

الهيئة العامة للطيران المدني
GENERAL CIVIL AVIATION AUTHORITY



Air Accident Investigation Sector

Accident - Final Report -

AAIS Case N° AIFN/00018/2012

Passenger Door Separation In-flight

Operator: Horizon International Flight Academy
Make and Model: Diamond DA 42 NG
Nationality and Registration: UAE, A6-HIC
Place of Occurrence: Al Ain International Airport
State of Occurrence: United Arab Emirates
Date of Occurrence: 12 October 2012



Air Accident Investigation Sector
General Civil Aviation Authority
The United Arab Emirates

Occurrence Brief

AAI Report Number	AFIN/0018/2012
Occurrence Classification	Accident
Occurrence Categorization	SCF-NP: System/component failure or malfunction (non-powerplant)
Operator	Horizon International Flight Academy
Aircraft Type and Registration	Diamond DA 42 NG, A6-HIC
MSN	42N045
No and Type of Engines	Two, Austro Engine E4/AE300
Location	Al Ain
Date and Time (UTC)	12 October 2012, 0600
Type of Flight	Training
Persons Onboard	Two
Injuries	None

Investigation Objective

This Investigation is performed pursuant to the United Arab Emirates *Federal Act 20 of 1991*, promulgating the *Civil Aviation Law, Chapter VII – Aircraft Accidents*, article 48. It is in compliance with *Part VI, Chapter 3* of the *UAE Civil Aviation Regulations*, in conformity with *Annex 13 to the Convention on International Civil Aviation*, and in adherence to the *Air Accidents and Incidents Investigation Manual*.

The sole objective of this Investigation is to prevent aircraft accidents and incidents. It is not the purpose of this activity to apportion blame or liability.

Investigation Process

The Accident was notified to the Air Accident Investigation Sector (AAIS) Duty Investigator on 12 October 2012.

An Investigation Team was immediately dispatched to the Accident site.

In accordance with *Annex 13*, the State of Manufacture was notified and appointed Accredited Representative to the Investigation and nominated Technical Advisers from the manufacturer of the airframe and the engine.

The AAIS is leading the Investigation, as the United Arab Emirates is the State of Occurrence.



Notes:

1. Whenever the following words are mentioned in this Report with first Capital letter, they shall mean the following:
 - (Aircraft)- the aircraft involved in this accident
 - (Investigation)- the investigation into the circumstances of this accident
 - (Accident)- this accident referred to on the title page of this report
 - (Report)- this accident Final Report
 - (Flight Instructor)- the flight instructor of this accident flight
 - (Student Pilot)- the student pilot of this accident flight
 - (Academy)- Horizon International Flight Academy (HIFA).
2. Unless otherwise mentioned, all times in the Report are UTC (Local time in UAE is UTC+ 4 hours).
3. Photos and figures used in this Report are taken from different sources and are adjusted from the original for the sole purpose to improve the clarity of the Report. Modifications to images used in this Report are limited to cropping, magnification, file compression, or enhancement of color, brightness, contrast, or addition of text boxes, arrows or lines.



Abbreviations

AAIS	Air Accident Investigation Sector
AD	Airworthiness directive
AFM	Airplane flight manual
AGL	Above ground level
AMM	Aircraft maintenance manual
AOC	Air operator certificate
ATC	Air traffic control
ATPL	Airline Transport Pilots Licence
CAR	<i>Civil Aviation Regulations</i>
CEO	Chief executive officer
CFRP	Carbon fiber reinforced plastic
CG	Center of gravity
CPL	Commercial pilots licence
CRM	Crew resource management
DAI	Diamond Aircraft Industries
EASA	European Aviation Safety Agency
ECU	Engine control unit
ERP	Emergency response plan
FI	Flight instructor
FTO	Flight training organisation
GCAA	The General Civil Aviation Authority
GPS	Global Positioning System
HIFA	Horizon International Flight Academy
IAS	Indicated airspeed
ICAO	International Civil Aviation Organization
ICS	Integrated control system
IFIS	Integrated flight instrument system
MFD	Multi-function display
MSN	Manufacturer serial number
OMAL	Al Ain International Airport (ICAO code)
P/N	Part number
PF	Pilot flying



PFD	Primary flight display
RTO	Rejected takeoff
SMS	Safety management system
SOP	Standard operating procedure
SP	Student pilot
SR	Safety recommendation
UAE	The United Arab Emirates
UTC	Coordinated Universal Time



Synopsis

The Student Pilot and Flight Instructor onboard a Diamond DA 42 NG Twin Star aircraft became aware of an unusual slipstream noise during the initial climb phase of a training flight from Al Ain International Airport (OMAL).

