Air Accident Investigation Unit Ireland

SYNOPTIC REPORT

ACCIDENT

Avions de Transport Régional
ATR 72-212A, EI-FAX
Dublin Airport, Ireland
30 September 2015

An Roinn Iompair
Turasóireachta agus Spóirt

Department of Transport,
Tourism and Sport

Foreword

This safety investigation is exclusively of a technical nature and the Final Report reflects the determination of the AAIU regarding the circumstances of this occurrence and its probable causes.

In accordance with the provisions of Annex 13[1] to the Convention on International Civil Aviation, Regulation (EU) No 996/2010[2] and Statutory Instrument No. 460 of 2009[3], safety investigations are in no case concerned with apportioning blame or liability. They are independent of, separate from and without prejudice to any judicial or administrative proceedings to apportion blame or liability. The sole objective of this safety investigation and Final Report is the prevention of accidents and incidents.

Accordingly, it is inappropriate that AAIU Reports should be used to assign fault or blame or determine liability, since neither the safety investigation nor the reporting process has been undertaken for that purpose.

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[1] **Annex 13**: International Civil Aviation Organization (ICAO), Annex 13, Aircraft Accident and Incident Investigation.
[2] **Regulation (EU) No 996/2010** of the European Parliament and of the Council of 20 October 2010 on the investigation and prevention of accidents and incidents in civil aviation.
[3] **Statutory Instrument (SI) No. 460 of 2009**: Air Navigation (Notification and Investigation of Accidents, Serious Incidents and Incidents) Regulations 2009.

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In accordance with Annex 13 to the Convention on International Civil Aviation, Regulation (EU) No 996/2010 and the provisions of SI 460 of 2009, the Chief Inspector of Air Accidents on 1 April 2015, appointed Mr Howard Hughes as the Investigator-in-Charge to carry out an Investigation into this Accident and prepare a Report.

Aircraft Type and Registration:	ATR 72-212A, EI-FAX
No. and Type of Engines:	2 x Pratt & Whitney Canada PW127M
Aircraft Serial Number:	1129
Year of Manufacture:	2013
Date and Time (UTC[4]):	30 September 2015 @ 12.30 hrs
Location:	Dublin Airport (EIDW), Ireland
Type of Operation:	Commercial Air Transport
Persons on Board:	Crew - 4 Passengers - 58
Injuries:	Crew - Nil Passengers - 1
Nature of Damage:	None
Commander's Licence:	ATPL[5] issued by the German Federal Aviation Office (LBA)
Commander's Details:	Male, aged 41 years
Commander's Flying Experience:	6,673 hours, of which 3,031 were on type
Notification Source:	Dublin Airport Duty Manager
Information Source:	AAIU Field Investigation, AAIU Report Form, Cabin Crew report

[4] **UTC:** Coordinated Universal Time. On the day of the event, local time = UTC + 1 hour.
[5] **ATPL:** Airline Transport Pilot Licence.

SYNOPSIS

The aircraft was on a scheduled passenger flight from Manchester Airport, United Kingdom, to Dublin Airport, Ireland. Following an uneventful flight, the aircraft arrived at Dublin Airport and taxied to parking stand 133L. Once parked, and with clearance from the Commander, the Senior Cabin Crew Member opened the passenger door, located at the rear of the aircraft, and prepared the integral aircraft steps for disembarkation. This included securing the collapsible handrail in the upright position. During passenger disembarkation this handrail collapsed and a passenger fell from the aircraft steps. The passenger was taken to hospital where it was determined she had sustained a fracture to her right wrist.

NOTIFICATION

The AAIU received notification of the accident at 13.10 hrs from the Dublin Airport Duty Manager. Two AAIU Inspectors arrived at the aircraft at 14.00 hrs to commence a field investigation.

1. FACTUAL INFORMATION

1.1 History of the Flight

EI-FAX departed Manchester Airport, United Kingdom (EGCC) at 11.08 hrs on a scheduled passenger service to Dublin Airport, Ireland (EIDW). The flight was uneventful and the aircraft landed at EIDW and arrived on stand 133L at 12.18 hrs.

Once the aircraft had parked and the engines were shut down, the Commander informed the Senior Cabin Crew Member (SCCM) that the aircraft doors could be opened, and that the passengers could disembark.

