thereby increase the use 406 MHz ELTs in the General Aviation community. The submitted proposal change was based on the higher design standards and self-testing capabilities of 406MHz capable ELTs. In turn, service data was obtained from the Transport Canada Web Service Difficulty Reporting (SDR) System to support a risk assessment. Additional service data will be sought during the risk assessment activities.

Issue 2) New ELT Design Features and Current Airworthiness Standards (Appendix G of Standard 571)

The current airworthiness standard for ELT maintenance in Appendix G of Standard 571 does not reflect the new design features of 406MHz capable ELTs compared to the older CAN-TSO C91 and CAN-TSO C91a which transmit on 121.5MHz and 243MHz inclusively.

Issue 3) Equipment Installation Standards for ELTs (Airworthiness Manual Section 551.104)

The standards of airworthiness for ELT equipment and installation approval of this equipment required by section 605.38 of the CARs found in Airworthiness Manual (AWM) section 551.104 require amendment due to:

- the evolution of ELT technology;
- the advancement in battery technology;
- the evolution of installation standards;
- service experience; and
- harmonization with foreign civil aviation authorities, where appropriate.

*NOTE:

406 MHz capable ELTs are those that have been certified to the following:

- CAN- Technical Standard Order (TSO)-C126 (406MHz only) and CAN-TSO-C91a (121.5MHz and 243MHz)
- CAN-TSO-C126 (406MHz only) and CAN-TSO-C91a incomplete (121.5MHz only)
- CAN-TSO-C126a (121.5MHz and 406MHz)
- CAN-TSO-C91 and CAN-TSO-C91a transmit on both 121.5MHz and 243MHz.

2. Background

Provide any background information that is relevant (e.g., historical information, prior mitigation efforts).

► An Emergency Locator Transmitter (ELT) is a radio transmitter device which broadcasts distinctive signals on designated frequencies and, depending on application, may be automatically activated by impact or be manually activated. Section 605.38 of the Canadian Aviation Regulations (CARs) requires ELTs to be installed in Canadian aircraft to aid in finding a downed aircraft. There are two broad types. Those built and approved to the older CAN-TSO-C91 and CAN-TSO-C91a and those built and approved to CAN-TSO-C126/C91a or CAN-TSO-C126a . The 406 MHz signal carries data such as global positioning (GPS) location data and aircraft coded message and, when activated, transmits the data to the search and rescue (SAR) satellite system. The coded message is the aircraft 24 BIT address that is collocated with the country of registration as well as the aircraft registration and owner information. This 24 BIT address, along with the aircraft owner information must be registered with the Canadian Beacon Registry as stated in section 605.38 of the CARs. Since February 2009, the 121.5 MHz signal is no longer being monitored by the SAR satellite system.

The Canadian Beacon Registry is an integral part of COSPAS-SARSAT (see note** for acronym explanation), the search and rescue satellite system designed to provide distress alert and location data to search and rescue authorities. When a 406 MHz emergency beacon signal is received by the COSPAS-SARSAT satellite system, SAR authorities at the Canadian Mission Control Centre (CMCC) at Canadian Forces Base (CFB) Trenton will retrieve information from the registration database. This includes beacon owner contact information, emergency contact information, and aircraft identifying characteristics and equipment. Having this information allows search and rescue services to respond appropriately. The International COSPAS-SARSAT Programme is an intergovernmental organisation established in 1988 under an agreement signed by Canada, France, the former USSR, and the United States. The objective of the COSPAS-SARSAT System is to reduce, as far as possible, delays in the provision of distress alerts to SAR services, and the time required to locate a person in distress at sea or on land and provide assistance to that person, all of which have a direct impact on the probability of survival.

Issue 1) Increase in Maintenance Interval (Appendix C of Standard 625)

Since the implementation of the CARs in 1996, the maintenance requirements for ELTs have seen only administrative change. The ELT maintenance interval in Appendix C of Standard 625 has remained consistent at 12 months. The maintenance consists of on-aircraft system inspection, an in-shop ELT performance test and corrosion inspection, and an operational system test. While the current airworthiness standard found in Appendix G of Standard 571 does not reflect the 406 MHz ELT design standards, TCCA has not been able to gather sufficient occurrence data to justify a change to the interval as these ELTs are tested to the current Appendix G reflecting the old CAN-TSO-C91 and CAN-TSO-C91a technology. Nonetheless, a change to the interval between shop visits will be determined via the risk assessment activities.