The slipstream noise was originating from the rear passenger door and a gap was visible between the door sill and the lower edge of the door.

The Instructor stated that he attempted to hold the door closed and that he had to release his grip on the door handle to manage the flight and that the rear door then separated from the airframe.

The Instructor assumed control as the pilot flying (PF) to fly the Aircraft, manage the descent and circuit, ATC communication, and the high engine power demand required to maintain level flight caused by the increased aerodynamic drag and non-uniform aerodynamic loads due to the door separation.

The Air Accident Investigation Sector determines that the causes of the canopy door separation were:

- (a) Inadequate pre-flight supervision by the Flight Instructor in physically confirming that all external door locks had been closed as per the pre-flight check.
- (b) Non-adherence to *SOPs* and pre-takeoff checklist requirements regarding the cockpit canopy.
- (c) The Flight Instructor's fixation to the expected results of the Student Pilots' action when the Student Pilot advanced the throttles quickly, which introduced the potential for an ECU warning and potential rejected takeoff. The fixation caused a lapse in carrying out the pre-takeoff scan to confirm no warnings or cautions were present.
- (d) The probable attempt to close the rear door in-flight against the manufacturer's warning that in-flight door closure may cause latch disengagement and allow the door to open.

This Final Report contains two safety recommendations addressed to the General Civil Aviation Authority (GCAA) of the United Arab Emirates.



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1. Factual Information

1.1 History of the Flight

On 12 October 2012, a Diamond DA 42 NG twin engine light Aircraft operated by Horizon International Flight Academy (HIFA), registration A6-HIC, was tasked with a training flight with a Flight Instructor (FI) and a Student Pilot (SP) onboard.

The SP completed the pre-flight check and the mass and balance calculations. He then started the engines and taxied the Aircraft to the holding point.

The SP completed the checklist items. The Flight Instructor (FI) took control of the radio as the Aircraft was holding short of the holding point and the SP completed the pre-takeoff checklist.

During the pre-takeoff checks, the SP reported that the door warning light was out, as per the checklist. The FI corrected him as the front canopy was still in the cooling gap position. The SP closed the front canopy and rechecked the warning light.

The SP received the take-off clearance and was instructed to line up on the runway. He completed the runway items checklist.

Commencing the take-off roll, the SP advanced the throttles rapidly; the FI stated that historically, when the throttles are advanced rapidly, there was a concern that this action can result in an engine control unit (ECU) failure indication, which can lead to a rejected takeoff (RTO).

There was no ECU failure indication and the take-off roll continued to rotation and the initial climb. A short time after establishing a positive stabilized climb, the FI noticed an unfamiliar slipstream sound, which was increasing in volume. At approximately 200 ft above ground level (AGL) and at 100 knots (kt) indicated airspeed (IAS), the noise was identified to be coming from the rear door.

The rear passenger door then separated from the Aircraft. The FI took over control and landed the Aircraft.

1.2 Injuries to Persons

No Injuries to persons.

Table 1. Injuries to persons

Injuries	Flight Crew	Cabin Crew	Other Crew On-board	Passengers	Total On-board	Others
Fatal	0	0	0	0	0	0
Serious	0	0	0	0	0	0
Minor	0	0	0	0	0	0
None	2	0	0	0	2	0
TOTAL	2	0	0	0	2	0

1.3 Damage to the Aircraft

The passenger door separated from the fuselage as a complete assembly. The door detached from the latched lower edge and was blown upwards due to aerodynamic loads, before separating from the upper hinge line, which failed beyond the hinge design limit load.