The SCCM opened the passenger door, located at the rear of the aircraft, on the left-hand side. This door incorporates a set of passenger steps. The collapsible handrail was placed in the upright position and secured with its quick release pin. The SCCM then made a public address (PA) announcement to the passengers, asking those at the rear of the aircraft to disembark and requesting those in rows 1-10 to remain seated. After approximately 15 passengers had left the aircraft, the SCCM made a further PA asking the remaining passengers to disembark. Just as she finished making the PA, the SCCM heard calls from passengers outside the aircraft requesting assistance.

The SCCM went down the passenger steps. She noticed that the collapsible handrail had fallen back to its stowed position and she saw the injured passenger standing to the right of the steps. The passenger's right arm appeared to be grazed.

After briefly speaking with the injured passenger, the SCCM attended to the collapsed handrail by raising it back to the upright position and re-inserted the quick release pin, which had come out of its locating-hole. The SCCM asked a member of ground staff to stand at the passenger steps, on the side where the handrail had collapsed, to ensure it remained in the correct position, while she attended to the injured passenger.

The SCCM asked the injured passenger if she would like to get back onto the aircraft for their own comfort, whilst assistance was sought. The passenger declined. The SCCM then went back into the aircraft and informed the Commander of the event and made an ice-pack to apply to the passenger's injured arm.

1.2 Injuries to Persons

One passenger was injured. The injured passenger was taken from the airport to receive medical attention. It was later determined that the passenger's right wrist was fractured.

1.3 On-site Investigation

1.3.1 Examination of Aircraft Parking Stand

The Investigation examined the ramp area on which the aircraft was parked. The ramp area was of a concrete construction with a smooth level surface. The passenger door and steps, when deployed in the open position, were found to make contact with the ramp, as designed, and the steps remained stable when inspected by a member of the Investigation team.

1.3.2 Examination of the Aircraft

The Investigation examined the aircraft Technical Log which did not record any prior defects relating to the door or steps. An entry had been made in the defects page of the Technical Log just after the accident which stated '*Passenger/crew door Forward handrail locking pin not locking properly'.* The rectification action stated that the defective quick-release pin had been replaced. The Operator had retained the defective pin.

The Investigation examined the aft passenger door of the aircraft and the steps mechanism, including the handrail system. The steps, treads and handrail system appeared secure. There was no evidence of contamination of the steps from liquid spillage. The original quick-release pin used to lock the collapsible handrail in position was taken for further examination.

1.4 Meteorology

The event occurred during daylight hours. Winds were reported as light and there was no precipitation.

1.5 Interviews and Statements

1.5.1 Commander

The Commander submitted an AAIU Report Form. This indicated that he did not witness the event, but was informed of it by the SCCM via the aircraft interphone system. On receipt of this information he radioed the Handling Agent to notify them that a passenger had fallen and that an ambulance would be required.

Once outside the aircraft he noted that there was no ambulance in attendance, but saw that the injured passenger was sitting in an Airport Police vehicle. He assumed this vehicle would be able to take her for medical attention, if required.

As the injured passenger was in the care of the Airport Police, the Commander and his crew returned to the Operators crew area to file an Operator's Safety Report.

1.5.2 Senior Cabin Crew Member (SCCM)

The SCCM told the Investigation that she was stationed at the rear cabin crew position, by the aft passenger door. When signalled by the Commander, she opened the passenger door and secured the retractable handrail in the upright position with its quick release pin. The SCCM told the Investigation that she then pushed down on the handrail to ensure it was secure. She then handed a member of ground staff the '*ballast*[6]*'* and *'tail-pin'*[7].

She informed the Investigation that she then made a PA informing passengers at the rear of the aircraft that they could disembark, followed shortly after by a PA asking the remaining passengers to disembark.

Just as she finished making the PA, the SCCM heard calls from passengers outside the aircraft requesting assistance. She stated that she did not see what had happened as her attention was directed towards the PA system at the time. There were also a number of passengers standing between her and the aircraft steps.

The SCCM said that she then went to the aircraft steps where she saw that the stowable handrail had collapsed, and a passenger was standing beside the steps. The passenger was holding her arm in a manner that suggested it was injured.