Issue 2) New ELT Design Features and Current Airworthiness Standards (Appendix G of Standard 571)

The Appendix G of Standard 571 ELT airworthiness standard has remained the same since publication of the CARs in 1996. Since then, CAN-TSO-C126 became effective in December 1993 and was later replaced in May 2009 by CAN-TSO-C126a. In 2009, a Notice of Proposed Amendment (NPA) 2009-005 was written in order to adopt the necessary maintenance requirements and information pertaining to the maintenance of 406 MHz ELTs. The proposed requirements consisted of utilizing the self-test capability of the 406 MHz ELT to perform the operational test as well as additional performance testing of the new design features such as the 406 MHz Digital Message (24 BIT aircraft address). The corrosion inspection interval would see no change due to Canada's "freeze-thaw" climate and the extreme environment that ELTs are subject to. However, due to conflicting priorities, the proposal has been put on hold.

Issue 3) Equipment Installation Standards for ELTs (AWM Section 551.104)

The technical content of airworthiness manual (AWM) section 551.104 has not been amended since 2005. Since then, there has been an evolution in ELT technology and installation standards.

Issue 4) Existing Exemption on CAR 571 Schedule II Specialized Maintenance

The current exemption providing relief to Canadian Installers of 406 MHz capable ELTs from complying with the avionics specialized maintenance requirements of section 571.04 of the CARs has been in place since March 2008 and has been renewed every 18 months since. TCCA's intention is to amend Schedule II to incorporate the intent of the exemption, which is to allow installation of 406MHz ELTs in place of existing CAN-TSO-C91/C91a 121.5 MHz ELTs as non-specialized work.

**NOTE:

COSPAS is an acronym for the Russian words "Cosmicheskaya Sistyema Poiska Avariynich Sudov," which means "Space System for the Search of Vessels in Distress." SARSAT is an acronym for Search and Rescue Satellite-Aided Tracking.

3. Safety Profile

Provide occurrence data and/or outline the safety case for the issue, where applicable.

► Issue 1) Increase in Maintenance Interval (Appendix C of Standard 625)

Maintenance is intended to detect and prevent in service failures of an aeronautical product. Available data was examined to determine if there was a difference in the in-service failure rate between the two broad types of ELT. The occurrence data was extracted from the Transport Canada's Web Service Difficulty Reporting (SDR) System. The database represents in service data that is required by the regulations to be reported by aeronautical product manufacturers, aircraft operators and maintainers. The SDR system was queried for data from 1999 to February 7, 2014 for all ELT reported service difficulties, which included foreign SDRs that TCCA has reviewed. Between the dates mentioned above, there have been 490 SDRs on ELTs.
The following table represents CAN-TSO-C91, CAN-TSO-C91a, CAN-TSO-C126 and CAN-TSO-C126a ELTs occurrence data as well as unknown data due to the lack of information in order to determine the ELT design:

	CAN TSO-C91 and CAN-TSO-C91a 121.5MHz ELT	Unknown ELT	CAN-TSO-C126 and CAN-TSO-C126a 406MHz ELT	Service Difficulty Reports
TOTAL	246	121	123	490
Percentage of Total SDRs reported	50.2%	24.7%	25.1%	

Table 1.1 Total number of SDRs reported from 1999 to February 7, 2014.

The first SDR reported by a Canadian operator was recorded in 2007. The following table represents the total SDRs reported by Canadian owners, operators, maintainers and manufacturers of Canadian registered aeronautical products since the first SDR regarding a 406MHz ELT was reported in 2007. The Unknown column is removed from the calculations below, for accuracy:

	CAN TSO-C91 and CAN-TSO-C91a 121.5MHz ELT	CAN-TSO-C126 and CAN-TSO-C126a 406MHz ELT	Service Difficulty Reports
TOTAL	52	123	175
Percentage	29.7%	70.3%	

Table 1.2 Total number of SDRs since the first occurrence reported in 2007 of service difficulty of a 406 MHz CAN-TSO-C126 ELT.

Out of the 123 SDRs reported on 406 MHz ELTs, there were 87 that were domestically reported. The higher percentage of reported SDRs is due to the anticipation of the proposed regulatory change to mandate the installation of 406 ELTs on Canadian aircraft and international rule changes. Subsequently the mandated rule change proposal has been on hold due to industry and stakeholder comments.

The following table represents the type of issues / failures that were reported:

Item #	ISSUES/FAILURES	# of SDRs	Percentage
1	G-Switch	32	26.0%
2	Transmitter	10	8.1%
3	Self Test	2	1.6%
4	Contamination (leading to corrosion)	2	1.6%
5	Programming/Hex ID	2	1.6%
6	Case Cracks	2	1.6%
7	Toggle Switch	2	1.6%
8	Remote Switch	3	2.4%
9	Battery	8	6.5%
10	Un-commanded activations	24	19.5%
	Total	87	

Table 1.3 Type of issues / failures reported by Canadian owners, operators, maintainers and manufacturers of 406MHz ELTs since the first SDR on 406MHz ELT was reported in 2007.

