



ICAO

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Manual on the Approval and Use of Child Restraint Systems

Second Edition, 2019



Approved by and published under the authority of the Secretary General

INTERNATIONAL CIVIL AVIATION ORGANIZATION



| ICAO

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FOREWORD

The safest way to secure an infant or child on board an aircraft is in a State-approved child restraint system (CRS), in a dedicated seat, appropriate for that infant or child. Therefore, States and industry should encourage the use of CRS by passengers travelling by air with infants or children.

Proper use of restraints is one of the most basic and important factors in surviving an accident. It is not possible for a parent¹ to physically restrain an infant or child, especially during a sudden acceleration or deceleration, unanticipated or severe turbulence, or impact. The use of CRS provides an equivalent level of safety to infants and children as that afforded to adult passengers wearing seat belts. ICAO developed the *Manual on the Approval and Use of Child Restraint Systems* (Doc 10049) in order to facilitate widespread use of CRS at an international level. It provides guidance on provisions in Annex 6 — *Operation of Aircraft, Part I — International Commercial Air Transport — Aeroplanes* related to seats and restraints.

This manual contains guidance for States to develop the regulations and approval processes to enable the use of CRS. It also provides guidance for operators in the form of recommended content for relevant policies, procedures and training programmes as well as guidelines for managing change through their safety management systems to allow the use of CRS on board their aircraft.

The second edition of this manual has been expanded to include detailed guidance for the mutual acceptance of CRS between States, to promote their use at the global level. This additional guidance facilitates seamless international operations for persons travelling with CRS. The approach presented in this manual provides a means to verify that an equivalent level of safety is achieved when a State accepts devices approved by another State. The mutual acceptance of CRS between States facilitates the passenger experience when interlining between domestic and foreign operators.

The content of this manual was developed with input from experts from civil aviation authorities, operators, aircraft manufacturers, training organizations and international organizations, and thereafter submitted for extensive peer review to take into account comments from the expert community.

ICAO gratefully acknowledges the contributions of the ICAO Cabin Safety Group and individual experts who provided support, advice and input for this manual.

1. For the purpose of this manual, the term “parent” refers to the parent or guardian responsible for the infant or child.

GLOSSARY

DEFINITIONS

Adult. For purposes of accompanying an infant or child as a guardian, an adult is considered as any such person of an age as defined by the State of the Operator.

Bassinet. A device for accommodating an infant, which may attach to existing fittings on bulkheads, and is intended for use in flight but not during taxi, take-off and landing. Certain such devices may be certified for use in turbulence. Use of the device is restricted by infant size and weight.

Booster seat. A device that contains no built-in harness. The principal aim of the device is to enhance the positioning of a motor vehicle safety harness on a child. It may include a base, back and side wings.

Cabin crew member. A crew member who performs, in the interest of safety of passengers, duties assigned by the operator or the pilot-in-command of the aircraft, but who shall not act as a flight crew member.

Change management. A formal process to manage changes within an organization in a systematic manner, so that changes which may impact identified hazards and risk mitigation strategies are accounted for, before the implementation of such changes.

Child. A passenger who has reached their second birthday but not their twelfth birthday.

Child restraint system. Any device, other than a seat belt, that is designed specifically to protect and restrain an infant or child during all phases of flight. It typically has an internal harness and belt combination. The device needs to interface with the aircraft seat. This includes devices that are secured using the aircraft seat belt as well as systems that secure the device to the aircraft seat. The device needs to meet minimum performance standards, as specified by the State of the Operator.

Classroom training. In-person, instructor-led training which may include group exercises and interactive instructional sessions.

Computer-based training. Training involving instructional aids, such as computers and tablets. Computer-based training may encompass the use of CD-ROMs as well as web-based training (commonly referred to as eLearning).

Crew member. A person assigned by an operator to duty on an aircraft during a flight duty period.

Critical phases of flight. The period of high workload on the flight deck, normally being the periods between the beginning of taxiing until the aircraft is on the route climb phase and between the final part of descent to aircraft parking.

Direct access. A direct route or passage from a seat to an exit from which a passenger can proceed without entering an aisle or passing around an obstruction.

Emergency exit. Door, window exit, or any other type of exit (e.g. hatch in the flight deck, tail cone exit) used as an egress point to allow maximum opportunity for cabin evacuation within an appropriate time period.

Emergency exit row seating. Each seat in a row of seats located at an emergency exit, having direct access to the exit.

Flight crew member. A licensed crew member charged with duties essential to the operation of an aircraft during a flight duty period.

Forward-facing seats. Seats installed within eighteen degrees of the longitudinal axis of the aircraft.

Infant. A passenger who has not reached their second birthday.

Infant sling. A device consisting of a pouch which holds an infant close to the wearer's body. It is also referred to as a vest.

Oblique-facing seats. Seats installed in the aircraft where the occupant angle relative to the aircraft longitudinal axis is other than those described for forward-facing, rearward-facing or side-facing seats.

Operations manual. A manual containing procedures, instructions and guidance for use by operational personnel in the execution of their duties.

Operator. The person, organization or enterprise engaged in or offering to engage in an aircraft operation.

Passenger. A person who is not an operating crew member.

Rearward-facing seats. Seats installed within eighteen degrees of the longitudinal axis of the aircraft, facing aft.

Restraint. A device designed to safely restrain an occupant in his/her seat to prevent injuries resulting from inertia forces or other in-flight forces such as turbulence. A restraint may be a seat belt, safety harness or approved child restraint system.

Safety harness. A webbing based restraint consisting of at least three anchor points restraining both the pelvis and upper torso.

Seat belt. A webbing based restraint consisting of two anchor points restraining the pelvis. It is also referred to as a lap belt.

Side-facing seats. Seats installed into the aircraft where the occupant angle θ relative to the aircraft longitudinal axis is $\theta = 90.0$ degrees, or $\theta = 270.0$ degrees.¹

State of the Operator. The State in which the operator's principal place of business is located or, if there is no such place of business, the operator's permanent residence.

Supplemental loop belt. A belt for infant use that is attached to an adult seat belt by inserting the adult's segment through a loop in the infant's belt. The infant is restrained by an abdominal belt attached to the adult's seat belt. It is also referred to as a belly or loop belt, or infant seat belt.

1. SAE ARP6316 — Performance Standards for Oblique Facing Seats in Transport Aircraft

ABBREVIATIONS AND ACRONYMS

ADREP	Accident/Incident Data Reporting System
AS	Aerospace Standard
ATD	Anthropomorphic test dummy
ATSB	Australian Transport Safety Bureau
CAMI	Civil Aerospace Medical Institute (FAA)
CASA	Civil Aviation Safety Authority
CMVSS	Canadian Motor Vehicle Safety Standard
CRS	Child restraint system
EASA	European Aviation Safety Agency
ETSO	European technical standard order
FAA	Federal Aviation Administration
FMVSS	Federal Motor Vehicle Safety Standard
ISOFIX	International standard for attachment points for child safety seats in cars
LATCH	Lower anchors and tethers for children
LODA	Letter of design approval
MPS	Minimum performance standards
MTOW	Maximum take-off weight
SAE	Society of Automotive Engineers
SARPS	Standards and Recommended Practices
SMS	Safety management system
STC	Supplemental type certificate
TC	Type certificate
TSO	Technical standard order
TSOA	Technical standard order authorization

Chapter 1

INTRODUCTION

1.1 BACKGROUND

1.1.1 Proper use of restraints is one of the most basic and important factors in surviving an accident, whether it is in a motor vehicle or on board an aircraft. Accident investigations and scientific dynamic testing have indicated that it is not possible for a parent to physically restrain an infant or child, especially during sudden acceleration or deceleration, unanticipated or severe turbulence, or impact. In such scenarios, an infant or child who is not restrained in a child restraint system (CRS) may suffer serious or fatal injury.

1.1.2 Research on CRS has concluded that infants and children are at higher risk of sustaining injuries if they are not properly secured in a suitable device that has been approved for use on board the aircraft. The use of certain types of devices, not specifically designed for use with an aircraft seat, is detrimental to an infant/child's safety (see Chapter 2, 2.3). Such devices do not provide the same level of safety as CRS approved for use on board aircraft, or that provided to other passengers who occupy their own seats. Studies to note on this subject include, but are not limited to:

- a) Federal Aviation Administration (FAA) — *The Performance of Child Restraint Devices in Transport Airplane Passenger Seats* (conducted by the Civil Aeromedical Institute (CAMI) and published in 1994);
- b) Australian Transport Safety Bureau (ATSB) — *Child Restraint in Australian Commercial Aircraft* (conducted by Human Impact Engineering and Britax Childcare Pty Ltd. and published in 2006); and
- c) European Aviation Safety Agency (EASA) — *Study on Child Restraint Systems* (conducted by TÜV Rheinland Krafftahrt GmbH and published in 2008).

Note.— Copies of these studies can be obtained from the ICAO Cabin Safety Library at <http://www.icao.int/cabinsafety>.

1.1.3 ICAO's primary indicator of safety in the global air transport sector is the accident rate based on scheduled commercial operations involving aircraft having a maximum take-off weight (MTOW) above 5 700 kg. Statistically, the global accident rate is significantly low, which while affirming the safety of aviation as a mode of transport, makes the collection of sufficient data on infant and child safety in accidents challenging. Additionally, historical data in the ICAO Accident/Incident Data Reporting System (ADREP) does not contain a significant number of reported occurrences resulting in serious or fatal injuries to infants or children in scheduled commercial operations. Therefore, data from research, including scientific dynamic testing, is the most widely available source of information used to understand the issues surrounding infant and child safety.

1.1.4 Infants and children differ significantly from adults in terms of size and weight, body proportions and anatomy. Current seats on passenger aircraft are designed and tailored to the anatomical structure of an adult; they are not specifically designed to accommodate infants or children under a certain weight and/or height. To enhance their safety, infants and children should be restrained in an approved CRS that is appropriate to their weight and/or height which can safely accommodate their body structure and is designed for use on board an aircraft or with an aircraft seat.

1.1.5 At the time of publication, there was no internationally harmonized approach to the approval, acceptability and use of CRS on board aircraft. Certain States have regulations on CRS; others have recommendations on their use. Most States recommend that all occupants be restrained. However, there are variations in the types of CRS that may be used on board aircraft and in their effectiveness. Ultimately, the State is responsible for determining which CRS are suitable for use on board its operators' aircraft. Prior to allowing the use of CRS on board, the State should develop a clear process for the approval of changes in policy and procedures by operators, and determine actions that should be undertaken to maintain or enhance the expected levels of safety performance while implementing any changes. Information on the types of CRS approved by the State should be communicated to the travelling public via the State's relevant website or through other means (e.g. the operator's website).

1.2 PURPOSE

1.2.1 The purpose of this manual is to encourage the widespread use of CRS at an international level by presenting an internationally harmonized approach to the approval and use of CRS on board aircraft. In order to promote such harmonization, States are encouraged to incorporate the content of this manual into their guidance material and make use of it in the development or amendment of regulations.

1.2.2 This manual is intended to provide guidance for States to develop regulations and approval processes for the use of CRS on board aircraft. It provides guidance on provisions in Annex 6 — *Operation of Aircraft, Part I — International Commercial Air Transport — Aeroplanes* related to seats and restraints. The manual presents a series of considerations that the State should integrate into the approval process, including modifications to regulations and changes which should be required of operators to allow the use of CRS. For the purpose of this manual, "State" refers to State of the Operator, unless specified otherwise.

1.2.3 Guidance is also provided for operators to develop a process to allow the use of CRS on board their aircraft, including the recommended content of relevant policies, procedures and training programmes, as well as guidelines for managing changes through their safety management system. Furthermore, the manual contains guidance for post-implementation activities related to continued surveillance by the State and safety assurance processes by the operator in relation to the use of CRS.

1.2.4 This manual also provides guidance for the mutual acceptance of CRS between States. (see Chapter 2, Appendix B)

1.3 SCOPE

The content of this manual is presented as guidance material. The approach outlined was developed as an acceptable means, but not the sole means, to allow the use of CRS on board aircraft. States may also use guidance material issued by other States to assist with the implementation process. Operators should consult with their respective States on specific requirements for the approval and use of CRS and comply with national regulations where applicable.

Chapter 2

CHILD RESTRAINT SYSTEMS

2.1 TYPES OF CRS

2.1.1 Certain CRS are suitable for use on board aircraft while others are not. Data from research, including scientific dynamic testing, is the most widely available source of information that can be used to understand the issues surrounding infant and child safety. Results from internationally recognized research studies on the effectiveness of CRS were utilized to determine the suitability of types of devices for use on board aircraft. (See Appendix A to this chapter for additional information on these studies.)