The SCCM told the Investigation, that as the injured passenger did not appear to be suffering concussion or loss of blood, she immediately ensured that the handrail was restored to the upright position for passenger safety. This was done with the assistance of a ground staff member. During this, she noted that the quick-release pin went into the locating-hole of the cross-brace and stanchion without resistance, and would not lock. She asked the member of ground staff to remain by the steps, to ensure the handrail remained in the upright position.

1.5.3 Witness

A member of ground staff was working at the main baggage hold of the aircraft. He was working on the ramp, on the left side of the aircraft, facing the aircraft passenger door and steps. He witnessed the event.

[6] **Ballast**: The Ballast consists of a weighted block that is inserted into a recess of the door, which acts prevent the door and steps rising off the ground under certain conditions.

[7] **Tail-pin**: The Tail-pin consist of a bar secured under the rear of the fuselage that extends to the ground to prevent the aircraft tipping on its tail should a weight imbalance occur towards the rear of the aircraft during loading or unloading of the aircraft on the ground.

The witness told the Investigation that he saw a female passenger on the top of the integrated aircraft steps. He stated that this passenger had her hand on the stowable handrail. As the passenger began to move down the steps he saw this handrail collapse, and the passenger falling to the ground. The witness stated that *"she fell from the first or second step* [from the top of the stairs]". He informed the Investigation that she fell to the ground "*on the side of the steps where the handrail is located"*. He noted that the passenger was carrying a single item of hand baggage. He immediately went to assist the passenger, where he was joined by the SCCM.

He then assisted the SCCM to re-deploy the handrail. He told the Investigation that the SCCM commented that the pin would not lock properly into the locating-hole. He told the Investigation that the SCCM asked him to remain at the aircraft steps in case the handrail collapsed again.

1.6 Aircraft Information

The ATR 72 is a twin-engine turboprop short-haul regional airliner. EI-FAX was configured with a seating capacity for 72 passengers, and with a compliment of two cabin crew members. As is usual practice, the SCCM was stationed at the rear of the aircraft cabin and a second CCM was stationed at the front of the aircraft cabin.

1.6.1 Passenger Door

The passenger door is located at the rear of the aircraft, on the left side. It is an outward opening door, hinged at the bottom, and incorporates an integral stairs. There are two folding handrails; one which automatically erects when the door is opened, and a folding, or collapsible handrail, which must be manually deployed.

1.6.2 Collapsible Handrail

The collapsible handrail is located on the forward side of the passenger door, i.e., on the right side of the steps, as one exits the door during disembarkation. When the door is closed, this handrail sits flush with the steps, in the stowed position. It remains stowed when the door is opened. When in use, this handrail must be raised manually and locked in the upright position using a quick-release pin.

Due to its design, when deployed and locked in the upright position, the handrail does not form a rigid structure, but can be moved slightly from side to side.

Photos No. 1 and 2, show the deployment of the collapsible handrail.

Photo No. 1: Collapsible handrail in stowed position

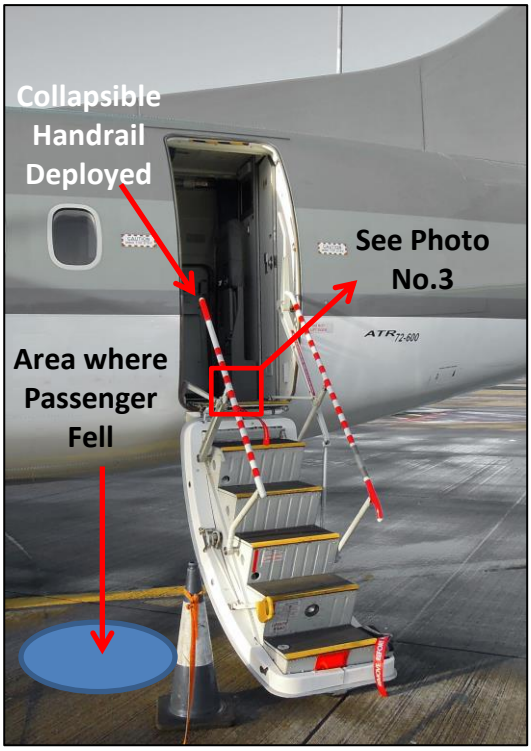


Photo No. 2: Collapsible handrail in deployed position

7

The collapsible handrail must be extended manually. As the handrail is raised to the upright position, a sliding cross-brace on the handrail stanchion nearest the fuselage moves to the top of the stanchion. This cross-brace is then locked in position on the stanchion, by means of a quick release pin. The quick release pin engages the cross-brace and stanchion through matching locating holes in each item, which, when aligned, permit the pin to pass through both sets of holes and lock, see **Photo No. 3**.

