



Preventing Inadvertent Slide Deployments

The number of people injured when emergency escape slides are inadvertently deployed is low. Nevertheless, such events pose a threat to the safety of people in or around aircraft. They are also a cause of aircraft damage, and departure delays.

This article looks at how Inadvertent Slide Deployments (ISDs) can be avoided, and presents a new solution available to prevent them.

INADVERTENT SLIDE DEPLOYMENTS

ISDs and their impact

Aircraft escape slides are an essential piece of Safety equipment. Designed to be fully deployed and inflated within a maximum of ten seconds, they are a powerful and efficient means of ensuring safe exit from an aircraft in case of an emergency.

Yet the same speed and efficiency of activation can also mean that there is no time to stop the deployment, when anybody operating a door inadvertently activates a slide.

As per IATA definitions, an Inadvertent Slide Deployment (ISD) is the 'unintentional deployment (full or partial) of an aircraft emergency evacuation slide or slide raft'.

ISDs occur when the operator attempts to open the door under normal operational circumstances such as at aircraft turnaround, when the slide is in the armed condition.

If an ISD occurs, it may cause serious injury of operatives inside the cabin or outside the aircraft. ISDs also have economic impacts and cause operational disruptions.

The minimum cost of an event involving a 90 minute ground delay is estimated at around 11,000 USD. If the ISD leads to a flight cancellation and a requirement to accommodate passengers in hotels, the cost can rise as high as 200,000 USD.

Causes of ISDs

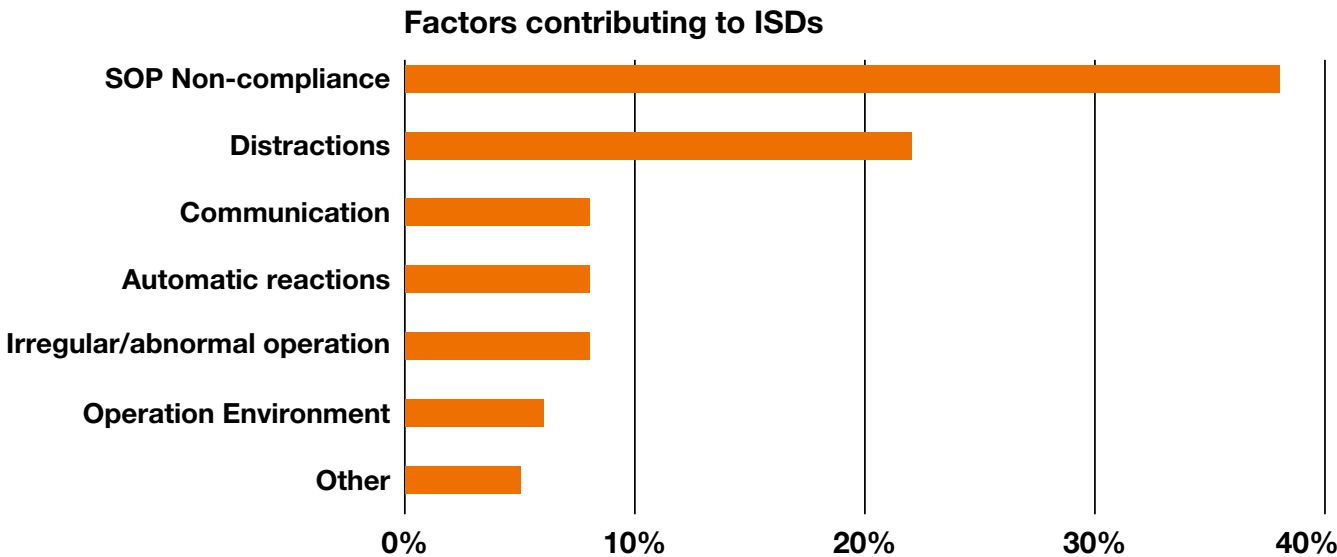
Airbus monitors reports of ISDs coming in from in-service operations, and investigates each report to understand the causes. The number of cases reported to Airbus is quite consistent on an annual basis, at 35-45 per year.

Investigation of the location of ISDs occurring on Airbus fleets in 2017 shows that the majority occur at the forward left door and the rear doors, due to the more frequent usage for boarding and loading operations.

“ An Inadvertent Slide Deployment is the full or partial unintentional deployment of an aircraft emergency evacuation slide or slide raft. ”

(fig.1)
Results of a study into factors contributing to ISDs.
Source: IATA Cabin Operations Safety Conference 2014.

An IATA survey of 47 airlines conducted between 2014 & 2015, found that the occupational group most frequently identified in reported ISDs was cabin crew. Ground staff, maintenance, flight crew and passengers were all less frequently identified in ISD reports.



“ SOP Non-compliance and distractions are identified as the leading factors of ISDs. ”

In a previous study presented at the 2017 IATA Cabin Operations Safety Conference, a number of contributing factors to ISDs were identified which are highlighted in **(fig.1)**. SOP Non-compliance and distractions are identified as the leading factors.