2.1.2 Section 2.2 presents the types of devices considered suitable for use as CRS on board aircraft; section 2.3 presents the types of devices deemed not suitable for use as CRS on board aircraft. Prior to allowing the use of a CRS on board, the device should go through the State's approval process as noted in section 2.6.

2.2 TYPES OF DEVICES SUITABLE FOR USE AS CRS ON BOARD AIRCRAFT

2.2.1 The suitability of a particular type of CRS is based on the infant/child's weight and/or height. Additionally, the parent or crew member should comply with manufacturer specifications and instructions. Children whose weight is less than 26 kg (60 lbs.) and whose height is less than 125 cm (49 in) should occupy an approved CRS. Weight restrictions presented in this section are provided as examples and may be subject to variations.

2.2.2 *Aft-facing CRS.* An aft-facing (rearward-facing) CRS is typically intended for an occupant who is unable to walk unassisted and weighing less than 10 kg (22 lbs.). However, some aft-facing CRS can accommodate occupants of a greater weight. Weight restrictions are specified on the device and may vary from one CRS to another. Figure 2-1 presents an example of an aft-facing CRS.

2.2.3 *Forward-facing CRS.* A forward-facing CRS is typically intended for an occupant weighing 10 to 30 kg (22 to 66 lbs.). However, some forward-facing CRS can accommodate occupants of a greater weight. Weight restrictions are specified on the device and may vary from one CRS to another. Figure 2-2 presents an example of a forward-facing CRS.

2.2.4 *CRS specific to aviation.* A CRS that has been designed and approved by the State specifically for use on board an aircraft.



Figure 2-1. Example of an aft-facing CRS



Figure 2-2. Example of a forward-facing CRS

2.3 TYPES OF DEVICES NOT SUITABLE FOR USE AS CRS ON BOARD AIRCRAFT

2.3.1 *Booster seat.* A device that contains no built-in harness. The principal aim of the device is to enhance the positioning of a motor vehicle safety harness on a child. It may include a base, back and side wings. This type of device is not suitable for use as a CRS on board aircraft.¹ Figure 2-3 presents an example of a booster seat.

2.3.2 *Infant sling.* A device consisting of a pouch which holds an infant close to the wearer's body. It is not suitable for use as a CRS on board an aircraft. Figure 2-4 presents an example of an infant sling.



Figure 2-3. Example of a booster seat



Figure 2-4. Example of an infant sling

1. Some high-backed booster seats may be approved by the State for use on board aircraft if the devices meet specific requirements and testing.

2.4 THE USE OF MOTOR VEHICLE CRS ON BOARD AIRCRAFT

2.4.1 A CRS designed for a motor vehicle may or may not be compatible, in fit or function, with aircraft seats. Therefore, in some cases, the CRS cannot be installed properly and may not perform as intended on board an aircraft. The lack of available space between armrests (width of seat base) and the lack of space between two rows of seats (seat pitch) are two reasons why a motor vehicle CRS may not fit on board a particular aircraft. Furthermore, these devices are not configured to be fully compatible with an aircraft seat (break-forward seat backs, no attachment point for a tether strap, etc.), nor are they fully tested with the aircraft seats in mind. (See Chapter 6 for guidance on information for passengers regarding suitable CRS.)

2.4.2 The width between the armrests of an aircraft seat depends on the location and style of the armrests. Some motor vehicle CRS do not fit between the armrests, particularly on seats with seat trays stowed in the armrests. In addition, the dimensions of the available seat base (on which the CRS rests) may differ between motor vehicles and aircraft. The typical seat pan of an aircraft is smaller and narrower than that of a motor vehicle.

2.4.3 The seat pitch or the available space between two rows of seats may also be an issue and particularly significant for aft-facing CRS as they are further reclined and take up more horizontal space. The inability to be effectively installed using existing aircraft seat belts may also render motor vehicle CRS ineffective on board. The location of anchor points can also be problematic. This includes the location of the aircraft seat belt attachment to the aircraft seat, as a CRS must translate forward until the belt path angle allows for belt tension forces to restrain the device.

2.4.4 The installation method and the available maneuvering space for installing a CRS in aircraft differ from the motor vehicle environment. Parents usually stand outside the motor vehicle and can position themselves on either side of the CRS to attain the best possible position for installing the device.

2.4.5 CRS installation frequency may pose a problem. In motor vehicles, the CRS is usually installed and left in the same position for several months, or the base remains installed when the rest of the device is removed. In an aircraft, the CRS is only installed for a particular flight segment.

2.5 SPECIAL CONSIDERATIONS FOR OTHER DEVICES

Special consideration should be paid to the following:

- a) *Bassinets*. Bassinets are not considered CRS. They should not be used during critical phases of flight. These include taxi, take-off and landing. Unless the device has been approved for use during turbulence, an infant should be removed from a bassinet in the event of turbulence. Parents should be made aware of the need to remove and restrain the infant under these circumstances. Bassinets should be used in accordance with the manufacturer's instructions.
- b) *CRS for infants/children with special needs*. The CRS should still be weight and/or height appropriate and capable of supporting the infant/child without impeding accessibility to exits in an emergency situation.
- c) *Medical transportation*. In special operations, such as medical flights, the use of a restraint may conflict with the immediate medical needs of an infant/child. In these circumstances, alternate means, such as humidicribs/incubators (neonatal intensive care units), need to be considered. Any such non-compliance or alternative compliance with the relevant regulations should be granted with a specific exemption or approval of alternate procedures. The operator engaged in this type of flight should work in close cooperation with the State to address the specific requirements for each flight. Qualified medical personnel may need to accompany the infant/child.

2.6 APPROVAL OF CRS BY THE STATE

2.6.1 The State is responsible for determining which CRS may be used on board its operators' aircraft. An approved CRS needs to be compatible with the aircraft seat and meet minimum performance standards (MPS), as specified in this chapter.

2.6.2 The State's approval process should cover the following points:

- a) the use of existing CRS standards to establish MPS (see Appendix B to this chapter);
- b) acceptance of other States' CRS approvals (in line with Appendix B to this chapter);
- c) an approved CRS should be labelled indicating that the device can be used on board aircraft. The label attests that the device has been subjected to specific testing and has been certified for use on board aircraft in accordance with the applicable State regulation (see Chapter 4, 4.2.5); and
- d) a review of the latest research on restraining infants and children, including new products or safety studies.

2.6.3 As a first step in the process, the State should define what constitutes an acceptable CRS that may be approved for use on board aircraft, and determine restrictions on the use of CRS, if applicable.

2.6.4 When approving CRS for use on board aircraft, the State should ensure that the device meets applicable certification requirements, as outlined below:

- a) *Type certificate (TC) process.* A TC is an original design approval process in which an applicant applies for, and the certifying authority may issue, a TC or design approval of a product, or a major design change to a product. A product is an aircraft, an aircraft engine or an aircraft propeller. The process, if approved, results in the issue of a TC.
- b) *Supplemental type certificate (STC) process.* An STC is a TC issued when an applicant has received approval, by the certifying authority, to modify an aircraft from its original design. The STC, which incorporates by reference the related TC, approves not only the modification but also how that modification affects the original design.
- c) In both TC and STC processes, the application for use of a CRS in a specific type of aircraft constitutes a novel and unusual design feature not addressed by current regulations and safety standards. In this case, the State may publish special conditions. These conditions explain the additional safety standards that the State deems necessary for the CRS to comply with existing regulations. They also indicate the required performance of the CRS and the capability of the CRS to be installed and used without creating safety concerns.
- d) An applicant seeking approval for the design of a device should utilize the *technical standard order (TSO) process*. A specific TSO can have different names based on a State or region, such as Canadian technical standard order (CAN-TSO) or European technical standard order (ETSO) process, while maintaining the same technical content. A TSO is an MPS issued by the State for specified materials, parts, processes, and appliances used on aircraft. The MPS must be used for an applicant to receive TSO authorization (TSOA) or a letter of design approval (LODA). An example of an MPS is TSO C-100, which specifies the requirements that a CRS must meet. Clear markings on the CRS indicate that it conforms to the requirements of this TSO. These TSOs apply to equipment intended to provide proper restraint of infants/children in the aircraft environment and suitable for use during all phases of flight. The TSO process also requires the manufacturer to provide technical data, including operating instructions, equipment limitations, installation procedures and limitations, and instructions

for continued airworthiness and maintenance of the CRS. Receiving a TSOA means the applicant obtained an approval for design and production of a device. However, a TSO is not an approval to install and use the device on board aircraft. It means that the device meets the specific TSO and the applicant is authorized to manufacture it.

2.6.5 Typically, a CRS approved by the State for use on board aircraft through the TSO process will likely be similar in design and performance standards to a CRS meeting the requirements for motor vehicles. However, devices approved by the State through a TC or STC may contain novel and unique design features. The MPS for the air transport industry provide more realistic CRS testing regarding performance of CRS in an aviation environment.

2.6.6 Additional information related to the certification of CRS can be obtained from the ICAO Cabin Safety Library at <http://www.icao.int/cabinsafety>.

Appendix A to Chapter 2

RESEARCH ON CRS AND OTHER DEVICES

1. GENERAL

This appendix presents an overview of three significant studies on CRS in the aviation environment. Research on CRS concluded that infants and children are at higher risk of sustaining injuries if they are not properly restrained in a suitable CRS. In addition, research noted that the performance of certain types of devices does not enhance the level of safety for infants and children in aircraft seats and can also contribute to injuries.

2. STUDY 1: THE PERFORMANCE OF CHILD RESTRAINT DEVICES IN TRANSPORT AIRPLANE PASSENGER SEATS

2.1 The Federal Aviation Administration (FAA) issued a study in 1994 entitled *The Performance of Child Restraint Devices in Transport Airplane Passenger Seats*. The research for the study, conducted by the FAA Civil Aerospace Medical Institute (CAMI), involved dynamic impact tests with a variety of CRS installed in aircraft passenger seats. The results of this study were used by the FAA as the basis for prohibiting the use of supplemental loop belts, booster seats and infant slings during surface movement, take-off and landing.

2.2 Supplemental loop belt

During dynamic testing of supplemental loop belts, the forward flailing of the adult and the child resulted in severe body impacts against the forward row seat. The child anthropomorphic test dummy (ATD) moved forward to impact the forward row seat back, followed by the adult ATD torso striking the child ATD. Then, the adult ATD torso continued to move forward after contact with the child ATD, crushing the child ATD against the seat back.

2.3 Booster seat

A key concern raised in the study for backless booster seats used in aircraft seats is the combined effect of seat back break-over and impact of an adult seated behind the child. Booster seats may expose the child occupant to potential abdominal injury due to the combined effects of these forces.

2.4 Infant sling

The infant slings¹ tested in the study consisted of a torso harness for the child ATD placed in its own seat with the aircraft seat belt inserted through a loop of webbing attached to the back of the harness. During dynamic testing, the devices allowed excessive forward body excursion, resulting in the child ATD sliding off the front of the seat indicating a high likelihood that the child's entire body would impact the forward row seat back. Then, elasticity in the webbing of the harness and seat belts pulled the ATD rearward and this rebound acceleration presented a further risk of injury.

3. STUDY 2: CHILD RESTRAINT IN AUSTRALIAN COMMERCIAL AIRCRAFT

3.1 In 2006, the Australian Transport Safety Bureau (ATSB) published a study entitled *Child Restraint in Australian Commercial Aircraft*, conducted by Human Impact Engineering and Britax Childcare Pty Ltd. The goals of the study were to review the developments in the safe transport of children on board aircraft and to conduct a test programme based on CRS available in Australia at the time. The study was later extended to include the assessment of infant slings for use as infant restraints on board aircraft.

3.2 Turbulence (inversion) test

Twenty models of CRS, certified to AS/NZS 1754:2004 (*Child Restraints for Use in Motor Vehicles*), were fitted to a typical aircraft seat according to the manufacturer's instructions. A turbulence test demonstrated that Australian motor vehicle CRS adequately retained the child ATD when exposed to 1G of vertical acceleration.

3.3 Dynamic sled test

Eleven models were subjected to modified FAA dynamic sled tests in an aircraft seat. The CRS exhibited significant forward motion, rotation and rebound motion as a result of design incompatibilities between the aircraft seat and lap belt system and the lack of a top tether. In tests where the child ATDs were restrained only by the aircraft seat lap belt, excessive forward motion of the ATD head and torso occurred. This motion would likely result in impact with the forward row seat back.