Figure 1. Passenger door damage

1.4 Other Damage

No other damage was reported

1.5 Personnel Information

Both the FI and the SP held current licences and medical certificates at the time of the event.

1.5.1 The Flight Instructor

Commercial pilot licence (CPL) issued by the General Civil Aviation Authority (GCAA) of the United Arab Emirates

Valid until: 25 May 2018

Ratings: SE Land/ME Land/Instrument

Medical certificate expiry date: 31 March 2013

Total time: 2,387 hours

1.5.2 The Student Pilot

Medical certificate expiry date: 31 January 2013

Note. The GCAA does not issue Student Pilot Licences.

1.6 Aircraft Information

1.6.1 Aircraft data

The Aircraft was a Diamond DA 42 NG Twin Star, manufactured by Diamond Aircraft Industries, Austria.



Figure 2. Diamond DA 42 NG Twin Star

The DA 42 NG is a twin-engine, four seat, low wing monoplane. It has a cantilever wing and a T-tail. The Aircraft structure is manufactured from fiber reinforced plastic composite.

The Accident Aircraft manufacturer serial number (MSN) was 42N045. It was manufactured in May 2011, and powered by two Austro E4/AE300 engines.

1.6.2 Airworthiness

The Aircraft was airworthy at the time of the Accident.

The GCAA certificate of airworthiness had been revalidated on 29 April 2012.

1.6.3 Cockpit canopy and passenger door

The one-piece canopy has a large quantity of wrap-around glazing. This gives good all-round visibility from the cockpit. A glazed rear passenger door on the left hand side of the Aircraft gives access to the rear seats. The passenger door lifts up to give access and is supported in the open position by a gas filled strut.

1.6.4 Cockpit systems

The DA 42 NG has a full range of flight instrumentation contained in an integrated cockpit system (ICS).

The ICS has two display screens and can display all of the aircraft flight instrumentation, navigation, engine and other aircraft systems data.

The ICS also displays all the warnings, cautions and alerts. The ICS can be configured to show the ground and flight checklists.



1.6.5 Passenger door handle and latch system

The passenger door is of carbon fiber reinforced plastic (CFRP) moulded construction, with inner and outer frames. The frames are bonded together with thickened resin. Each part of the frame is made up of layers of carbon cloth and one layer of glass cloth. Areas of high stress have extra layers of carbon cloth. Mounting bushes for the door locking bolts bond to the inside of the frame with thickened resin.

The door has an acrylic glass window. A special flexible adhesive bonds the window to the doorframe.

Two hinges attach the door to the top of the fuselage near the fuselage centreline. The hinges are bolted to the doorframe.

With the door fully closed, pushing the door handle towards the doorframe engages the locking bolts in the fuselage holes. The forward locking bolt operates the door locked/unlocked micro switch. When the door handle is flush with the doorframe, the door is locked. Pushing outwards on the bottom of the doorframe provides a positive indication that the door is locked. A key operated lock can be used to secure the door in the closed position when the aircraft is parked.

A door unlocked warning caption on the ICS display illuminates when the door is unlocked. A handle on the left hand side of the door operates two locking bolts. The locking bolts are at the lower forward and aft corners of the door.

The handle consists of two parts: the inner handle is red and has a double lever, and the outer handle is red and is attached by two roll pins to the inner handle. A long connecting rod attaches to the rear of the double lever. The other end of the long connecting rod attaches to the inside of the rear locking bolt. A safety lock is fitted to prevent accidental movement of the handle.

The safety handle must be lifted before the red handle can be operated from inside the passenger compartment. To operate the red handle from outside the aircraft it is necessary to push the button next to the red handle to lift the inner safety lock.

A short connecting rod attaches to the front of the double lever. The short connecting rod goes to the front locking bolt. If the canopy handle is pulled away from the canopy frame, the following actions occur:

- The double lever turns to pull both of the connecting rods
- The long connecting rod pulls the rear locking bolt forward
- The short connecting bolt pulls the front locking bolt aft
- The aft movement of the locking bolt operates a micro switch for the warning caption located on the ICS.