In reports provided to Airbus these factors are also evident, together with information putting into context the human factors elements associated with the report.

Issues of crew fatigue, distraction by passengers moving in the cabin, and the time pressures of turn-around operations can be identified.

Other factors include poor communication/coordination between crew members, and the complexity present when cabin crew fly on various aircraft types with different door designs.

Examples of ISD report contents:

“The captain accidentally deployed Door 1R slide at the gate, when he opened the door to look outside, the door was still armed.”

“At arrival, the flight attendant at the forward doors inadvertently pulled the door operating handle instead of the door disarming lever.”

“During a short transit time, catering staff opened Door 1R in armed position and the escape slide deployed.”

DOOR OPENING PRACTICES

Cabin Crew Standard Operating Procedures (SOP)

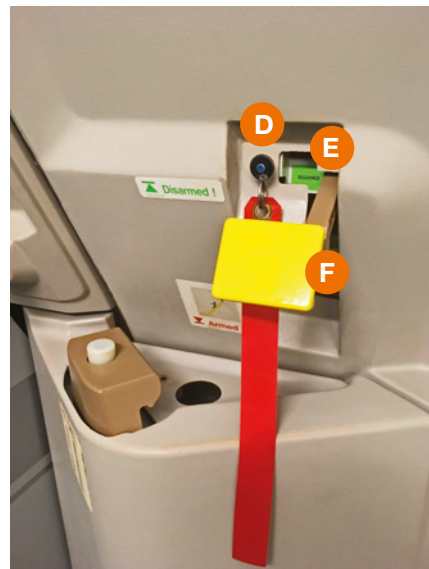
Definition of SOP by each airline is a process which needs to take into account factors specific to the airline, including standardisation of procedures in mixed fleet operations between aircraft of different manufacturers, the regulations of local airworthiness authorities, practices of ground handling companies at different airports, etc.

It is therefore an airline responsibility to identify within their own SOP which staff take which actions, and when. Nevertheless, in all cases, the procedures to arm and disarm the slide include three stages; the command, the action (arm or disarm), and the confirmation (cross-check).

When performing these three stages on Airbus aircraft, SOP can take into account the design of Airbus slides, which include a Safety Pin. When used in accordance with SOP, the Safety Pins prevent the arming lever from being inadvertently moved to the armed position.

The Airbus PIN-LEVER-PIN model

Once the command to arm or disarm the slides has been issued, cabin crew can use the mental model of 'PIN-LEVER-PIN' in order to ensure the steps associated with arming or disarming in the SOP are correctly followed.



(fig.2)

ARMED/DISARMED conditions for A320 Family cabin door

- A** Visual indicator shows **ARMED** condition
- B** Arming lever in the **ARMED** position
- C** Safety pin in its stowage
- D** Safety pin installed
- E** Visual indicator shows **DISARMED** condition
- F** Arming lever in the **DISARMED** position

To disarm a door slide, the first action is to remove the safety pin from its stowage in the door (PIN). The arming lever is then placed in the disarmed position (LEVER). Finally, the Safety Pin is inserted into the dedicated hole near the Arming Lever (PIN). The lever then cannot be accidentally being moved from the disarmed to the armed position.

(fig.3)
Girt Bar Floor Indicator on
A320 Family aircraft



To arm a slide, the procedure is applied in reverse; the Safety Pin is removed from its hole near the Arming Lever (PIN). The Arming Lever can then be pushed down into the armed position (LEVER). With the door armed, the pin is placed back in its stowage (PIN).

Once the arm or disarm action is complete, the principle means of confirmation of the door condition of the door is by use of the Visual Indicator **(fig.2)**.

For A320 Family aircraft, Girt Bar Floor indicators at doors 1 and 4 provide an additional visual indicator to aid crew awareness of the slide's arming condition **(fig.3)**. When the door is armed the indicator (orange spot) aligns with an arrow

A PRODUCT IMPROVEMENT TO PREVENT ISD

Doors on Airbus aircraft are equipped with a “SLIDE ARMED” warning light and an optional buzzer. This light and buzzer are activated when the slide is armed and someone lifts the door handle.

In order to prevent ISDs Airbus has introduced an upgraded “SLIDE ARMED” light and buzzer system, which provides a warning to operatives before they touch the handle.

This system is called the Inadvertent Slide Deployment Prevention Light (ISDPL), and is currently available for the forward and aft doors of A320 Family aircraft.

Inadvertent Slide Deployment Prevention Light (ISDPL)

ISDPL is a maintenance free plug & play replacement to the standard Slide Armed Warning Lights, which are installed under the passenger door window **(fig.4)**.

Compared to the standard warning light, ISDPL also includes an ultrasonic sensor to measure the proximity of personnel to the door handle, and a small loudspeaker to provide audible warnings.

(fig.4)
Example of pre and
post-modification ISDPL



Standard Slide Armed Warning Light



ISDPL

When operative, ISDPL provides both visual and audible means for reminding personnel who are operating the door that the door is armed. Both visual and acoustic alerts are triggered when three conditions are met:

1. The aircraft is powered, and on ground
2. The slide lever is in the armed position
3. A person approaches or tries to lift the door handle

As operatives approach the door, warnings are triggered. Two different warning levels occur, depending on the person's proximity to the ultrasonic detection device, located near the door handle **(fig.5)**.