3.4 Infant slings

An inversion test demonstrated that infant slings were able to retain the child ATD provided the sling was securely fastened. Dynamic testing, using a 9G sled pulse, demonstrated that these slings were not able to restrain child ATDs under crash situations. Furthermore, the forward motion of the adult ATD restrained only by a lap belt trapped the child ATD in the space between the forward row seat back and the head, torso and knees of the adult ATD.

3.5 Supplemental loop belt

Although retained during dynamic testing, the child ATD underwent significant forward excursion resulting in severe impact of the ATD's head with the forward row seat back. In addition, the adult ATD folded over the child ATD trapping and crushing it in the process.

1. The device tested by CAMI, consisting of a vest type harness that attached to the adult seat belt in the same manner as a supplemental loop belt, was different from the device described in the Definitions and in section 2.3.2 as an "infant sling".

3.6 Suggestions included in the study report

The study report made a series of suggestions about CRS and procedures for use on board aircraft. The suggestions were based on the findings of the study and the principle that infants and young children are entitled to the same level of protection afforded to adults, both in flight and during emergency landings. The study included a suggestion that the use of CRS by infants and young children on flights is to be encouraged. It further suggested that the CRS used be either designed specifically for use on board aircraft or a motor vehicle CRS approved for use on board aircraft.

4. STUDY 3: STUDY ON CHILD RESTRAINT SYSTEMS

4.1 This study on CRS was published in 2008 and conducted by TÜV Rheinland Kraftfahrt GmbH, Team Aviation, by order of the European Aviation Safety Agency (EASA). The study addressed the issue of protecting infants/children from injuries caused by turbulence, rejected take-offs, hard landings or emergency landings on board aircraft.

4.2 The EASA study addressed an equivalent level of protection for children and focused particularly on infants (of age two years or less). The study analysed the current methods of transporting infants/children, as well as the use of aircraft passenger seat belts, aviation CRS and seat built-in CRS, and add-on motor vehicle CRS and other systems currently used in motor vehicles. The study noted concerns that current regulations and operational practices may not provide infants/children with the level of impact protection equivalent to that provided to other passengers. The study was divided into three phases:

- a) phase I: Literature and data search and review;
- b) phase II: Evaluation of available solutions; and
- c) phase III: Evaluation of possible regulatory and non-regulatory options.

4.3 Based on the review of other studies, test reports and accident analyses, the study came to the conclusion that the lap-held transport of infants restrained with or without a supplemental loop belt does not provide a safe restraint for them during rejected take-offs, runway excursions, turbulence, emergency landings and other accidents. Sections 4.4 through 4.9 present a summary of the study's main findings.

4.4 Seat belt

The aircraft seat belt is designed to support the webbing on the iliac crest of the adult. In children, the iliac crest is not fully developed (i.e. almost two-thirds of the belt width lies within the abdominal region of the child). The study stated that, in an accident, the seat belt would slip completely into the abdominal region which would lead to serious injuries. It concluded that the seat belt is not deemed a suitable method of restraining infants and smaller children; and recommended that it should be used at the earliest for children of approximately seven years of age, or with a body length greater than approximately 125 cm (49 in).

4.5 Double-seat occupancy

The study noted that a lap-held infant acts as an energy absorption element for the adult when both share a seat. The infant does not have his or her own survival space. During an accident sequence, the crash loads are reduced for the adult. However, for the infant they increase significantly. In such instances, the infant is additionally loaded by the pressure of the downward movement of the adult's upper torso and his or her femurs hitting upwards. Therefore, the

study concluded that the transport of lap-held infants secured with or without a supplemental loop belt does not provide any protection to the infant.

4.6 Lap-held infants without supplemental restraint

In emergency landings, as required by the certification process, an infant weighs at least sixteen times more than he or she normally weighs. In turbulence, upward accelerations in an aircraft can reach up to 6G. The study noted that an adult may not be able to hold an infant on his or her lap in sudden accelerations, even when prepared. The infant may then be projected through the cabin and suffer serious injury as a result. Therefore, the study concluded that lap holding of infants without supplemental restraint is not deemed a suitable method of transporting them.

4.7 Supplemental loop belt

The supplemental loop belt rests almost entirely within an infant's abdominal region. The induction of forces into the abdominal region of the infant may result in serious injuries. Therefore, the study concluded that the supplemental loop belt is not deemed a safe restraint system for infants in turbulence, rejected take-off, hard landing, emergency landing, and other accident scenarios.

4.8 ISOFIX/LATCH

The international standard for attachment points for child safety seats in cars (ISOFIX)/lower anchors and tethers for children (LATCH) are internationally standardized attachment systems for child seats. ISOFIX/LATCH are alternatives to the lap belt attachment for CRS. An increasing number of devices are equipped with these types of systems. The lower anchorage points of the ISOFIX/LATCH are compatible. The test reports identified the possibility of using ISOFIX/LATCH attachment systems on aircraft passenger seats. However, at the time of publication, the study noted this remained impossible since aircraft passenger seats are not equipped with ISOFIX/LATCH anchorage points.

4.9 Built-in CRS

Specific seats in the aircraft cabin can be equipped with built-in CRS. The study noted that built-in CRS provide a high potential for the safe transport of children on board aircraft and may be a good alternative to add-on CRS installed on aircraft seats. At the time of publication, the study noted that there was no approval or operating instructions available for this type of system.

4.10 Recommendations to ICAO

The study addressed some recommendations to ICAO, citing that the Organization could facilitate worldwide implementation. Recommendations included the following:

- a) that all passengers, including infants, obtain a seat of their own (no double occupancy); and
 - b) that children aged up to seven years be transported in an appropriate CRS.
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Appendix B to Chapter 2

GUIDANCE FOR THE MUTUAL ACCEPTANCE OF CRS BETWEEN STATES

1. GENERAL

This appendix presents information about recommended standards that can be used by States to create their own regulations and/or guidance material for the use of CRS. It also provides information about mutual acceptance of CRS approvals between States, criteria for inclusion of new standards, and consideration for international harmonization of labelling. The standards listed in this appendix are not an exhaustive list of available standards. Each State uses its own standards and may add additional standards to their regulations and/or guidance material based on the criteria contained in Section 5 of this appendix.

2. AEROSPACE STANDARDS

The following are some of the most widely accepted aerospace standards.

2.1 TSO C-100 (as amended)

Issued by the FAA, technical standard order (TSO) C-100, *Child restraint systems* is for manufacturers seeking a technical standard order authorization (TSOA) or letter of design approval (LODA) on the minimum performance standards (MPS) their CRS must first meet to obtain approval and be identified with the applicable TSO marking. This document is based on Society of Automotive Engineers (SAE) aerospace standard (AS) 5276/1, *Performance Standard for Child Restraint Systems in Transport Category Airplanes*. TSOs may be obtained from the FAA.

2.2 SAE AS5276/1 (as amended)

The SAE AS5276/1 defines minimum performance standards (MPS), and related qualification criteria, for add-on CRS that provide protection for infants and children in aircraft passenger seats. AS5276/1, which may be obtained from SAE International, is not intended to provide design criteria that can be met only by an aircraft-specific CRS. Its goal is to achieve child-occupant protection by specifying a dynamic test method and evaluation criteria for the performance of a CRS in emergency landings. AS5276/1 applies to CRS on forward-facing aircraft passenger seats and comprises the following requirements, among others:

- a) definition of child classification/definition of CRS types;
- b) compatibility of CRS and aircraft passenger seat (as per SAE ARP4466 – see section 4.1, below);
- c) installation of CRS on aircraft passenger seats;
- d) fire protection;

- e) turbulence protection (inversion test pursuant to FMVSS 213 must be performed – see section 3.5 below);
- f) dynamic strength and occupant protection; and
- g) labelling.

3. MOTOR VEHICLE CRS STANDARDS

This section contains examples of standards for the approval, by individual States, of CRS for use in motor vehicles, that may also be used for the approval of CRS on board aircraft. Certain conditions may apply when approving CRS, originally designed for use in motor vehicles, for use on board aircraft (e.g. conducting an inversion test). Additional installation limitations may apply — see Chapter 2, section 2.4 above.

3.1 AS/NZS 1754:2013

The Australian and New Zealand Standard (AS/NZS) 1754 (2013 or later), *Child Restraints for Use in Motor Vehicles* covers various requirements for design, manufacturing, performance, user instructions, marking, and packaging of motor vehicle CRS. The Civil Aviation Safety Authority (CASA) and Standards Australia collaborated to modify AS/NZS 1754 to consider the installation of CRS on board aircraft. CRS certified to AS/NZS 1754:2013 and onward can meet additional criteria relevant to use on board aircraft. These criteria include installation with only the use of the aircraft seat belt. Such CRS have labelling similar to that presented in Figure 6-1 (see Chapter 6). CRS certified to AS/NZS 1754 that do not bear this label are still acceptable for use on board aircraft, provided there is an approved means to attach the top tether strap. AS/NZS 1754:2013 may be obtained from Standards Australia or Standards New Zealand.

3.2 CMVSS 213/213.1 (as amended)

In Canada, CRS must be approved to Canadian Motor Vehicle Safety Standard (CMVSS) 213, *Child Restraint Systems* or CMVSS 213.1, *Infant Restraint Systems*. CMVSS 213 and 213.1 define tolerance limits, which the anthropomorphic test dummy (ATD) must not exceed in the dynamic test. CMVSS 213/213.1 require an inversion test and also specify further tests and test procedures. CMVSS may be obtained from Transport Canada.

3.3 ECE R-44 (as amended)

In Europe, CRS are tested in accordance with the European safety standard requirements of the United Nations Economic Commission for Europe (UNECE) Regulation No 44 (ECE R-44), *Uniform provisions concerning the approval of restraining devices for child occupants of power-driven vehicles (“Child Restraint System”)*. ECE R-44 provides general requirements for the design of CRS (minimum height of the backrest, belt dimensions, belt geometry, etc.). It requires an overturning test, defines tolerance limits the ATD must not exceed in the dynamic test, and also specifies further tests and test procedures. The ECE-R44 approval does not automatically include the two-point-restraint attachment approval. CRS for use in motor vehicles are usually approved for three-point belt and/or International Organization for Standardization standard ISO 13216 (ISOFIX) installation, only due to market demands. These approvals do not comply with the lap belt installation in aircraft. However, CRS that are ECE R-44 approved may be accepted on board with additional testing (e.g. TÜV/958-01/2001, *Qualification Procedure for Child Restraint Systems for use in Aircraft*). These CRS carry the label “For use in Aircraft”, issued by TÜV Rheinland. ECE R-44 may be obtained from the UNECE.

3.4 ECE R-129 (as amended)

ECE R-129, *Uniform provisions concerning the approval of enhanced Child Restraint Systems used on board of motor vehicles (ECRS)* is a stand-alone regulation and coexists with ECE R-44. A CRS may be certified either to ECE R-44 or ECE R-129. Under ECE R-129, CRS are no longer categorized by weight groups, as is the case under ECE R-44. The weight and size limit of the child is defined by the manufacturer (e.g. 0 to 12 months, 45 to 75 cm or 18 to 30 inches). This information is displayed on the CRS. Under the new regulation ECE R-129, infants under the age of 15 months must be transported in rearward-facing CRS. In addition, ECE R-129 requires a dynamic test for side impact, not included in ECE R-44, and focuses on ISOFIX attachment. Requirements for a CRS, where the child is restrained by the vehicle safety belt, are currently being developed by the UNECE for future revisions of ECE R-129. Rearward-facing CRS that are fixed with vehicle safety belts can already be approved to ECE R-129. ECE R-129 approvals do not comply with the lap belt installation in aircraft. However, CRS that are ECE R-129 approved must undergo additional testing before being accepted on board (e.g. TÜV/958-01/2001). These CRS carry the label “For use in Aircraft” issued by TÜV Rheinland. ECE R-129 may be obtained from the UNECE.

3.5 FMVSS 213 (as amended)

In the United States, a CRS must meet Federal Motor Vehicle Safety Standard (FMVSS) 213. Such CRS must have two markings: “This restraint is certified for use in motor vehicles and aircraft” (in red lettering) and “This child restraint system conforms to all applicable federal motor vehicle safety standards”. FMVSS 213 gives general requirements for the design of CRS (minimum height of the backrest, belt dimensions, belt geometry, etc.) and only requires an inversion test if the CRS is to be used on board aircraft. FMVSS 213 specifies further tests and test procedures. FMVSS may be obtained from the United States Department of Transportation.