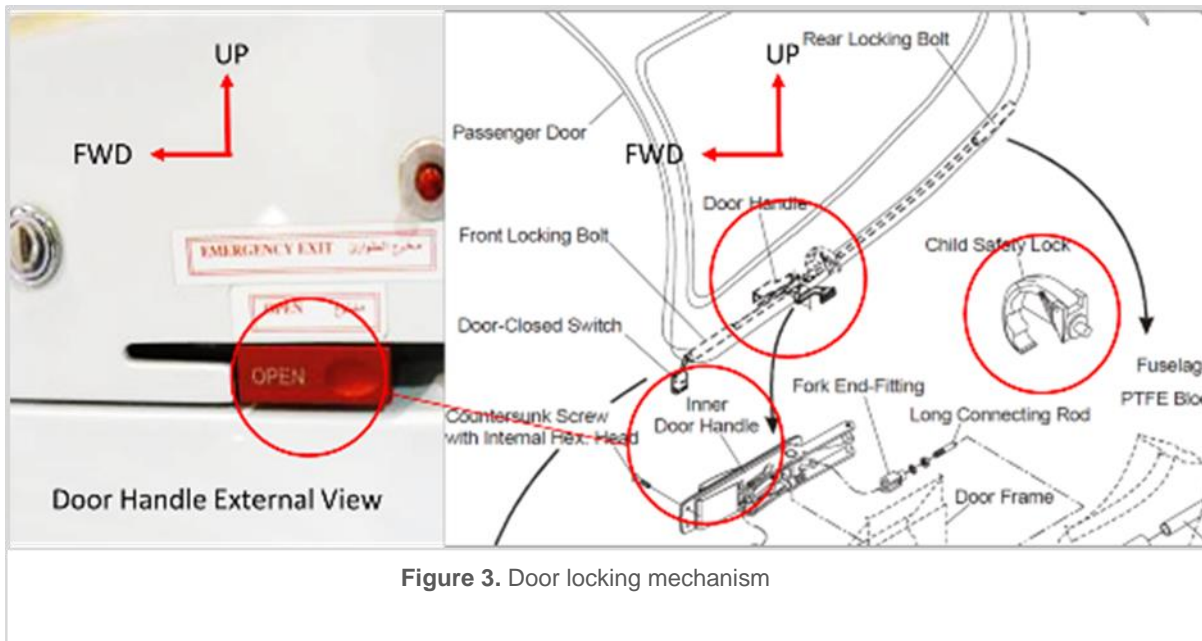


Figure 3. Door locking mechanism

1.6.6 Crew alerting system

The DA 42 NG Twin Star has a crew alerting system (CAS) to indicate, both visually and audibly, if the doors are open and unlocked.

1.6.7 Garmin G1000 integrated flight instrument system (IFIS)

The Garmin G1000 is a digital integrated flight instrument system (IFIS) comprising two display units: one serving as a primary flight display (PFD), and one as a multi-function display (MFD).

All crew alerts and warnings are indicated on the PFD, together with an associated aural warning.

1.6.8 Door open warning caution and alerting system

The cockpit canopy and rear passenger door open audible and visual warnings that are alerted to the crew are the same. The alerting system detects 'door open' position but it does not differentiate visually or audibly which door or canopy is affected.

The CAS is designed to provide visual and aural alerts to the flight crew. The alerts are categorised into three levels: WARNING, CAUTION, or ADVISORY.

Each of the three levels has a different text, colour, and audible tone. For example, a warning indicator text, which is red, may require immediate corrective action. A warning chime tone, which repeats without delay until acknowledged by the crew, will be heard until cancelled, or until the required action is completed.

The PFD has a red door open warning. When the door warning is active, there is a corresponding audible alarm through the cockpit speaker and the headset, if connected.

Crew alerts appear in the alerts window on the PFD. In this window warnings appear at the top, followed by cautions and advisories, respectively.



1.6.9 Cockpit canopy 'cooling gap' position

The DA 42 NG in service with the Academy did not have air-conditioning installed. There was ability to latch the canopy in the cooling gap position as described in the *Airplane Flight Manual (AFM)* for normal operating procedures that take place prior to flight. The *AFM* contained instructions of when the canopy can be left in the cooling gap positions (one or two) and when the canopy must be closed and locked.