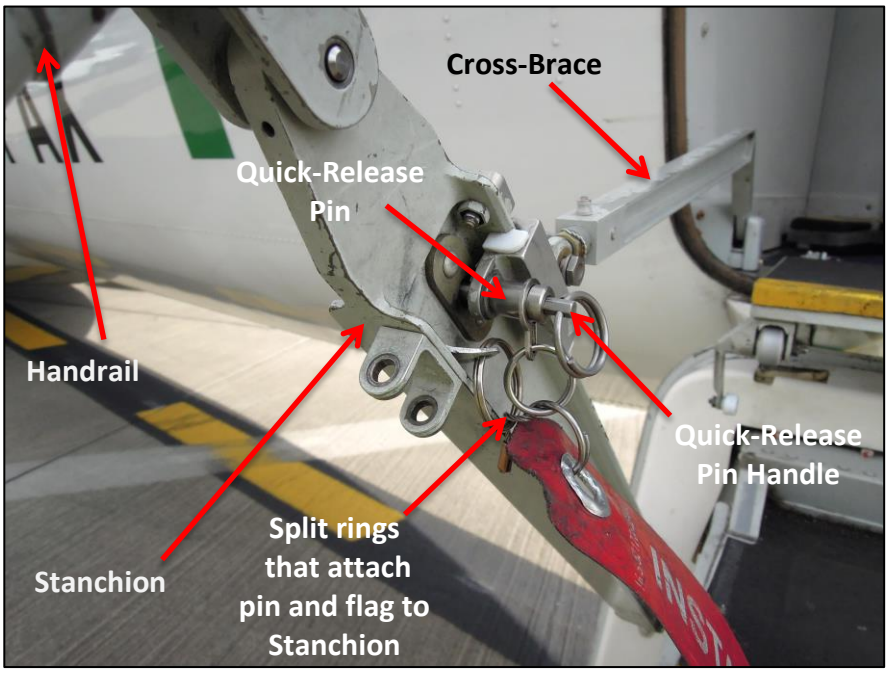


Photo No. 3: Close-up of collapsible handrail in deployed position

The cross-brace, stanchion, and handrail were examined by the Investigation and no anomalies were noted.

1.6.3 Handrail Quick release Pin

The quick-release pins used by the Operator to secure the collapsible handrail were of the push-pull variety, whereby the pin can be released by pushing or pulling the handle of the pin. The pin consists of a barrel, a plunger and two ball bearings that protrude from the barrel. The plunger slides within the barrel and is operated by a push-pull handle, through a spring mechanism, see **Photo No. 4**.

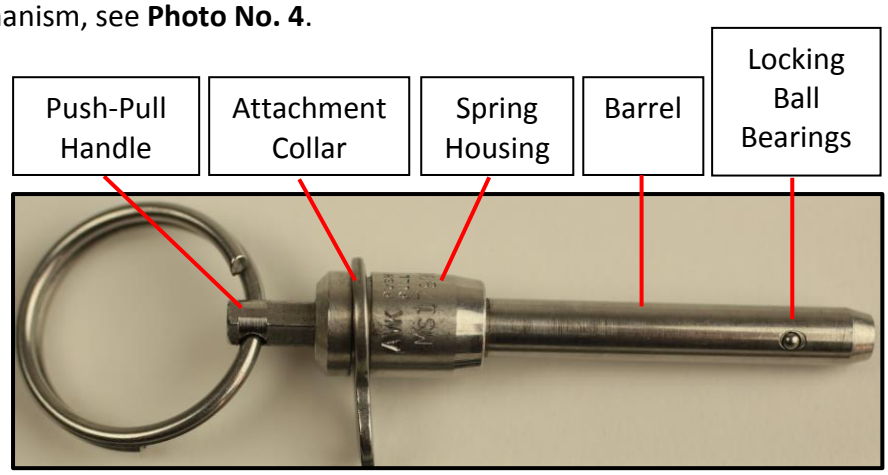
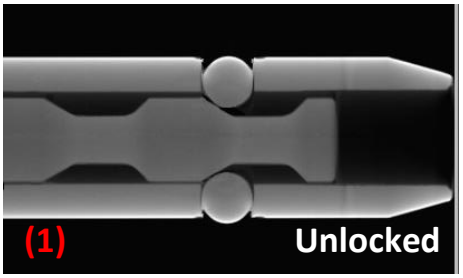
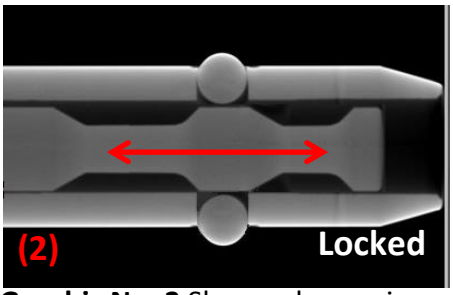