4. OTHER

4.1 SAE ARP4466 (or later version)

SAE ARP4466, *Dimensional Compatibility of Child Restraint Systems and Passenger Seat Systems in Civil Transport Airplanes* provides guidance to promote dimensional compatibility between forward-facing aircraft passenger seat systems and CRS developed primarily for use in motor vehicles. It includes the following specifications, among others:

- a) aircraft passenger seat (test fixtures);
- b) lap belt (test belt); and
- c) installation and removal tests with the CRS on the test fixtures, using the test belt.

ARP4466 can be obtained from SAE International.

4.2 TÜV/958-01/2001 (or later version)

4.2.1 TÜV/958-01/2001 (or later version) provides procedures to qualify CRS developed primarily for use in motor vehicles for use in passenger seats on commercial aircraft. The procedures close an existing gap, particularly between aircraft-two-point restraint installation and the automotive standard, ECE-approved, three-point-harness-installation. The qualification guarantees easy installation of the CRS on most economy, first, and business class seats, taking into account the variety of restraint and seat geometries found on board aircraft. It does not apply to the use on folding seats, oblique-facing seats, or side-facing seats. The qualification of a CRS is based on:

- a) the proof of suitability of the CRS, to be submitted by its manufacturer, and to include, among others:
 - 1) a proof of compliance with the ECE R-44, ECE R-129, FMVSS 213, or equivalent regulation, as a baseline requirement;
 - 2) additionally, a proof of structural strength when attached, with two-point lap belt only (without shoulder harness), in a dynamic crash test;
 - 3) a technical drawing;
 - 4) a suitable and easy to read manual for installation in aircraft seats with a lap belt, taking into account special conditions such as turbulence and airbag belts; and
 - 5) for an inflatable CRS, a proof of functionality under specific ambient conditions.
- b) a test regarding operational suitability, performed on a special test setup by TÜV Rheinland, which includes:
 - 1) testing that the CRS is compatible with a wide range of different lap belt designs and webbing lengths; and
 - 2) testing that the CRS is compatible with almost every existing aircraft seat geometry, including belt anchorage points, armrest constructions, seat back angles, lap-belt designs, seat-to-seat pitches, etc.

4.2.2 If the CRS passes all tests, it can be installed on almost every economy-class seat as well as on first and business class seats. TÜV/958-01/2001 may be obtained from TÜV Rheinland Kraftfahrt GmbH. An overview of qualified CRS according to the procedures described above can be found at <https://www.tuv.com/landingpage/en/manufacturers-of-child-seats/index.html>.

5. CRITERIA FOR APPROVAL OF DEVICES VIA ANOTHER STANDARD

This appendix provides multiple references to documents related to the development of a standard and the acceptance of CRS. A State may wish to use another standard, not listed in this appendix, to approve a CRS for use on board aircraft. In such cases, the State should do a comparison between the standard used for the CRS approval and the standard in section 2.1 or one of the standards listed in sections 3.1 to 3.5 of this appendix. The purpose of this comparison is to ensure other standards used for the CRS approval provide an equivalent level of safety to those listed in this appendix (i.e. the device offers an acceptable level of protection to its occupant). If the State deems that other standard acceptable, it should ensure the CRS approved using such standard bear proper labelling to facilitate mutual acceptance of CRS between States.

6. MUTUAL ACCEPTANCE OF CRS AMONG STATES

Each State is encouraged to establish or update its regulations and/or guidance material based on the standards indicated in this document, or the criteria for selection of additional standards, in order to promote international harmonization on the use of CRS (see Chapter 3, section 3.12).

7. INTERNATIONAL HARMONIZATION OF LABELLING

7.1 The State should provide clear guidance on how parents can assess whether their CRS is approved for use on board aircraft. Figure 6-1 presents one example of labelling requirements that a CRS could have in order to be accepted, such examples should be available on the State's website.

7.2 A consistent and uniform labelling of acceptable CRS assists the State, the operator, parents, crew members, and ground personnel to avoid confusion when determining whether the CRS is approved for use on board aircraft.

7.3 The best means to address the issue of inconsistent labelling is to develop an international label using a unique pictogram (a symbol representing a concept, object, activity, place or event by illustration) to reduce the use of text and eliminate the need for a large number of different labels. A unique pictogram will facilitate check-in and boarding as well as the use of CRS across the aviation network. When developing the unique pictogram, the following should be considered:

- a) one relevant organization should be assigned to lead and develop the harmonized, unique pictogram and to encourage its use (e.g. a standards-making organization);
 - b) a working group, composed of States and the lead organization, should be formed to work on the development and implementation process of this unique pictogram;
 - c) that this unique pictogram be the sole means to attest that the device has been subjected to specific testing and has been certified for use on board aircraft, in accordance with the applicable State regulation;
 - d) the timeframe required to fully implement a unique pictogram solution, during which current and future labels would coexist; and
 - e) the need to implement a quality assurance process for the issuance and use of the proposed unique pictogram, in order to prevent misuse.
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Chapter 3

REGULATORY CONSIDERATIONS

3.1 ICAO STANDARDS AND RECOMMENDED PRACTICES (SARPS)

3.1.1 The provision of seats and restraint systems on board commercial passenger aircraft is a requirement of Annex 6 — *Operation of Aircraft*. The current Standards and Recommended Practices (SARPs) require that a seat or berth be provided for each occupant over a certain age. This age is determined by the State. Additionally, Annex 6 currently states that restraint systems (e.g. seat belt) must be provided for each seat or berth.

3.1.2 Paragraph 6.2.2 of Annex 6, Part I — *International Commercial Air Transport — Aeroplanes*, states that:

“6.2.2 An aeroplane shall be equipped with: [...]”

- c) 1) a seat or berth for each person over an age to be determined by the State of the Operator;
- 2) a seat belt for each seat and restraining belts for each berth; and
- 3) a safety harness for each flight crew seat. The safety harness for each pilot seat shall incorporate a device which will automatically restrain the occupant’s torso in the event of rapid deceleration;

Recommendation.— *The safety harness for each pilot seat should incorporate a device to prevent a suddenly incapacitated pilot from interfering with the flight controls.*

Note.— *Safety harness includes shoulder straps and a seat belt which may be used independently.*”

3.2 NEED FOR HARMONIZATION

3.2.1 The majority of States require children (defined by age, weight and/or height) to use an approved CRS when travelling in a motor vehicle. In many States, there are no equivalent regulations for air travel.

3.2.2 At the time of publication, there was no internationally harmonized approach to the approval and use of CRS on board aircraft. Certain States have regulations on CRS; others have recommendations on their use. Most States recommend that all occupants be restrained. However, there are variations in the types of CRS that may be used on board aircraft and in their effectiveness. Additionally, there is no internationally harmonized approach to double-seat occupancy (i.e. allowing lap-held infants with or without a supplemental restraint). The two main issues that require harmonization are:

- a) approval and use of CRS on board aircraft; and
- b) regulations related to double-seat occupancy.

3.3 ESTABLISHING A SAFETY CASE

The use of CRS should be addressed by the State through its national regulations. Prior to modifying existing regulations and recommendations on the means to restrain aircraft occupants, or developing new ones, the State should establish a safety case. The safety case should consider the following elements:

- a) historical data on infant/child survivability;
- b) scientific studies on infant/child restraint in aircraft;
- c) anthropometrics of an infant/child;
- d) seat design and existing standards (technical considerations associated with CRS seat interface);
- e) survival “space” necessary for infants/children (e.g. head injury criteria);
- f) evacuation considerations for passengers travelling with infants/children;
- g) safety risk assessment;
- h) change management;
- i) financial implications of the regulations (business case); and
- j) operational practicality of the proposed regulatory changes.

3.4 DEVELOPING REGULATIONS ON CRS

3.4.1 The requirements for the use of CRS should be embedded in the State’s national regulations pertaining to seats, seat belts and restraint systems. The regulations should specify the need to place an occupant under a certain age, weight and/or height in an approved CRS. In that respect, the State should define who is considered an infant or child.

3.4.2 The State’s regulations on CRS should address the following points:

- a) methods of restraining infants/children on board aircraft;
- b) requirements for accompanying parent;
- c) responsibility for furnishing CRS;
- d) criteria to assess CRS suitability (types of CRS approved for use on board);
- e) location of CRS in the cabin; and
- f) CRS installation.

3.4.3 Sections 3.5 to 3.10 present detailed guidance on each of these points.

3.5 METHODS OF RESTRAINING INFANTS/CHILDREN ON BOARD AIRCRAFT

The regulations for the methods of restraining infants/children on board aircraft should be clearly outlined by the State and should:

- a) specify requirements for the approval and use of CRS to be used in a dedicated seat, as outlined in this manual; and
- b) cover the following points related to double-seat occupancy:
 - 1) *Lap-held infants without supplemental restraint.* Regulations should address (i.e. allow, restrict or prohibit) lap holding of infants without supplemental restraint. When making a decision in regard to lap holding, the State should take into consideration findings from scientific studies conducted on the safety of infants/children on board aircraft (see Chapter 1, 1.1.2), information from continued surveillance activities (see Chapter 7, 7.1.2) and aspects related to international operations (see Chapter 3, 3.12.2).
 - 2) *Supplemental loop belt.* Regulations should address (i.e. allow, restrict or prohibit) the use of the supplemental loop belt. When making a decision in regard to the use of the supplemental loop belt, the State should take into consideration findings from scientific studies conducted on the safety of infants and children on board aircraft (see Chapter 1, 1.1.2), information from continued surveillance activities (see Chapter 7, 7.1.2) and aspects related to international operations (see Chapter 3, 3.12.2).
 - 3) *More than one occupant per seat belt.* Regulations should prohibit the use of one seat belt for more than one infant/child. Additionally, a parent should not be allowed to share a seat belt with an infant/child.

3.6 REQUIREMENTS FOR ACCOMPANYING PARENT

The State should specify that an infant/child using an approved CRS must be accompanied by a parent or guardian, as defined by the State, who will attend to the safety of that CRS occupant during the flight. In addition, for the safety of both parent and infant/child, the State may limit how many infants/children one parent may be responsible for during a flight.

3.7 RESPONSIBILITY FOR FURNISHING CRS

3.7.1 CRS accepted for use on board aircraft may be furnished by the operator or by the passenger. An operator that provides CRS should be responsible for CRS availability and airworthiness. The operator should establish the maximum number of infants/children permitted on board, relative to the aircraft type and considering the number of oxygen masks available and life jackets, if available. The operator should also define the required pre-flight checks for the CRS. These include verifying the functionality of harnesses. If the passenger provides the CRS, the operator should establish procedures to be followed by crew members during normal, abnormal and emergency situations in line with its policies and per the criteria established by the State. These procedures should be included in the operations manual (see Chapter 4, 4.3).

3.7.2 The operator should not prohibit an infant/child from occupying an approved CRS furnished by the parent when a ticket has been purchased for that purpose provided all necessary requirements are met (see Chapter 4, 4.2). An approved CRS should not be considered an item of carry-on baggage when the device is carried on board the aircraft by a passenger as a means of restraining an infant/child.

3.8 CRITERIA TO ASSESS CRS SUITABILITY

3.8.1 The State should specify the criteria used to assess whether a CRS is suitable for use on board aircraft (including acceptance of CRS approved for use by other States). The criteria should include how a person would assess:

- a) whether the particular CRS has been approved by the State for use on board aircraft;
- b) which CRS are appropriate for an infant/child (typically based on their age, weight and/or height); and
- c) whether the CRS can be properly installed on the respective aircraft seat.

3.8.2 Other criteria should be specified in the technical standards. Guidance on the approval process is presented in Chapter 2, 2.6. The CRS should adhere to the requirements established by the State and be appropriately tested and labelled by the manufacturer as safe for use on board aircraft.

3.9 LOCATION OF CRS IN THE CABIN

The location(s) in the cabin where CRS can or cannot be used should be taken into consideration. When defining acceptable locations for CRS on board aircraft, the State should address the following points:

- a) *Preferred location(s)*. CRS should be located near a floor level exit, if possible, but should not hinder an evacuation. The recommended location for a CRS is at a window seat. CRS should be placed in a seat next to or closest to the accompanying parent; and in the same row unless the aircraft configuration does not permit it; and
- b) *Location restrictions*. CRS should not be located in an emergency exit row, nor in a row immediately forward or aft of an emergency exit row. An aisle seat or a cross aisle seat (at a bulk head) that forms part of the evacuation route to exits should not be used for CRS. Aisle seats are not recommended as the CRS occupant could be injured by a passing person or service cart. The CRS may also present an obstruction during an evacuation. The CRS should not prevent or hinder the movement of adjacent passengers or block exits. It should not block access to safety and emergency equipment. Other locations may be acceptable provided the access to the nearest aisle is not obstructed by the CRS.