The data from table 1.3 indicates that a great percentage of the failures are due to G-switch failures and un-commanded activations of the ELT itself. The un-commanded activations are a regular occurrence with either ELT types, though still an issue, however is disregarded as those SDRs do not contain any maintenance data. Items 2, 3, 5, 8 and 9 were all detected during the ELT manufacturer's prescribed self-test/operational check. Items 4, 6 and 7 were discovered during the annual on-aircraft inspection. Item 1, G-switch failures, range from the part not being within manufacturer's specifications and complete failure. All 32 SDRs are ELT models from the same

manufacturer where it is indicated that there may have been a batch problem with the G-switches themselves. As it stands today, the testing of the G-switch takes place during the annual performance test shop visit. Escalating the annual performance test does present a risk to not testing the ELT G-switches annually. However incorporating this particular test into the annual on-aircraft inspection would mitigate this risk. Based on the last and the available SDR occurrence data, the risk of escalating the interval of the ELT performance test and corrosion inspection for CAN-TSO-C126 and C126a 406MHz ELTs appears to be low and, further examination of the existing standard is warranted.

Issue 2) New ELT Design Features and Current Airworthiness Standards (Appendix G of Standard 571)

CAN-TSO-C126 design standards for 406MHz ELTs have been approved for use in Canadian aircraft since 1993. It was updated in 2009 as CAN-TSO-C126a. The airworthiness standards described in Appendix G of Standard 571 of the CARs have not been updated to include the design features of 406MHz ELTs such as self-test, digital message identifying the aircraft and, if configured, GPS position data. Therefore, the Appendix needs to be updated to reflect the testing of these new ELT capabilities to determine its serviceability and functionality in order to quickly locate a downed aircraft.

Issue 3) Equipment Installation Standards for ELTs (AWM Section 551.104)

406 MHz ELT Design Standards: Minimum performance and environmental standards for 406 MHz ELTs in aviation use have been specified in Federal Aviation Administration (FAA)'s Technical Standard Order (TSO) C126, dated 12/23/92, in TSO-C126a, dated 12/17/2008, and more recently in TSO-C126b, dated 11/26/2012, along with other requirements that must be met in order to be identified with the applicable TSO marking. Transport Canada recognizes TSO-C126 or subsequent revisions as appropriate for aviation use in Canada. AWM section 551.104 does not reflect this and requires amendment.

ELT Battery Design and Installation Standards:
AWM section 551.104 currently does not address the installation of lithium or magnesium batteries in ELTs. TCCA has issued Alternate Means of Compliance (AMOC) –AARDG 2008/A13 to Airworthiness Directive AD CF-81-29R2 – Emergency Locator Transmitter (ELT), which allows for the installation of lithium batteries in ELTs. With the AMOC in place, lithium batteries can be installed on ELTs installed on the aircraft. However, this AMOC does not alleviate the restriction imposed by the requirement on batteries installed on ELTs packed inside a life raft. AWM 551.104 requires amendment to update the battery types that are acceptable to be installed.

406 MHz Beacon Coding and Registration:
AWM section 551.104 does not specify the current 406 MHz beacon coding protocols to be used for aviation in Canada. The International Civil Aviation Organization (ICAO) has defined four coding methods which are in accordance with the general structure of COSPAS-SARSAT user protocols described in COSPAS-SARSAT *Guidelines on 406 MHz Beacon Coding, Registration and Type Approval C/S G.005 – Issue 2- Revision 6 dated October 2013*. AWM section 551.104 needs to specify the protocol(s) to be used in aviation in Canada.

406 MHz Installation requirements:
AWM section 551.104 installation requirements have evolved over time, where Transport Canada has provided requirements that addressed issues associated with the service experience and the technological evolution of ELTs and their batteries. Since development of these installation standards, internationally recognized consensus-based standards for ELT installation have been published and are referenced within the TSOs for 406 MHz ELTs. The ELT installation requirements of AWM 551.104 require alignment with those of the consensus-based standards, through their adoption into the TSOs for 406 MHz ELTs.

4. Key Stakeholders

► The issues affect:

- All aircraft owners and operators in Canada who have or will have a 406 MHz ELT installed on their aircraft.
- Aircraft Maintenance Engineers (AMEs) and Approved Maintenance Organizations (AMOs) who conduct inspections on aircraft with 406 MHz ELTs installed.
- Avionics category AMOs with a radio rating and 406 MHz ELT capability to perform the maintenance requirements of Appendix C of Standard 625 and Appendix G of Standard 571 of the CARs.