According to the *AFM*, it is an approved procedure to latch the canopy in the cooling gap position during the normal operating procedures: *Before Starting Engine* (Section 4A.6.2), *Starting Engine* (Section 4A.6.3), *Before Taxiing* (Section 4A.6.4) and *Taxiing* (Section 4A.6.5). Item 6 of the normal operating procedure (*Before takeoff* (Section 4A.6.6)) instructs the pilot to close and lock the canopy and check the following:

- Front canopy - closed and locked
- Front baggage doors - closed (visual check)
- Door warning (DOOR) - check no indication.

It is not approved to keep the canopy open in the cooling gap position until just before commencing the actual take off.

1.7 Meteorological Information

Meteorological data for OMAL on 12 October, 0001-0600 UTC was as follows.

201210120100 METAR OMAL 120100Z 04006KT 3500 HZ NSC 23/20 Q1013 A2991=

201210120200 METAR OMAL 120200Z 04007KT 5000 HZ NSC 23/20 Q1013 A2992=

201210120300 METAR OMAL 120300Z 05004KT 5000 HZ NSC 25/19 Q1014 A2994=

201210120400 METAR OMAL 120400Z 04007KT 5000 HZ NSC 26/19 Q1014 A2996=

In summary, the weather was light variable winds, no significant clouds, good visibility.

1.8 Aids to Navigation

Not relevant to this Investigation.

1.9 Communications

Not relevant to this Investigation.

1.10 Aerodrome Information

Not relevant to this Investigation.

1.11 Flight Recorders

For this category of aircraft, flight data recorders and cockpit voice recorders are not mandatory.

1.12 Wreckage and Impact Information

The rear passenger door was recovered from the sand area adjacent to the active runway. The door was intact but had sustained edge damage due to impact with the ground.



The upper hinges for the aft passenger door suffered damage consistent with failure beyond limit load. The door support/gas operated strut retainer had failed under load.

There was impact damage consisting of an abrasion/scuff mark on the upper surface of the fuselage consistent with the angle of elevation of the door as it was lifted due to aerodynamic loads and the door hinge geometry.

The abrasion line indicated that the door elevation restraint mechanism (the gas spring strut) had failed.

1.13 Medical and Pathological Information

There was no psychoactive material found in the blood of both Pilots that may adversely affect their performance.

1.14 Fire

There was no fire.

1.15 Survival Aspects

Not relevant to this Investigation.

1.16 Test and Research

Functional checks were conducted in controlled conditions with the Accident aircraft and an adjacent sister aircraft in the Academy's maintenance hangar.

1.17 Organizational and Management Information

1.17.1 The Academy's safety management system

All aspects of air safety at Horizon were managed utilizing a safety management system (SMS) that had been accepted by the GCAA. The Chief Executive Officer (CEO) was the Accountable Manager and a Safety Manager had been appointed. Prior to the Accident, a number of serious incidents and accidents had occurred, involving both fixed and rotary wing aircraft, operated by Horizon.

The sequence of serious incidents and accidents led the Director General of the GCAA to establish a working group, comprising GCAA personnel, which was tasked with reviewing the management of air safety and operations at the Academy. A detailed examination resulted in the production of a comprehensive report containing recommendations for improvements across the organization.

All of the recommendations were implemented rapidly by the Academy management and the trend of frequently occurring serious safety events ceased.

1.18 Additional Information

1.18.1 GCAA safety audits

Shortly after this Accident, and the occurrence of several other accidents and incidents, the GCAA carried out a review of air safety and operational management at the Academy. The review involved examination of the management, operational and technical aspects, and the



effectiveness of the SMS. Some of the Academy's personnel, at all levels from the CEO down, were interviewed regarding operations and air safety.

A gap analysis comparing the SMS to best practice as stated in ICAO Document 9859 – *Safety Management Manual*, and a detailed examination of the previous accidents and incidents was undertaken. A second gap analysis, comparing the SMS against the GCAA requirements was also carried out. Two internet-based surveys, one for the post holders, and the other for all other Academy personnel, were carried out. The surveys primarily covered the respondent's perceptions of the effectiveness of air safety management at the Academy. The review took place over a period of two months and was undertaken by four GCAA personnel.