3.10 CRS INSTALLATION

3.10.1 A CRS should only be installed on an aircraft seat using the type of connecting device for which it is approved. The method of connecting the CRS to the seat should be the one shown in the CRS manufacturer's instructions. All safety and installation instructions should be followed. When defining acceptable installation for CRS on board aircraft, the State should address the following points:

- a) *Installation of forward-facing CRS*. These devices should be installed on forward-facing passenger seats. They may be installed on rearward-facing passenger seats, if fitted in the same direction as the

passenger seat on which they are positioned, and if stated by the manufacturer criteria and approved by the State;

- b) *Installation of aft-facing CRS.* These devices should only be installed on forward-facing passenger seats;
- c) *Side-facing and oblique-facing seats.* CRS should not be installed on these types of seats, unless otherwise stated by the CRS manufacturer and approved by the State; and
- d) *Inflatable restraint/airbag.* This is a design feature installed on a passenger seat restraint system that contains an integrated inflatable airbag. CRS should not be installed within the radius of action of an airbag, unless the airbag is deactivated; or if the airbag, when activated, does not create a hazardous situation for the CRS occupant.

3.10.2 Once a CRS is installed, it should remain secured to the aircraft seat during all phases of flight. If a forward-facing CRS can be reclined, it should be placed in an upright position during movement on the surface, take-off and landing, or whenever the parent is instructed to do so by crew members.

3.11 OPERATOR IMPLEMENTATION REQUIREMENTS

3.11.1 As part of the implementation process, the State should require operators to address the following, as a minimum:

- a) develop a policy and procedures specific to the use of CRS;
- b) revise the approved cabin crew training programme so that cabin crew members are:
 - 1) knowledgeable on the policy and procedures related to the use of CRS;
 - 2) aware of their responsibilities in relation to CRS; and
 - 3) adequately trained and proficient in order to perform their duties in relation to CRS;
- c) provide passengers with information about the use of CRS prior to their travels;
- d) monitor for any potential issues associated with CRS, as part of their safety management system; and
- e) ensure other personnel (e.g. ground crew) are trained on and knowledgeable about the operator's policy and procedures related to the acceptability and use of CRS and are proficient to perform their tasks.

3.11.2 Chapters 4 to 7 include detailed guidance on these subjects.

3.12 CRS IMPLEMENTATION CONSIDERATIONS

3.12.1 Financial impact

Prior to implementing a regulatory change related to the use of CRS, the State should consider the financial impact on the various stakeholders of any recommendation or regulatory requirement. Costs associated with the use of CRS may include, but are not limited to the following:

- a) State: costs associated with development and implementation of regulations;
- b) operator:
 - 1) cost of purchasing and maintaining CRS, if provided by the operator, as well as potential revenue generated by providing same; and
 - 2) revenue fluctuation — potential for lost or gained revenue based on the reaction of the travelling public or on fares for infants/children using CRS;
- c) passenger:
 - 1) cost of purchasing or renting a CRS suitable for use on board aircraft;
 - 2) cost comparisons to other modes of transportation; and
 - 3) cost of purchasing an additional ticket (for an extra seat to install the CRS) from the operator; and
- d) equipment manufacturer: costs related to the development and certification of CRS and their installation on board aircraft.

3.12.2 International operations

3.12.2.1 Prior to developing or modifying regulations regarding the use of CRS, the State should consider the impact of a regulatory change on national operators, operating international passenger flights. This includes determining if each State of destination to which the national operators operate:

- a) has regulations allowing the use of CRS which differ from those of the State of the Operator;
- b) does not allow the use of certain types of CRS; and
- c) requires all passengers to occupy their own seat.

3.12.2.2 In order to promote seamless international operations, provide an equivalent level of safety, and facilitate the passenger experience when interlining between domestic and foreign operators, the State should consider allowing operators to accept CRS approved for use by other States. States are encouraged to broaden the types of CRS approved for use on board aircraft to include those meeting the standards of the United Nations or approved by another State. When doing so, States should refer to the guidance for the mutual acceptance of CRS between States as presented in Chapter 2, Appendix B.

3.12.3 Implementation timelines

As with any regulatory change, the State should take into consideration the timelines needed for the implementation of new or modified regulations. The State should consider the time needed for the completion of the following tasks when deciding on an applicability date for requiring the use of CRS on board aircraft:

- a) rulemaking process;
- b) oversight activities by the State, including the development of guidance material on acceptable means of compliance, State inspector awareness/training, initial approval process and continued surveillance activities;
- c) development of operator policy and procedures, and other documentation (e.g. changes to passenger safety briefing cards);
- d) training for operational personnel;
- e) integrating policy and procedures with interlining operators; and
- f) dissemination of information to the travelling public.

3.13 STATE OVERSIGHT RESPONSIBILITIES RELATED TO CRS IMPLEMENTATION

3.13.1 Approval process

3.13.1.1 In order to facilitate and standardize the approval process for the use of CRS, the State should develop the following at a minimum:

- a) guidance for use by State inspectors when approving the changes to an operator's policies, procedures, training programme(s) and equipment;
- b) a documented process for approvals;
- c) standardized checklists/job aids to support the documented process;
- d) guidance to CRS manufacturers (e.g. technical guidance and requirements); and
- e) guidance to operators on the:
 - 1) approval process;
 - 2) documentation required; and
 - 3) evidence required.

3.13.1.2 The State should approve changes related to the following items, if necessary, using its established processes:

- a) operator policy and procedures on the use of CRS;
- b) operator training programme(s) as related to CRS; and
- c) equipment (if the operator provides the CRS).

3.13.2 Continued surveillance

Chapter 7 includes detailed guidance on this subject.

3.13.3 Foreign operators

Consideration should be given by the State to foreign operators. Foreign operators are required to comply with their respective State regulations. Safety oversight is conducted by the State of the Operator that issued the air operator certificate. If a State has concerns regarding the use of CRS by a foreign operator, these should be communicated to the State of that operator for review.

Note.— Detailed guidance on safety oversight responsibilities is contained in the Manual of Procedures for Operations Inspection, Certification and Continued Surveillance (Doc 8335).

Appendix A to Chapter 3

MODEL REGULATIONS ON CRS

1. GENERAL

1.1 This appendix was developed to promote international harmonization regarding the approval and use of CRS. It is addressed to States' civil aviation authorities concerned with the regulation of civil aviation. It is not intended to replace existing Standards and Recommended Practices (SARPs).

1.2 The model regulations aim at presenting a basic scheme of provisions that will allow uniform development of national regulations governing the carriage of infants/children and the approval and use of CRS; yet they remain flexible enough to accommodate any special requirements that may need to be met. States should give consideration to the principles in these model regulations when revising or developing national regulations, in order to contribute to international harmonization in this subject. States that envisage adopting the model regulations may consider working in collaboration with other States in their region, as well as with States that share significant international commercial aviation route networks, in order to promote seamless international operations and facilitate the passenger experience when interlining between domestic and foreign operators. Operators' acceptance of CRS will be facilitated and obstacles to international operations reduced accordingly. Although only a recommendation, the model regulations have been drafted in the mandatory sense (i.e. the word "shall" is employed throughout the text rather than "should") in order to facilitate direct use of the model regulations as a basis for national regulations.

1.3 Among other aspects, the model regulations address the following:

- a) methods accepted for restraining infants and children;
- b) persons who need to occupy a CRS;
- c) criteria to assess if a CRS is suitable for use on board aircraft;
- d) CRS marking/labelling requirements;
- e) locations where CRS may or may not be placed in the cabin; and
- f) installation considerations.

2. MODEL REGULATIONS

Seats, seat belts and restraint systems

- 1) No operator of an aircraft shall operate the aircraft unless, during movement on the surface, there are available take-off, cruise flight, and landing:
 - a) an approved seat or berth for each person on board the aircraft; and
 - b) an approved seat belt and/or safety harness for separate use by each person on board the aircraft.
- 2) Each person on board the aircraft shall occupy an approved seat or berth with a separate seat belt and/or safety harness properly secured about him/her during movement on the surface, take-off, and landing. A seat belt and/or safety harness provided for the occupant of a seat may not be used by more than one person.
- 3) Notwithstanding the preceding requirements, a person under [x] years of age, referred to as an infant/child, shall occupy an approved restraint system appropriate to their weight and height furnished by the operator or a parent or guardian.
- 4) An operator of an aircraft shall not permit a parent or guardian to be responsible for more than one infant at any time on board the aircraft.

Child restraint system

- 1) No operator of an aircraft shall permit the use of a child restraint system on board the aircraft unless:
 - a) the infant/child using the approved child restraint system is accompanied by a parent or guardian who will attend to the safety of the infant/child during the flight;
 - b) the height and weight of the infant/child using the child restraint system is within the range specified by the CRS manufacturer;
 - c) the child restraint system bears a legible label as provided in subsection (4) or bears a legible label or markings as provided in subsection (5);
 - d) the child restraint system is properly secured to a seat that is not located in an emergency exit row, or one row forward or behind, and does not block access to an aisle or safety and emergency equipment;
 - e) the child restraint system is installed on an aircraft seat with the type of connecting device for which it is approved; and
 - f) if the child restraint system utilizes a tether strap, it shall be used according to the manufacturer's instructions or, where subsection (2) applies, secured so as not to pose a hazard to the infant/child using the child restraint system, or to any other person.
- 2) Where a seat incorporates design features to reduce occupant loads, such as the crushing or separation of certain components, and the seat is in compliance with the applicable design standards, no person shall use the tether strap on a child restraint system to secure it to the seat.

- 3) A parent or guardian who is responsible for an infant/child who is using a child restraint system on board an aircraft shall be:
 - a) seated in a seat next to or closest to the seat to which the child restraint system is secured;
 - b) familiar with the manufacturer's installation instructions for the child restraint system; and
 - c) familiar with the method of securing and of releasing the infant/child in the child restraint system from the child restraint system.
- 4) As provided in subsection (1)(c) of this section, the approved child restraint system must bear labels as follows:
 - a) devices manufactured to [State] standards on or after [date] must bear two labels:
 - i) "This child restraint system conforms to all applicable [State] motor vehicle safety standards"; and
 - ii) "This child restraint system is certified for use in motor vehicles and aircraft" in red lettering; or
 - b) devices must bear two labels:
 - i) that the device was manufactured under the standards of the United Nations; and
 - ii) that the device was approved for use on board aircraft.
- 5) Child restraint systems that do not qualify under subsection (4) of this section must bear a label or markings showing:
 - a) that the device was approved by another State in accordance with [standard];
 - b) that the device was manufactured under the standards of the United Nations;
 - c) that the device furnished by the operator was approved by the [State] through Type Certificate or Supplemental Type Certificate; or
 - d) that the device furnished by the operator, or by a parent or guardian, was approved by the [State] in accordance with [standard].
- 6) Booster seats are not approved for use on board an aircraft.
- 7) The following prohibitions apply to operators of aircraft:
 - a) no operator may permit an infant/child in an aircraft to occupy an infant sling during movement on the surface, take-off, and landing;
 - b) except as required in subsection (7)(a) above, no operator may prohibit an infant/child (if requested by the infant/child's parent or guardian) from occupying a child restraint system furnished by the child's parent or guardian, provided:
 - i) the infant/child holds a ticket for an approved seat or berth or such seat or berth is otherwise made available by the operator for the infant/child's use;

- ii) the requirements of subsection (1) of this section are met;
- iii) the requirements of subsection (3) of this section are met; and
- iv) the child restraint system has one or more of the labels or markings described in subsections (4) through (5) of this section.

Chapter 4

OPERATOR POLICY AND PROCEDURES

4.1 GENERAL

4.1.1 The operator should develop a policy to address the use of CRS. The goal of this policy is to produce a common understanding among passengers and the operator's personnel regarding the use of CRS, including the types of CRS that are permitted and how and where they should be installed while passengers are on board the aircraft. The policy is a means to demonstrate compliance with State regulations, where applicable, and should be communicated to passengers and the operator's personnel.

4.1.2 The operator should also describe personnel's tasks related to the use of CRS and include the necessary procedures in the appropriate documentation. Procedures should be reviewed by the State prior to approving the operations manual or any subsequent changes thereto.