Photo No. 4: Push-Pull Quick-Release Pin

To install the pin, the plunger is displaced, which allows the ball bearings to move inwards, permitting the pin to be inserted into the locating holes, **Graphic No. 1**. When the plunger is released, a spring mechanism returns the plunger to the locking position and the ball bearings are pushed outwards, locking the pin in place, **Graphic No. 2**.



Graphic No. 1 Shows plunger in retracted (unlocked) position



Graphic No. 2 Shows plunger in normal (locked) position. Red arrow indicates plunger movement

The Investigation obtained the quick release pin that was in use at the time of the accident. The handle and plunger were found to operate only partially in the pull direction and the locking ball bearings were found retracted and could not be pushed out into the locking position using the plunger. Inspection revealed that whilst the pin would fit correctly into the locating holes of the cross-brace and stanchion, the pin could not be locked in position. **Graphic No. 1** above shows the plunger in the condition as found by the Investigation, with the locking balls retracted.

The quick release pin was stamped with part number MS17990C412. An attachment collar allows the pin to be attached to the stanchion using split rings and a lanyard. A flag is attached to the lanyard. Pulling on the flag or attachment rings, does not operate the push-pull handle of the quick-release pin.

1.6.4 Tests and Research

The pin was sent to the French *Bureau d'Enquêtes et d'Analyses pour la Sécurité de l'Aviation Civile* (BEA) for X-Ray examination. This revealed that the small washer of the internal spring mechanism had become displaced and had migrated down the shaft of the plunger, restricting its movement and leaving the plunger positioned such that the locking ball bearings were permanently retracted (unlocked). The X-Ray images below, **Photo Nos. 6 and 7**, show the internal spring mechanism of the quick release pin.

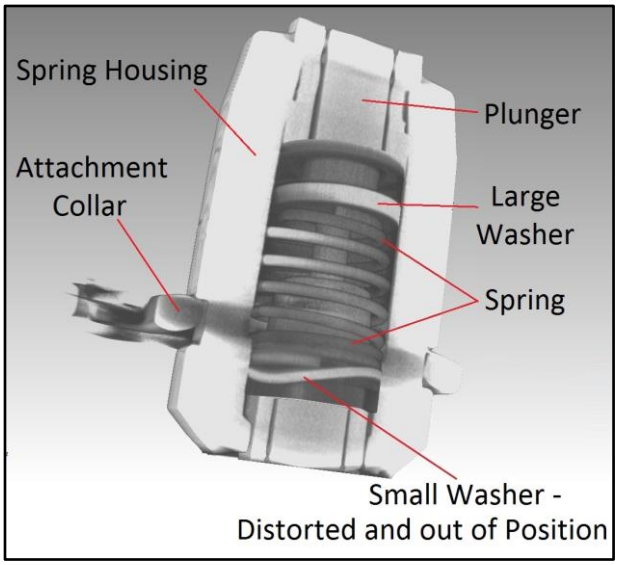


Photo No. 6: 3D X-Ray of Spring Housing.