The review identified shortcomings in air safety management, resource availability, and operations and led to changes, among which were:

- The Academy engaged independent consultants to evaluate the SMS and provide recommendations for safety management improvements.
- The Academy's *Safety Manual* was rewritten and re-issued in June 2013.
- The *Emergency Planning Manual* was re-written and re-issued in June 2013.
- A full emergency exercise was held in September 2013 to verify the new emergency response procedure.
- All management and staff have received SMS training. The program included recurrent training.
- GPS tracking equipment has been installed in all aircraft.
- All helicopter training landing areas have been improved.
- Introduction of power checks.
- CRM training introduced.
- The ratio of instructors to students has been increased to a level acceptable to the GCAA.
- Improvements to safety briefings have been implemented.
- Air-conditioning is being installed in all helicopters.

The implementation of these changes, together with initiatives designed to establish and maintain a safety culture, has eliminated the previous trend in accident and serious incident occurrences.

The Academy, as it was at the time of the review in 2012, no longer exists as an integrated rotary and fixed wing entity. The fixed wing training school was purchased by Etihad Airways and the helicopter school remained under the AOC of the Academy as a rotary wing training school.

The implementation of the recommendations of the GCAA review provided the foundation for the establishment of effective operational management and SMS programs, and contributed to the situation of no reported serious incidents or accidents since the Academy was divided between rotary and fixed wing operations and sold.



1.18.2 The Academy's checklist for 'door open'

The Academy's *Door Open* checklist was not in line with the manufacturer's '*Rear Passenger Door Unlocked*' checklist.

The Academy's *door open warning* checklist warning required the crew to check canopy and rear door visually and if unable to latch land "ASAP [as soon as possible]." (Figure 4).

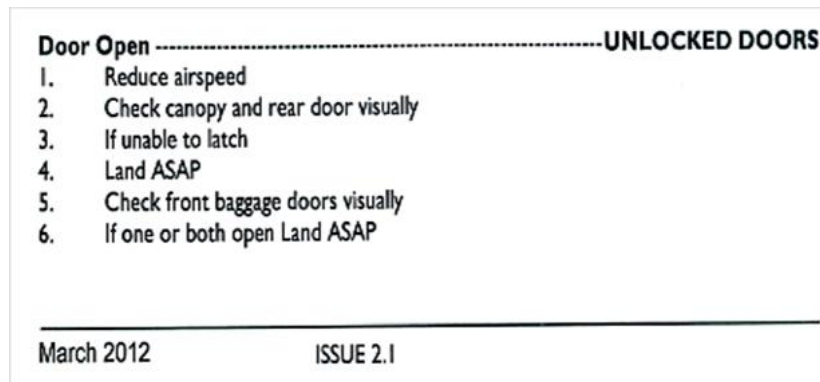


Figure 4. The Academy's *Door Open* warning checklist

The manufacturer's *Rear Passenger Door Unlocked* checklist implicitly states that no attempt should be made to 'lock the rear door in flight'. The reason for this is that the safety latch may disengage and the door may open in flight. (Figure 5).