4.1.3 The operator should consider conducting a safety risk assessment to determine means to mitigate any potential safety-related risks associated with the use of CRS, as well as any special considerations related to CRS occupant safety. For example, the operator may conduct a risk assessment to assess the impact of the acceptability of a new type of CRS on board its aircraft; or to reassess the assigned locations for CRS in the cabin when reconfiguring an aircraft with new types of passenger seats. The policy and procedures should address the issues identified in the risk assessment.

4.2 POLICY ON THE USE OF CRS

4.2.1 General

4.2.1.1 The operator's policy should include, but not be limited to, the following aspects:

- a) methods of restraining infants/children on board aircraft;
- b) requirements for accompanying parent;
- c) responsibility for furnishing CRS;
- d) types of CRS approved for use on board;
- e) acceptance and refusal policies regarding CRS;
- f) location of the CRS in the cabin;
- g) CRS installation; and
- h) considerations related to special situations.

4.2.1.2 Sections 4.2.2 to 4.2.9 present detailed guidance on each of these aspects. The appendix to this chapter includes sample operator policy and procedures on the use of CRS.

4.2.2 Methods of restraining infants/children on board aircraft

The operator's policy should define the acceptable methods of restraining infants/children on board its aircraft. These methods should be clearly outlined by the State (see Chapter 3, 3.5).

4.2.3 Requirements for accompanying parent

4.2.3.1 The operator's policy should require that a CRS occupant be accompanied by a parent of a certain age, as defined by national regulations. A parent must not be allowed to share a seat belt with an infant/child. Additionally, the operator should prohibit the use of one seat belt for more than one infant/child.

4.2.3.2 In addition, no person should be responsible for more than one infant (i.e. person less than two years of age). Considerations related to parents travelling with more than one child (i.e. person over two years of age) are addressed in section 4.2.9.

4.2.4 Responsibility for furnishing CRS

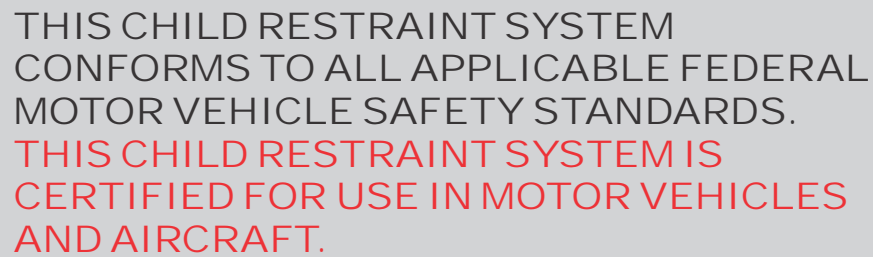
The operator's policy should define who is responsible for furnishing the CRS which may be provided by the operator or by the parent. The responsibility for CRS installation depends on who furnishes the device. Considerations regarding CRS installation should be addressed in the operator's procedures. See 4.3.2.1 for further guidance.

4.2.5 Types of CRS approved for use on board

4.2.5.1 The operator's policy should clearly indicate how passengers and the operator's personnel can identify whether a CRS is approved for use on board aircraft.

4.2.5.2 CRS may be referenced by make (i.e. the manufacturer), model or labels. Labels on the CRS may include:

- a) required labels mandated by the State (see Figure 4-1);
- b) approval labels (e.g. showing approval by the State through a supplemental type certificate (STC), an approval of another State or a label showing that the CRS was manufactured under standards of the United Nations); or
- c) other labelling criteria (e.g. CRS approved under TSO-C100b must be permanently and legibly marked "TSO C-100b").



THIS CHILD RESTRAINT SYSTEM
CONFORMS TO ALL APPLICABLE FEDERAL
MOTOR VEHICLE SAFETY STANDARDS.
THIS CHILD RESTRAINT SYSTEM IS
CERTIFIED FOR USE IN MOTOR VEHICLES
AND AIRCRAFT.

Figure 4-1. Example of a State's required label on CRS

4.2.6 Acceptance and refusal policies regarding CRS

4.2.6.1 CRS need to comply with the applicable State criteria and the established operator policy. The policy should indicate that only devices meeting State criteria are to be accepted for use on board. Criteria should include, but not be limited to, the following:

- a) the CRS occupant must meet the limitations established by the manufacturer of the device;
- b) the CRS needs to fit the aircraft seat dimensions; and
- c) the CRS when fitted must not cause any obstruction to other passengers' egress in an emergency.

4.2.6.2 Any CRS unable to meet these criteria should be refused by the operator's personnel. Some CRS may fit the seat dimensions but features may not allow for proper installation. In such instances, they should also be refused by the operator's personnel.

4.2.6.3 When the parent has purchased a ticket for the infant/child with the intent of placing him/her in a CRS in a dedicated seat, the operator should not prohibit that person from using an approved CRS which meets the established criteria. The self-check-in process should redirect parents to the ground crew to facilitate the assignment of seats for the CRS, prior to boarding.

4.2.6.4 Currently, some States do not allow operators to accept CRS approved for use by other States. In order to harmonize international operations, States are encouraged to broaden the types of CRS approved for use on board aircraft to include those meeting the standards of the United Nations or approved by another State (guidance for the mutual acceptance of CRS between States is presented in Chapter 2, Appendix B). Once the process of mutual acceptance of CRS between States is completed, the operator should include these CRS as acceptable for use on board its aircraft. Passengers should be made aware when differences existing between operators restrict the use of certain types of CRS.

4.2.7 Location of CRS in the cabin

4.2.7.1 The operator's policy should define where a CRS can or cannot be installed. Additionally, the policy should indicate the operator's acceptable alternatives should a CRS not fit into the assigned seat.

4.2.7.2 The policy should include the following points:

- a) the preferred location for the CRS is a window seat;
- b) the CRS cannot block emergency exits or access to safety and emergency equipment;
- c) the CRS cannot be placed in an aisle seat or emergency exit row;
- d) the CRS cannot be placed in the seat row immediately forward or aft of an emergency exit row;
- e) for an infant, the CRS is to be placed in a seat next to the accompanying parent; and
- f) for a child, the CRS should be placed in a seat next to, or closest to, the accompanying parent; and in the same row unless the aircraft configuration does not permit it.

4.2.8 CRS installation

4.2.8.1 The operator's policy should state that a CRS must only be installed on an aircraft seat with the type of connecting device for which it is approved. The person installing the device must follow all safety and installation instructions. For forward- and aft-facing CRS, the manufacturer's criteria must be complied with, in relation to the following:

- a) forward-facing aircraft seats;
- b) rearward-, side- or oblique-facing aircraft seats;
- c) seats equipped with an inflatable restraint/airbag;
- d) seats which can accommodate seat belt extensions; and
- e) seats with unique designs.

4.2.8.2 The installation of CRS on rearward-, side- and oblique-facing seats should be prohibited, unless otherwise stated by the manufacturer's criteria and approved by the State (see Chapter 3, 3.10.1).

4.2.8.3 The policy should specify that, once installed, the CRS should remain appropriately secured to an aircraft seat at all times during the flight, including in the event of an emergency evacuation.

4.2.9 Special situations

The operator's policy should address considerations for special situations that the operator's personnel may encounter. Special situations include, but are not limited to:

- a) *Parents travelling with more than one child.* The operator should define conditions for seat allocations for a person or group that has more than one child per parent (particularly if a parent is not seated next to a child due to the seating configuration of the aircraft). The operator should develop specific procedures for such circumstances, particularly in the event of a decompression or an evacuation.
- b) *Oxygen supply.* The operator should define the seating location of infants so that an oxygen mask is available for each infant on board (regardless of CRS use).
- c) *Infants/children with special needs.* The operator should allow the use of approved restraint systems designed for an infant/child with special needs. This may require additional approvals or exemptions from the State.

4.3 PROCEDURES RELATED TO THE USE OF CRS

4.3.1 General

The operator should develop cabin crew procedures, in line with its policy, on the use of CRS during normal, abnormal and emergency situations. Procedures should also be developed for the operator's ground crew (e.g. check-in agents).

4.3.2 Normal operations procedures

4.3.2.1 Normal operations procedures for cabin crew members should address the acceptability and installation of CRS, considerations related to the seat allocation for CRS and information to be provided during the pre-flight passenger safety briefing and turbulence management. They should include the following:

- a) cabin crew members should check that the CRS is approved for use on board the aircraft, as per State and/or operator's requirements, and secured prior to departure:
 - 1) the CRS needs to be correctly installed and secured by the accompanying parent, as per the manufacturer's instructions; or
 - 2) where supplied by the operator, cabin crew members are responsible for correctly installing the CRS and verifying that its occupant is secured;
- b) seat allocation considerations/restrictions, as defined in the policy, should be applied (see sections 4.2.7 and 4.2.8); and
- c) information to be provided to the accompanying parent, in addition to the required content of a passenger safety briefing as follows:
 - 1) when they are required to secure the CRS occupant, by phases of flight and when the seat belt sign is illuminated;
 - 2) use of oxygen masks;
 - 3) use of infant life jackets, if available on board;
 - 4) securing the infant/child in case of turbulence (if the infant/child is not in the CRS when turbulence is encountered, the parent is responsible to secure him/her in it);

- 5) securing the infant/child in the CRS in the event of an anticipated emergency landing or ditching; and
- 6) in the event of an evacuation, the parent should remove the infant/child from the CRS and leave the device behind.

4.3.2.2 Procedures should include stowage location(s) for devices that are not approved for use on board or CRS that do not fit, or are otherwise incompatible with, the seat. Procedures should take into account space limitations on smaller, regional aircraft, if applicable.

4.3.3 Abnormal and emergency procedures

Abnormal and emergency procedures for cabin crew members should address anticipated emergency landing/ditching and evacuation with infants/children. Cabin crew members should:

- a) carry out the operator's procedures for an anticipated emergency landing or ditching (including the use of flotation devices, if applicable);
- b) instruct the parent to secure the infant/child in the CRS until the evacuation commences; and
- c) instruct the parent to remove the infant/child from the CRS and leave the device behind during the evacuation.

4.3.4 Procedures for ground crew

Operator procedures should require ground crew members to check that the CRS is approved for use on board the aircraft, as per the established requirements.

Appendix A to Chapter 4

SAMPLE OPERATOR POLICY AND PROCEDURES ON CRS

1. GENERAL

1.1 This appendix was created to assist operators to develop a policy and procedures on the use of CRS. It is addressed to operators as well as States' civil aviation authorities. It is not intended to replace any existing policies and procedures developed by operators in accordance with their States' national regulations.

1.2 Although only a recommendation, the sample policy and procedures have been drafted in the mandatory sense (i.e. the word "must" is employed in the text rather than "should") in order to facilitate direct use of the sample policy and procedures as a basis for an operator's policy and procedures.

2. SAMPLE OPERATOR POLICY ON THE USE OF CRS

- a) [Operator] requires all occupants on board its aircraft to occupy a seat with a seat belt and/or safety harness fastened during aircraft movement on the surface, for take-off, landing, and turbulence, and whenever the seat belt sign is illuminated. An infant/child cannot share a seat belt with an adult or another infant/child;
- b) [Operator] requires the use of an approved child restraint system (CRS) appropriate for the infant/child. The CRS is to be furnished by a parent or guardian, who must be over [x] years of age (refer to [State] approved CRS below);
- c) the CRS occupant must meet the limitations established by the manufacturer of the device;
- d) a parent or guardian may not be responsible for more than one infant, at any time, on board the aircraft;
- e) an infant using a CRS must be accompanied by a parent or guardian, who is seated next to the CRS occupant;
- f) a child using a CRS must be accompanied by a parent or guardian, who is seated next to, or closest to, the CRS occupant (and in the same row), unless the aircraft configuration does not permit it;
- g) the use of booster seats is not permitted on board [Operator] aircraft;
- h) the use of infant slings is not permitted during movement on the surface, take-off, and landing;
- i) the CRS must be appropriately secured to an aircraft seat at all times;
- j) [Operator] restricts seating locations of CRS on its aircraft to comply with safety requirements. As one example, a CRS cannot be used in an emergency exit row or seat. Other locations may vary depending on the aircraft type and configuration; and

- k) in order for [Operator] to best meet passenger needs for special assistance, parents or guardians travelling with infants/children with special needs should make the assistance request when booking the ticket, at least [x] hours prior to departure.

[State] approved CRS

Most CRS that are used in motor vehicles are acceptable for use on board aircraft. Acceptable CRS must bear two labels. However, typically the text for these two required labels is merged onto one label. The labelling must include the text “This child restraint system conforms to all applicable [State] motor vehicle safety standards” and, in red lettering, “This child restraint system is certified for use in motor vehicles and aircraft”.