5. Population Size

Quantify current affected population (operators, category of aircraft, Canadian Aviation Document (CAD) holders, etc).

►Aircraft Owners

According to the 2013 national year-end summary contained on the Canadian Civil Aircraft Register website and Part VI Subpart 5 of the CARs, the total number of Canadian registered aircraft requiring an installed ELT is approximately 27,000.

Registered 406 MHz ELTs

There are approximately 12,000 406 MHz ELTs registered through the Canadian Beacon Registry. The totals include fixed ELTs and serialized ELTs. These may include installations in life rafts or other portable installations.

AMO – Avionics Category Radio Rating

According to TCCA's database, there are approximately 200 Avionics AMOs that have the proper rating to perform the maintenance requirements listed in Appendix G of Standard 571 of the CARs. Since the capability to perform the corrosion inspection and performance test is specified in the company's approved Maintenance Policy Manual, TCCA does not have a specific number of the Avionics AMOs who are approved to perform this work.

AMEs

According to TCCA's database, there are approximately 14,000 AMEs with the appropriate rating (M1, M2 or E) to sign a maintenance release in an aircraft technical record for the on-aircraft inspection of the ELT system and certify a maintenance release for a 406 MHz capable ELT.

AMOs – Aircraft Category

According to TCCA's database, there are approximately 650 AMOs with an Aircraft Category which includes ones with ratings under non-specialized and check-limited would be capable of performing the on aircraft inspection.

6. Current Framework

Describe current requirements under CARs. Confirm limitations of current framework. Provide reference to guidance material if any.

► Section 605.38 of the CARs describes the ELT equipment and carriage requirements for aircraft operating in Canada.

Section 605.86 of the CARs describes the requirement to have an approved maintenance schedule.

Part of that schedule, under Appendix C of Standard 625 of the CARs, is the 12 month ELT inspection requirement. This requirement includes the in-shop performance test and corrosion inspection of the ELT as described in Appendix G of Standard 571.

AWM section 551.104 contains the standards of airworthiness for ELT equipment and for installation approval of ELT equipment required by section 605.38 of the CARs.

Limitations of current framework:

The current regulatory framework on ELT maintenance does not make a distinction between the older and newer design standards for ELTs. All installed ELTs, whether certified to CAN-TSO-C91, C91a, C126 or C126a, must be inspected annually for performance and corrosion. A NPA was drafted in 2009 to implement maintenance requirements reflecting the newer design requirements of CAN-TSO-C126 and C126a 406 MHz ELTs. Since the airworthiness standard does not reflect the 406 MHz ELT design standards, TCCA has not been able to gather sufficient occurrence data to determine whether a change to the 12 month maintenance interval is justified.

AWM section 551.104 does not reflect the latest accepted design standards of 406MHz capable ELTs as well as the latest battery design and installation standards.

7. ICAO Obligations

Identify applicable standards (ICAO SARPs) and any existing differences filed on the issue.

► ICAO provides a high level regulatory framework in the Annexes to the Chicago convention, in particular in Annex 6 *Operation of Aircraft Part I International Commercial Air Transport – Aeroplanes*, Part II *International General Aviation — Aeroplanes, Part III International Operations – Helicopters*, Annex 8 *Airworthiness of Aircraft* and in the supporting document, the *Airworthiness Manual* (Doc 9760).

The requirements defined by ICAO are implemented through the detailed regulations of each contracting states' civil aviation authorities, the exceptions being documented through declared differences.

The potential changes to Appendix C of Standard 625,Appendix G of Standard 571 will not affect TCCA's current level of compliance with the ICAO requirements of Annex 6 or 8. The potential changes to AWM section 551.104 will align with the ICAO standards and COSPAS-SARSAT guidelines for aviation ELT coding and protocols.

8. International Agreements, foreign Civil Aviation Authorities

Describe international agreements, if any. Explain what has been done by FAA / EASA to address the issue or problem.

► The FAA regulation on ELT maintenance is found in 14 Code of Federal Regulations section 91.207 of the *Federal Aviation Regulations* (FARs). The annual inspection includes:

(1) Inspection for proper installation;

(2) Inspection for battery corrosion;

(3) Operation of the controls and crash sensor (G-switch); and

(4) The presence of a sufficient signal radiated from its antenna.

There is no prescribed annual performance test “shop visit”, under the current FAA regulations.

9. Potential Impact on the Civil Aviation Safety Program

Describe the potential impacts of the issue on the Civil Aviation Safety Program (e.g. Service & Surveillance to the Aviation Industry, Aviation Safety Oversight).