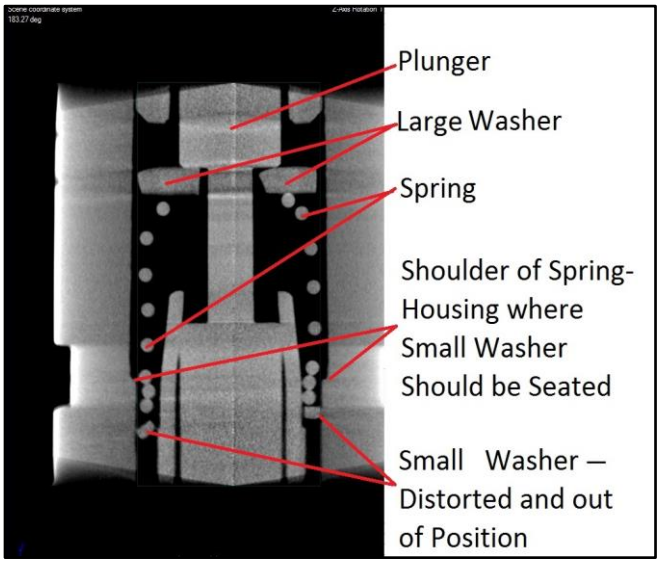


Photo No. 7: Cross Section X-Ray of Spring Housing

The spring mechanism is designed such that the small washer, seated on a shoulder of the spring housing, keeps the spring in place between the small washer and the large washer. When the plunger is pulled, the larger washer compresses the spring against the small washer, and when released the spring pushes against the larger washer, returning the plunger to the locked position. When the plunger is pushed, a shoulder on the plunger pushes against the small washer, which in turn compresses the spring against the large washer. When released the spring pushes against the small washer, returning the plunger to the locking position.

Examination of the X-Ray photographs revealed that the shoulders of the spring housing, intended for seating the small washer, showed signs of damage and wear, with the shoulders becoming worn and rounded, allowing the small washer to migrate out of position, jamming the plunger.

1.6.5 Aircraft Manufacturer

The aircraft Manufacturer was asked to provide details of quick-release pins that are approved for use with the handrail. It confirmed that pins conforming to NAS[8] standard NASM17990, with part number MS17990C412 were approved for use with the handrail mechanism. The aircraft Manufacturer also confirmed that the pin is an *'On-Condition'* item. *'On-Condition'* means that the item is not part of a scheduled maintenance check, and only requires replacement should it become unserviceable for any reason.

The aircraft Manufacturer also informed the Investigation that: *'In April* [2016] *all* […] *operators will receive the information and recommendation for Cabin Crew to inspect the pin prior to each boarding or disembarkation'.*

1.7 Operator Procedures

The Operator provided the Investigation with a copy of the Aft Passenger Door procedures issued to its crew at the time of the event. The section dealing with operation of the Collapsible Handrail is reproduced in **Figure No. 1**, below.

To Open from Inside
Operation of Collapsible Handrail – *ATR72-500 and* ***ATR 72-600***   ▪ *To collapse handrail, remove the pin and push the handrail down and forward.*   ▪ *To fix handrail back in place, pull the handrail upwards and re-insert the pin.*

Figure No. 1: Extract from Aft Passenger Door procedures

Following this event the Operator issued a Cabin Crew Instruction (CCI) which made changes to the procedures for operation of the collapsible handrail. Additional text was added to Section 5.1.9.2.1 of the Operator's CSPM[9]', which states:

'*CABIN CREW MUST CHECK THE PIN LOCKING MECHANISM IS SERVICEABLE FOLLOWING EACH INSTALLATION OF THE PIN; crew must grip the pin head by the external rim and try to pull it out. It should not be possible to remove the pin by pulling the external rim'.*

In addition, following this event, the Operator has introduced a specific maintenance inspection on the handrail. This will consist of a visual inspection checking for the correct configuration, as well as any signs of damage. In addition a check will be carried out to verify correct functionality of the pin and handrail mechanism. Both inspections are performed at every Weekly Check on maintenance schedule 526100-SUP-10000-1.

[8] **NAS**: National Aerospace Standard.
[9] **CSPM**: Cabin Safety Procedures Manual.

2. ANALYSIS

With the exception of the fault noted with the quick-release pin, examination of the aircraft steps and handrail components indicated no pre-existing defects that may have contributed to the occurrence. There was no evidence of contamination of aircraft steps from liquids such as water, oil or de-icing fluid.