CRS manufactured outside [State] may be accepted provided that they bear either a label showing approval of a foreign government or a label showing that the CRS was manufactured under the standards of the United Nations. However, booster seats approved by other States or the United Nations remain prohibited for use at any time.

3. SAMPLE OPERATOR PROCEDURES ON THE USE OF CRS

Infant and child seating

[State] regulations require all occupants on board an aircraft to occupy a seat with a seat belt and/or safety harness during aircraft movement on the surface, for take-off, landing, turbulence, and whenever the seat belt sign is illuminated. An infant/child cannot share a seat belt with an adult or another infant/child. The infant/child must be in an approved child restraint system (CRS). The CRS occupant must be accompanied by a parent or guardian. The following restrictions apply:

- a) for infants, the parent or guardian must be seated next to the CRS occupant; and
- b) for children, the parent or guardian must be seated next to, or as close as possible to, the CRS occupant (in the same row), unless the aircraft configuration does not permit it.

CRS criteria

Only approved CRS can be used on board [Operator] aircraft. CRS must be certified and labelled as complying with the regulations of [State], or the United Nations, or another State, as long as the CRS can be secured to a forward-facing passenger seat.

Booster seats are prohibited for use at any time. Infant slings are prohibited during movement on the surface, take-off and landing. Any device without approval label(s) is also prohibited.

If a passenger has purchased a ticket in order to use a CRS on board the aircraft, and the device is an approved type and is compatible with the seat, use of the CRS must be allowed.

CRS location in the cabin

So that a CRS do not block or restrict passenger movement during an emergency evacuation, its preferred location is a window seat. Centre seats, in a row of seats, may be acceptable provided that the seats next to the infant/child are occupied by adults responsible for the CRS occupant.

When practical, one CRS per row segment is preferable. For passengers travelling with more than one infant or child, more than one CRS per row segment is allowed if the CRS occupants are from the same family or travelling group, provided that each parent or guardian is responsible for no more than one infant. Seating may depend on the aircraft type.

A CRS may face toward the front or rear of the aircraft in accordance with the manufacturer's instructions, as long as it does not prevent or hinder the movement of adjacent passengers, block exits, or obstruct access to safety and emergency equipment.

The CRS must be secured to a passenger seat at all times during aircraft movement on the surface and during flight, even when it is not occupied. No other person may occupy the same passenger seat. The infant/child must occupy the CRS when the seat belt sign is illuminated, during turbulence, when placards are posted, and when crew members give instructions to fasten seat belts.

CRS are not permitted in the following locations:

- a) an aisle seat;
- b) a cross aisle seat (at a bulk head) that forms part of the evacuation route to the exits;
- c) an emergency exit row; and
- d) a row immediately forward or aft of an emergency exit row.

CRS installation

A CRS may only be installed on aircraft seats with the type of connecting device for which it is approved and qualified. All safety and installation instructions must be followed carefully by the parent or guardian.

Cabin crew members should check with the parent or guardian that the CRS has been properly secured to a forward-facing passenger seat and the occupant is secured in the device. Cabin crew members must prohibit the use of any inadequately secured CRS that do not meet the above qualifications.

Additional limitations are:

- a) certain CRS do not fit the First and Business Class seats on the [fleet] aircraft;
- b) CRS cannot be installed on oblique-facing or side-facing seats, unless approved by [State]; and
- c) devices that are not approved for use on board the aircraft, or CRS that do not fit in the seat, should be stowed in the designated stowage location(s) of the [fleet] aircraft.

Passenger safety briefing

The following information should be given to the parent or guardian, in addition to the required content of a passenger safety briefing:

- a) information on when they are required to secure the CRS occupant, by phases of flight and when the seat belt sign is illuminated;
- b) use of oxygen masks;
- c) use of infant life jackets, if available on board;
- d) in case of turbulence, the infant/child needs to be secured in the CRS. If the infant/child is not in the CRS when turbulence is encountered, the parent or guardian is responsible to secure them in it;
- e) in the event of an anticipated emergency landing or ditching, the infant/child needs to be secured in the CRS; and
- f) in the event of an evacuation, the parent or guardian should remove the infant/child from the CRS and leave the device behind.

Emergency evacuation procedures

In an emergency situation, the infant/child must remain secured in the CRS until the evacuation commences. During the evacuation, the CRS must remain attached to the passenger seat. Only the infant/child must be removed from the aircraft.

Chapter 5

TRAINING

5.1 REVISION OF THE CABIN CREW TRAINING PROGRAMME

5.1.1 The operator's policy and procedures related to the use of CRS should be addressed during cabin crew training. Guidance on cabin crew training regarding infant/child safety and the use of CRS can be found in the *Cabin Crew Safety Training Manual* (Doc 10002) (see chapter related to normal operations training). Additionally, training should address the application of procedures in the case of an emergency landing/ditching and in the event of evacuation with infants/children on board. Guidance on cabin crew training regarding abnormal and emergency situations can be found in Doc 10002 (see chapter related to abnormal and emergency situations training).

5.1.2 As part of the process to allow the use of CRS on board, the operator should modify its approved training programme to ensure it addresses policy changes, specific procedures and relevant modifications regarding cabin crew tasks. The revised training should focus on the changes in the policy and procedures that accompany the use of CRS. The revised training content should be reviewed by the State.

5.1.3 This chapter provides a list of key elements that, if not currently covered, should be addressed in the operator's cabin crew training programme in order to safely implement the use of CRS. The State may consider it acceptable that the operator provides written or verbal briefings, or other methods of communication that it normally uses to convey urgent information, as an interim method until the training programme can be revised or receives final approval. When moving forward with the use of CRS, the operator should consider the benefits of early communication with its cabin crew members regarding upcoming changes.

5.2 CONTENT OF THE CABIN CREW TRAINING PROGRAMME

The operator should define the content related to CRS to be included in the approved cabin crew training programme. The operator's policy and procedures related to the use of CRS should be included in cabin crew initial training¹. In addition, the operator should update cabin crew members on any changes to the policy and/or procedures related to CRS (e.g. during recurrent training).

5.3 CABIN CREW INITIAL TRAINING

5.3.1 Doc 10002 presents specific cabin crew tasks, several of which address the use of CRS and the application of associated operator policies and procedures. The material covered in this manual addresses specific policies and procedures that cabin crew members should be knowledgeable about to perform their tasks in relation to the use of CRS. Classroom or computer-based training are appropriate conditions for training and assessment. If the operator provides specific CRS, hands-on exercises on the use of the CRS should be included during training.

1. Refer to the *Cabin Crew Safety Training Manual* (Doc 10002), Chapter 1 — *Cabin crew safety training requirements and qualifications*.

5.3.2 Cabin crew initial training should include, but is not limited to, the following topics:

- a) overview of CRS;
- b) operator's policy regarding the use of CRS, and how to interpret and apply it;
- c) operator's procedures on the use of CRS, and other cabin crew tasks related to infant/child passengers; and
- d) passenger management.

5.3.3 Sections 5.4 to 5.7 present detailed guidance on each of these topics.

5.4 OVERVIEW OF CRS

Training should include, but is not limited to, the following topics:

- a) types of approved CRS available and in general terms (that passengers may bring on board and/or CRS specific to the operator if it provides them to passengers), the criteria used to determine if a CRS has been correctly secured;
- b) label identification to assess acceptability of a CRS, including the content of labels which need to be on the CRS for use on board aircraft;
- c) types of devices that are not accepted for use at any time;
- d) limitations established by the CRS manufacturer for the types of CRS accepted by the operator (e.g. weight); and
- e) safety hazards associated with not using CRS, the improper use of CRS or the use of unapproved CRS.

5.5 OPERATOR POLICY ON THE USE OF CRS

Training should include, but is not limited to, the following topics:

- a) State's regulations on the use of CRS; and
- b) operator's policy regarding the use of CRS, their objectives and how they relate to cabin crew tasks as individuals in the organization.

Note.— Although not addressed in detail in this manual, flight crew members should be made aware of the operator's policy on the acceptance of CRS.

5.6 OPERATOR PROCEDURES ON THE USE OF CRS AND INFANT/CHILD SAFETY

Training should include, but is not limited to, the following topics:

- a) operator's policy and procedures for the acceptance or refusal of CRS and who is responsible for making this decision;
- b) cabin crew member's or passenger's responsibility for installing the CRS, as applicable;
- c) criteria for seat allocation for CRS, as well as applicable restrictions;
- d) stowage location(s) of devices that are not approved for use or instances where CRS may not fit, or otherwise be incompatible with the seat, including space limitations on smaller, regional aircraft (if applicable);
- e) information provided to the accompanying parent, in addition to the required content of a passenger safety briefing; and
- f) operator's procedures for:
 - 1) turbulence management;
 - 2) use of oxygen/decompression;
 - 3) emergency landing/ditching; and
 - 4) evacuation.

5.7 PASSENGER MANAGEMENT

Passengers who refuse to comply with the operator's CRS policy may be classified as unruly. Guidance on cabin crew training for managing unruly passengers is contained in Doc 10002 (see chapter related to aviation security training).

5.8 RECURRENT TRAINING

The content of cabin crew recurrent training should include, but is not limited to, the following topics, if applicable:

- a) changes to the operator's CRS policy and procedures;
- b) review of recent occurrences (e.g. incidents or issues) related to the use of CRS or infant/child safety; and
- c) recent developments in CRS that cabin crew members may encounter on board (e.g. CRS recently approved by the State for use on board aircraft).

5.9 GROUND CREW TRAINING

5.9.1 In addition to cabin crew training, the operator should define the content related to CRS to be included in the ground crew training programme. Ground crew members should receive training on the company's policy and procedures related to the use of CRS.

5.9.2 Training should include, but is not limited to, the following topics:

a) overview of CRS:

- 1) operator's policy and procedures for the acceptance or refusal of CRS and who is responsible for making this decision;
- 2) types of approved CRS that passengers may bring on board (and/or CRS specific to the operator, if it provides them to passengers) and their proper use;
- 3) label identification to assess acceptability of a CRS;
- 4) limitations established by the CRS manufacturer for the types of CRS accepted by the operator; and
- 5) types of devices that are not accepted for use at any time;

b) operator's policy and procedures on the use of CRS:

- 1) changes to the operator's CRS policy and procedures;
- 2) exit and restricted row requirements; and
- 3) carry-on baggage policy and restrictions, including space limitations on smaller, regional aircraft (if applicable); and

c) passenger management:

- 1) dealing with unapproved devices;
- 2) conflict resolution with passengers, including passengers who expect to be given an empty seat for their CRS;
- 3) carry-on baggage issues specific to CRS; and
- 4) passengers travelling with multiple operators, who may experience different policies on the acceptability of CRS.

5.9.3 The following considerations should be taken into account if the operator outsources its ground handling services:

- a) CRS training given for ground crew members by the ground handling service provider(s);
- b) process for updating changes to the operator's CRS procedures by the ground handling service provider(s); and
- c) service level agreements between operator and ground handling service provider(s).

5.10 STATE INSPECTOR AWARENESS

5.10.1 As part of its oversight responsibilities related to use of CRS, the State needs to approve changes in the operator's training programmes and documentation (operations manual, training manuals, etc.) and monitor aspects related to the use of CRS during scheduled, continued surveillance activities.

5.10.2 The State should conduct an awareness programme related to CRS for its designated inspectors to provide them with the knowledge needed to carry out their assigned oversight responsibilities. Similarly to the requirements for operators, the State should define the content to be included in the inspectors' awareness programme.