► N/A

II. DETERMINATION OF THE NEED FOR A FOCUS GROUP

The purpose of a Focus Group (FG) will be to:

- provide technical review and input in relation to specific tasks;
- provide advice on the content and execution of the task assigned, including commenting on the Preliminary Issue & Consultation Assessment (PICA) and Terms of Reference;
- provide guidance on the way forward for tasks related to complex technical issues;
- conduct risk assessments, as required; and
- provide input on proposed solutions, including the need for further rulemaking activities, and on their implementation.

Some issues may not require the establishment of a Focus Group. If established, Terms of reference will be developed. A Focus Group will not work in isolation and may consider other stakeholders input as its progress on an issue is communicated.

Assess the need to establish a Focus Group against the following criteria:

CRITERIA	SCORE IN POINTS (PTS)	RESULTS
Scope of the issue • Administrative change / non-technical: administrative amendments having no impact. Ex: errors in format, typographical errors, numbering errors, inconsistencies between the English and French versions, as long as these inconsistencies are non-substantive • Technical: issue that requires technical research/analysis • Highly technical: significant technical change to current program or introduction of new technology that requires complex research and/or analysis	a) Administrative change / Non-Technical = 1 pt b) Technical = 2 pts c) Highly technical = 3 pts	**2 POINTS**
Availability of information / data Factors to consider: • Previous research (Working Group, Issue Papers, Reports) • Reliability / Accuracy of the information available? • Reliable sources for the information / data? • Is the information protected or proprietary?	a) Readily available = 1 pt b) Partially available = 2 pts c) Not available = 3 pts	**2 POINTS**
Expertise on the issue/subject • Where are the Subject Matter Experts (SMEs) - persons with special knowledge or skills in a particular area or topic?	a) Internal = 1 pt b) Internal & External = 2 pts c) External = 3 pts	**2 POINTS**

NEED FOR A FOCUS GROUP		
TOTAL:	**3 to 4 pts**	**5 to 9 pts**
6 points	**NO**	**YES** **X**

Justify the need for the establishment or not of a Focus Group.

► As there could be other occurrence data that was not reported as SDRs, and that there is a need for external expertise, a Focus Group is required.

III. PROPOSED CONSULTATION STREAM

Assess the potential impact of the proposed solution against the following criteria:

CRITERIA	SCORE IN POINTS (PTS)	RESULTS
Introduction or revision of an element in the CARs Factors to consider: • Minor: Is the issue affecting one or few areas of the regulation? • Substantial: Is the issue cross-functional (several areas of specialty within TCCA)? • New: New element and/or consultation required with other departments / agencies (Ex: DND, NAV CANADA)?	a) Minor element change to current regulation = 1 pt b) Substantial element change to current regulation = 2 pts c) New element to current safety program or interdepartmental issue = 3 pts	**1 POINT**
Adverse impacts on one or several segments of industry including regional variations Factors to consider: • Does this issue relate to a specific type of operation or sector of the industry? • Population size of sector of the industry potentially affected • Specific regional impact	a) No impact = 1 pt b) Minimal impact = 2 pts c) Substantial impact = 3 pts	**2 POINTS**
Estimated costs to industry • Quantify the potential costs to industry (equipment, training, implementation, etc) based on available information or preliminary analysis	a) Decrease / Neutral = 1 pt b) Increased costs = 2 pts c) Substantial increase of costs = 3 pts	**1 POINT**

International agreements, obligations and standards (ICAO SARPs), Harmonization with other civil aviation authorities • Will the proposed solution align Canada with ICAO Standards and/or foreign civil aviation authorities?	a) Full alignment / non-applicable = 1 pt b) Some alignment = 2 pts c) No alignment = 3 pts	**1 POINT**

PROPOSED CONSULTATION STREAM			
TOTAL:	**4 pts**	**5 - 9 pts**	**10 -12 pts**
5 points	**LOW**	**MEDIUM** **X**	**HIGH**

Proposed consultation level and rationale.

- A medium consultation stream has been determined and stakeholders will be kept informed through the CARAC Activity Reporting System.
- The Preliminary Issue & Consultation Assessment (PICA) form (this document) will be shared online to provide an overview of the issues.
- A Focus Group will be established, as determined in Part II of this document, to perform a risk assessment on the issues raised.
- Should a regulatory solution be retained, a NPA would be drafted and shared with stakeholders for consultation.

UNTIL SEPTEMBER 11, 2015, COMMENTS ON THIS NOTICE MAY BE ADDRESSED, IN WRITING, TO:
CARAC Contact information : CARRAC@tc.gc.ca