Meteorological conditions were not a factor in this event and disembarkation took place during daylight hours. A witness report stated that the passenger was carrying a single item of hand baggage, and placed one hand on the stowable handrail as she exited the aircraft.

Subsequently, during the initial stages of passenger disembarkation, slight movement of the handrail assembly allowed the pin to become dislodged, causing the collapsible handrail to return to the stowed position. The collapse of the handrail most likely occurred just as the subject passenger put her weight on it, causing her to lose balance and fall to the ground from the top of the aircraft steps, fracturing her wrist.

The Investigation notes that at the time of the event, there was no documented requirement for the CCM to check if the pin was locking correctly. On this occasion, when the pin was inserted into the stanchion locating-holes, it is likely that the plunger mechanism became jammed in such a manner that the pin was not locked and was free to move out of the locating-holes.

The handrail quick release pin was not subject to regular maintenance inspection, nor was it required to be, as it was an *'On-Condition'* item. In this case, only when the locking mechanism of the pin failed, and the handrail collapsed, did the faulty condition of the quick-release pin become apparent.

The pin used in this case was found to comply with the specification laid down by the aircraft Manufacturer.

X-Ray photography of the pin revealed damage or wear to an area of the spring mechanism which allowed the small spring retaining washer to migrate between the plunger and the sidewalls of the spring housing, thus impeding the movement of the plunger, eventually preventing the plunger from returning to the locking position. The exact nature/cause of this damage or wear was not determined by the Investigation.

2.1 Safety Actions

2.1.1 Operator's Cabin Crew Procedures

The Operator has put in place procedures for checking that the quick-release pin is locking correctly when installed in the handrail, during normal operations.

2.1.2 Operator's Maintenance Procedures

The Operator has introduced a specific maintenance inspection on the handrail consisting of a visual inspection checking for the correct configuration, as well as any signs of damage. In addition a check will be carried out to verify correct functionality of the pin and handrail mechanism. Both inspections are performed at every Weekly Check on maintenance schedule 526100-SUP-10000-1.

2.1.3 Aircraft Manufacturer's Cabin Crew Operational Manual

Subsequent to this event, the aircraft Manufacturer informed the Investigation that it has introduced a change to the Cabin Crew Operational Manual. This change involves an inspection of the pin and a check to ensure that the safety pin is correctly locked prior to each boarding or disembarkation.

3 CONCLUSIONS

(a) Findings

1. The Senior Cabin Crew Member opened the passenger door and secured the stowable handrail in the upright position with its quick release pin, pushing down on it to ensure it was secure.
2. As the subject passenger placed her hand on the handrail for support, it collapsed back to the stowed position.
3. As a result of the handrail collapse, the passenger fell to the ground from the top of the aircraft steps, and sustained a fracture to the right wrist.
4. The quick-release pin which normally secured the collapsible handrail in the upright position was found to be jammed in an unlocked condition.
5. The quick-release pin was of the correct specification and part number.
6. The quick-release pin was an *'On-Condition'* part and not subject to maintenance inspection.
7. At the time of the event, no procedure was in place to check if the quick-release pin was functioning correctly.

(b) Probable Cause

The sudden retraction of the collapsible handrail which was being used by a passenger for support during disembarkation.

(c) Contributory Factors

1. The failure of the locking mechanism of the quick-release pin.
2. The lack of a checking procedure to ensure functionality of quick-release pin.

4. SAFETY RECOMMENDATIONS

In light of the safety actions taken by the Operator and the aircraft Manufacturer, this Report does not sustain any Safety Recommendations.

- END -

In accordance with Annex 13 to the Convention on International Civil Aviation, Regulation (EU) No. 996/2010, and Statutory Instrument No. 460 of 2009, Air Navigation (Notification and Investigation of Accidents, Serious Incidents and Incidents) Regulation, 2009, the sole purpose of this investigation is to prevent aviation accidents and serious incidents. It is not the purpose of any such investigation and the associated investigation report to apportion blame or liability.

A safety recommendation shall in no case create a presumption of blame or liability for an occurrence.

Produced by the Air Accident Investigation Unit

AAIU Reports are available on the Unit website at www.aaiu.ie

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