5.10.3 The inspectors' awareness programme should include, but is not limited to, the following topics:

- a) regulations and guidance material related to CRS:
 - 1) national regulations related to the use of CRS, as well as those of foreign operators operating into the State; and
 - 2) ICAO guidance material regarding the use of CRS;
 - b) overview of CRS:
 - 1) the types of approved CRS that passengers may bring on board (and/or CRS specific to the operator, if it provides them to passengers) and their proper use;
 - 2) label identification to assess acceptability of a CRS;
 - 3) identification of the safety hazards associated with not using CRS, the improper use of CRS or the use of unapproved CRS; and
 - 4) limitations established by the CRS manufacturer for the types of CRS approved for use by the State;
 - c) operator-specific information related to the use of CRS and to infant/child safety:
 - 1) familiarity with the operator's cabin crew and ground crew training programmes and operations manual, as relevant to the topic of CRS use;
 - 2) awareness of the operator's cabin crew and ground crew tasks related to CRS acceptability and use;
 - 3) awareness of the operator's procedures on infant/child seating (specifically during aircraft movement on the surface, take-off and landing), in the event of turbulence, decompression, emergency landing/ditching and evacuation with infants/children on board; and
 - 4) awareness of the operator's reporting procedures for occurrences involving CRS; and
 - d) occurrences related to infant/child safety, internationally and within the State.
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Chapter 6

INFORMATION TO PASSENGERS

6.1 RAISING AWARENESS ON THE NEED FOR CRS

6.1.1 Since, at the time of publication, there was no international standard mandating the use of CRS for air travel, public information campaigns that focus on the benefits of using CRS on board aircraft can be helpful to promote awareness among the travelling public. Such campaigns may help parents understand the safety reasons for, and importance of, using CRS and to promote the use of CRS. For example, in the field of road safety, the FIA Foundation for the Automobile and Society, the Global Road Safety Partnership and the World Bank recommend that, to be successful, legislation should be preceded by public information campaigns to raise awareness of the benefits of wearing seat belts¹. A public information campaign is a key step when States aim to implement a programme to increase use of a safety device or initiative. Similar benefits can be sought in aviation: public information campaigns aimed at parents can be used to raise awareness, increase safety consciousness and help make the use of CRS on board aircraft a social norm.

6.1.2 Raising awareness on infant/child safety and the use of CRS should be a joint State-industry effort. Both the State and the operator(s) should provide specific information on the use of CRS, and infant/child passenger safety more generally, to the travelling public. Information should be readily accessible (e.g. on the organization's website) and presented in a concise manner.

6.2 INFORMATION PROVIDED BY THE STATE

6.2.1 The State should conduct a public awareness campaign that can cover different types of media (internet, public announcements on television, etc.). The goal of the State's campaign is to promote the use of CRS, whether compulsory or voluntary. In addition, the State should provide pertinent information on the use of CRS, which should remain readily available on its website, for parents to consult.

6.2.2 Key messages that should be communicated to the travelling public include, but are not limited to, the following:

- a) the safest place for an infant/child is in an approved CRS, appropriate for that infant/child;
- b) an infant/child should be secured in a CRS based on his/her weight and/or height;
- c) a certain type of CRS may not be accepted throughout the passenger's entire journey if they connect onto an interlining flight operated by a foreign operator (because what constitutes an approved CRS may depend on specific requirements from the State of that operator); and

1. *Seat-belts and child restraints: A road safety manual for decision-makers and practitioners*, London, FIA Foundation for the Automobile and Society, 2009

- d) passengers need to consult with the operator for the types of CRS accepted (or available) and the appropriate location(s) for CRS installation on board aircraft.

6.2.3 The State should clearly explain that the safest place for an infant/child passenger is in an approved CRS, in a dedicated seat, and appropriate for that infant/child. If the use of CRS is voluntary, the State should make a clear recommendation that encourages parents to restrain infants/children meeting certain criteria (based on age, weight, height, etc.) in an approved CRS when travelling by air.

6.2.4 The State should explain to parents that, when choosing an appropriate CRS for their infant/child, the selection should be based on the child's weight and/or height, and on limitations established by the CRS manufacturer. The State should provide clear guidance (e.g. in the form of a table or pictorially on its website) to help parents understand which devices may be used. Table 6-1 provides an example that indicates to parents how to choose a CRS based on an infant/child's weight.

Table 6-1. Example of CRS selection criteria based on infant/child's weight

<i>If the infant or child weighs</i>	<i>Use</i>
Less than 10 kg (22 lbs)	Aft-facing CRS
10 to 30 kg (22 to 66 lbs)	Forward-facing CRS
More than 26 kg (60 lbs) and is taller than 125 cm (49 in)	Aircraft seat belt

6.2.5 Information should be conveyed to parents on what constitutes an acceptable CRS, approved by the State for use on board aircraft. To avoid confusion and promote the use of approved CRS, the State should provide clear guidance on how parents can assess whether their CRS is approved for use on board aircraft. Figure 6-1 presents an example of labelling requirements that a CRS must have in order to be accepted. Such examples should be available on the State's website. The State should clearly indicate which CRS are prohibited on board aircraft, particularly to avoid confusion when parents have CRS that the State allows for use in motor vehicles but not on board aircraft.

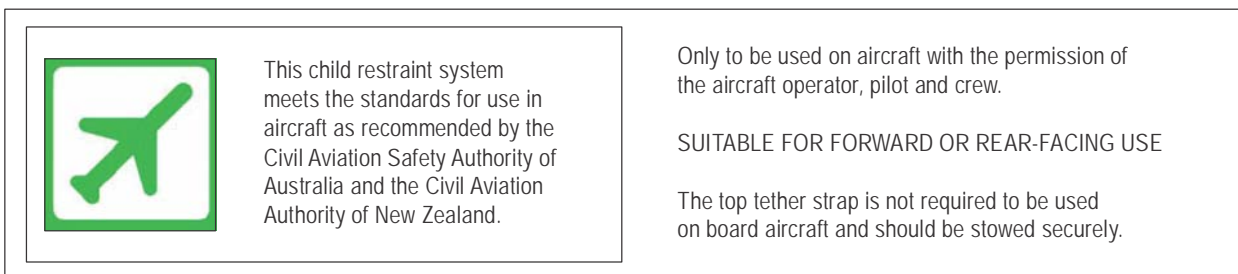


Figure 6-1. Example of labelling requirements (Source: CASA)

6.2.6 Approval of CRS may vary from State to State. The State should inform parents on the need to consult with each operator for the types of CRS permitted or available for use on board aircraft, as well as any restrictions or specifications (see Chapter 6, 6.3.2). Due to the lack of internationally harmonized regulations, parents may also be faced with different requirements related to the use of CRS, particularly when interlining on international flights. The State should recommend that parents consult with the individual operators, when travelling on a multi-sector journey with connections, to identify potential differences in CRS policies.

6.2.7 In addition to the different acceptability policies on international flights, financial repercussions associated with the use of CRS may need to be conveyed to the travelling public. The State should focus on the positive safety aspects that come with the use of an approved CRS, as part of its public awareness campaign.

6.3 INFORMATION PROVIDED BY THE OPERATOR

6.3.1 In addition to the information provided by the State, the operator should provide information as follows:

- a) CRS policy;
- b) passenger seat measurements;
- c) restrictions and specifications;
- d) on board safety information; and
- e) fees associated with the use of CRS on board.

6.3.2 The operator should convey information related to its policy on the use of CRS, in a concise manner, so that parents can choose a CRS appropriate for their infant/child. This includes the types of CRS permitted, as well as a list of prohibited devices, and how parents can determine whether their CRS is acceptable prior to arriving at the airport. It should also recommend that parents consult with the operator when travelling on a multi-sector journey with connections to identify potential differences in the CRS acceptability policies of individual operators which may operate some of the sectors.

6.3.3 The operator should provide information regarding the width of the passenger seat in each class for all cabin configurations of the aircraft in its fleet, as well as the pitch (some aft-facing CRS need more space to be fitted correctly and may also prevent the seat ahead from being fully reclined). This enables parents to determine ahead of time whether their CRS will fit in the aircraft's seat.

Note.— The operator may consider stating which brands and models of CRS fit its aircraft seats.

6.3.4 The operator may require that parents make pre-arrangements when travelling with infants/children using CRS. Some operators may provide a CRS which may need to be reserved by the parent before the flight. Operators that do not provide CRS, but accept them on board, may have additional information on their websites regarding restrictions or specifications. Some operators may limit the number of infants/children that can accompany a parent, or require advanced notification if the infant/child has special needs. The operator should provide information on any such restrictions and specifications.

6.3.5 The operator should also provide pertinent safety information to parents once they are on board and prior to departure. This may be accomplished through the pre-flight one-on-one safety briefing carried out by the cabin crew members (see Chapter 4, 4.3.2 for detailed guidance).

6.3.6 Additionally, the operator should indicate any applicable fees associated with the use of CRS and information on fares for the purchase of an additional seat to accommodate the CRS, if applicable.

6.4 METHODS USED FOR DISSEMINATION OF INFORMATION

The State and the operator should define the methods that will be used to disseminate information related to the use of CRS. These may include, but are not limited to, the following:

- a) *State media campaign.* The State should develop a public awareness campaign to promote the use of CRS (regardless if use is compulsory or voluntary). The campaign should raise the profile of CRS use and convey pertinent information, as described in 6.2.
 - b) *Organization's website (State and operator).* The State and operator should provide detailed information, as described in 6.2 and 6.3, respectively, on their websites so that this information remains readily available to passengers.
 - c) *Screen pop-ups.*
 - 1) on the operator's website in the booking system so that they appear when a ticket is purchased. The pop-up should provide information on the CRS that are required or recommended for infants/children;
 - 2) in the online check-in system or at self-check-in kiosks; and
 - 3) on the operator's website a means to respond to passenger queries.
 - d) *On board safety information.* Prior to departure, in addition to the required content of a passenger safety briefing, the operator should provide safety information to passengers who bring CRS on board, (see Chapter 4, 4.3.2).
 - e) *In-flight magazine.* The operator should consider providing relevant safety information in its in-flight magazine or other printed media (see 6.3.1).
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Chapter 7

POST-IMPLEMENTATION ACTIVITIES

7.1 CONTINUED SURVEILLANCE BY THE STATE

7.1.1 As a follow-up to the initial approval and implementation of the use of CRS, the State should include aspects related to CRS as part of its continued surveillance activities of the operator. These include, but are not limited to, the following:

- a) inspections/surveillance activities by the State;
- b) identification of non-compliance;
- c) resolution of issues/corrective action(s);
- d) enforcement action, if applicable; and
- e) voluntary reporting.

7.1.2 The State should require the operator to monitor hazards associated with the use of CRS through the established safety assurance processes of its safety management system (SMS). As part of its continued surveillance activities, the State should gather information to verify that the operator follows up on:

- a) any safety risks associated with the use of CRS and restrained or unrestrained infants/children;
- b) any occurrence that involved CRS;
- c) incidents/injuries caused by the use of CRS;
- d) data on the number of infants and children travelling by air; and
- e) any findings resulting from surveillance activities.

7.1.3 As part of its continued surveillance and in line with its established reporting requirements, the State should require the operator to:

- a) report occurrences involving the use of CRS within specified time frames;
- b) record and retain any hazard and occurrence reports involving the use of CRS and make them available to the State upon request or inspection; and
- c) monitor the effectiveness of corrective actions.

7.2 SAFETY RISK MANAGEMENT AND SAFETY ASSURANCE BY THE OPERATOR

The safety risk management process allows the operator to identify, analyse, assess and control the safety risks associated with identified hazards related to the use of CRS, as part of its SMS. This process may result in the establishment of mitigation strategies. Once these strategies have been approved and implemented, the operator should continue to monitor CRS-related occurrences (as described in 7.1.2) and collect data to assess the effectiveness of the established mitigation strategies through its safety assurance processes.

7.3 CREW REPORTING AND INVESTIGATION

7.3.1 As part of the operator's SMS, crew members should report hazards and occurrences involving the use of CRS through existing mandatory or voluntary reporting processes. The safety concerns related to the use of CRS should be reported to the operator for follow-up action and investigated, if applicable. These include, but are not limited to, the following:

- a) non-compliance with regulatory requirements;
- b) non-compliance with operator policies (acceptance of an unapproved CRS, installation of a CRS in a restricted location, passenger failure to comply with crew member instructions, lack of harmonization between operators, etc.);
- c) issues related to the use of CRS or other devices, or unrestrained infants/children; and
- d) issues encountered with new types of CRS or related technology.

7.3.2 Both the State and the operator should encourage reporting by crew members of hazards and occurrences pertaining to the use of CRS. In the interest of aviation safety, States may share aggregated, de-identified information related to CRS occurrences with other relevant stakeholders (other States, manufacturers, operators, etc.).

Note.— Safety data collection, analysis and exchange should be in accordance with Annex 19 — Safety Management.

7.4 ENFORCEMENT ACTION

The State should have an established process to enforce compliance with applicable rules and regulations. If the operator violates regulations regarding the use of CRS, or fails to accomplish the necessary corrective action(s) within a reasonable time, the established process for enforcement should be followed, as with any other issue.

Note.— Detailed guidance on SMS and safety assurance is contained in the Safety Management Manual (Doc 9859). Detailed guidance on State surveillance activities is contained in the Manual of Procedures for Operations Inspection, Certification and Continued Surveillance (Doc 8335).

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