When someone approaches within 60 cm of the ultrasonic detection device, the slide armed warning light flashes.

When someone approaches within 30 cm of the ultrasonic detection device, a second level of warning is generated by adding three short audio warnings in addition to the flashing light.

As with the basic "SLIDE ARMED" warning light, when someone has placed their hand in immediate proximity to the ultrasonic detection device, or moves the handle, ISDPL makes a continuous noise and the light remains on.

Testing & Certification

The development of ISDPL has been driven primarily by Human Factors (HF) considerations. Specifically, the design objective has been to provide a warning that reminds operatives that the slide is armed, with the warning being provided early enough to prevent crew action.

Testing of different designs allowed Airbus to identify that this warning must be provided before operatives have touched the handle.

Full scale Human Factors tests using the visual plus audible warning concept embodied in ISDPL were conducted with 240 industry professionals from three airlines including 185 cabin crew and 23 flight crew. These tests successfully validated that the concept prevents operatives from opening the door when the slide is still armed.

During certification of the design with the airworthiness authorities, additional Human Factors tests were performed to prove that passengers would still open the door during a real evacuation.

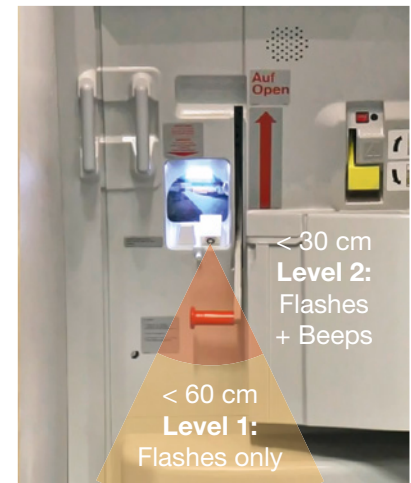
These tests proved that, when under evacuation conditions, the visual and audible warnings do not delay or prevent actions to open the door and deploy the escape slides.

Availability

ISDPL is available for both line-fit and retrofit on a chargeable basis, for A320 Family aircraft. Offerability of ISDPL on other Airbus programmes is currently under review.

(fig.5)

The levels of warning generated by ISDPL depend on proximity to the detection sensor



Watch a description video of the ISDPL by scanning this QR code, or connect to safetyfirst.airbus.com

AMM Procedures for opening A321ceo emergency exit doors

Opening of the Emergency Exit
Doors from the Inside TASK
52-22-00-010-001-A

Opening of the Emergency Exit
Doors from the Outside TASK
52-22-00-010-002-A

ISD ON A321 DOORS 2 & 3

Whilst over 70% of ISDs reported to Airbus occur at Doors 1 or 4 due to action by cabin crew or pilots, a further 25% of reported cases occur on Doors 2 and 3 of A321 aircraft.

Emergency Exit Doors are installed on all A321 aircraft, except on A321neo models with Airbus Cabin Flex (ACF). On A321neo ACF aircraft, Door 3 remains an Emergency Exit door which may however be optionally deactivated.

A321 Emergency Exit doors are similar in appearance to normal passenger doors, except that the escape slides are installed in the fuselage and not a door bustle.

Since they are emergency exits the majority of airlines do not configure them for passenger boarding/disembarkation. ISD reports to Airbus indicate that the slides of these doors are often left in the armed condition during turnaround. ISDs subsequently occur when the doors are opened by maintenance, or other operatives onboard the aircraft.

For cabin crew, Airbus SOPs for arming/disarming of the slides on these doors are the same as for Doors 1 and 4, and available in the CCOM Departure/Arrival procedures.

For maintenance staff, the procedures for slide arming or disarming of A321ceo Door 2 and 3 can be found in the AMM in chapter 52-22. Operators can communicate these procedures to any subcontracting organization which will need to open the doors, including catering or cleaning suppliers.

(fig.6)

Example of an A321ceo Emergency Exit Door, installed at Doors 2 and 3. Reports to Airbus indicate that 25% of ISDs on Airbus fleets occur on these doors. Reports indicate that the slides of these doors are sometimes left in the armed condition during turnaround.



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Inadvertent Slide Deployments (ISDs) can occur, and may cause serious injury of operatives inside the cabin or outside the aircraft. ISDs also have economic impacts and cause operational disruptions.

The main causes of ISDs are non-compliance with Standard Operating Procedures (SOPs), and operatives being distracted whilst operating the doors.

Human factors considerations such as crew fatigue and time pressures during turn-around operations are a key aspect behind non-compliance to SOPs.

To assist crew in memorising the correct sequence of actions in arming or disarming a slide, Airbus recommends using the mental model 'PIN-LEVER-PIN'.

To address the human factor considerations through a technical solution, a product improvement called Inadvertent Slide Deployment Prevention Light (ISDPL), is now available for the forward and aft doors of A320 Family aircraft.

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