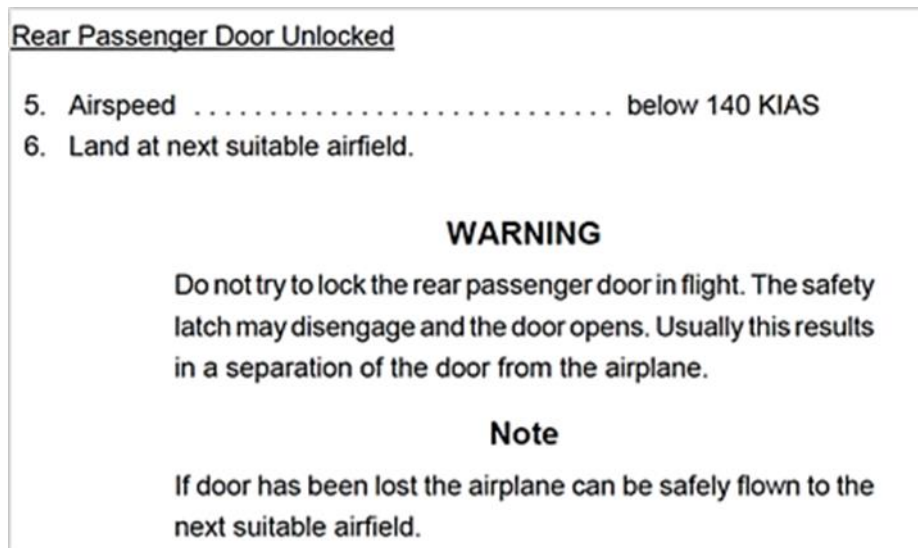


Figure 5. The manufacturer's *Rear Passenger Door Unlocked* checklist

1.18.3 EASA Airworthiness Directive (AD) 2010-0235R1 –Doors: Rear Passenger Door Retaining Bracket – Replacement

Since 2004, more than 30 reports have been received by the manufacturer of in-flight loss of the aft passenger door on Diamond aircraft. The majority of these events involved the DA 40 NG type. In addition, at least 18 doors have been replaced because of damage found to the hinge.



Diamond Aircraft Industries (DAI) conducted analyses and structural tests to determine the root cause of the door in-flight opening. The conclusions were that the primary locking mechanism provided adequate strength to react to the loads in flight.

It was also determined that the root cause of the events was that the crew did not properly secure the aft passenger door by the main locking mechanism, prior to flight.

Damage to the hinges has been caused primarily by external loads (wind gust conditions) while the aircraft was parked.

All DA 40 and DA 42 aircraft have a system installed that provides a warning (visual and audible) if the main door latch is not fully closed, and/or the canopy is not closed. The aircraft are also fitted with a rear passenger door secondary safety latch (with retaining bracket).

The initial intended design function of the secondary safety latch was to hold the aft passenger door in the 'near closed' position while the aircraft was on the ground, protecting the door from wind gusts. However, the original retaining bracket (part number 'P/N' DA4-5200-00-69) might not hold the door in this 'near closed' position during flight. This condition, if not corrected, could result in the aft passenger door opening and departing the aircraft in flight.

To address this problem, DAI designed an improved retaining bracket (P/N DA4-5200-00-69-SB), which has been satisfactorily tested to hold the door closed in flight.

In addition, DAI revised the *AFM* emergency door unlocked/open procedure.

This *Airworthiness Directive (AD)* requires the implementation of an amendment to the *AFM* procedures for flight with the door unlocked/open, and the replacement of the passenger door retaining bracket with an improved part.

This *AD* has been revised to specify that the use of the latest revision of the applicable *AFM*, if properly revised, is acceptable to comply with the *AFM* update requirements of this *AD*.

1.18.4 Previous similar accidents and incidents

Similar incidents have occurred involving in-flight separation of the aft passenger door of Diamond DA 42 NG Twin Star aircraft.

1.18.5 GPS or real time active location tracking

The aircraft used by the training school are not equipped with GPS, or real time tracking or location devices.

1.19 Useful or Effective Investigation Techniques

Standard investigative techniques were applied.

2. Analysis

2.1 Door Warning Systems Test and Verification

The fit, form, and function of the door operating system were examined in accordance with the *Aircraft Maintenance Manual (AMM)*.

The door locking mechanism was functionally tested, the door micro-switch was tested and verified to be in a serviceable condition and the audible warning system was tested and verified to be working in all functions/modes

The headset and intercom were functionally tested and verified as serviceable, with no malfunctions.

2.2 Passenger Door – Inadvertent Opening

The passenger door has a locking mechanism and a secondary safety latch and retaining bracket designed to prevent the door opening if it has not been latched closed. A micro switch provides a warning through the CAS, which is displayed on the PFD, if the door is unlatched.

With the door fully closed, pushing the door handle towards the doorframe engages the locking bolts in the fuselage holes. The forward locking bolt operates the door unlocked micro switch. When the handle is flush with the doorframe, the door is locked. Pushing outwards on the bottom of the door frame verifies that the door is locked.

During the pre-flight inspection, it must be physically verified that the door is locked and latched.

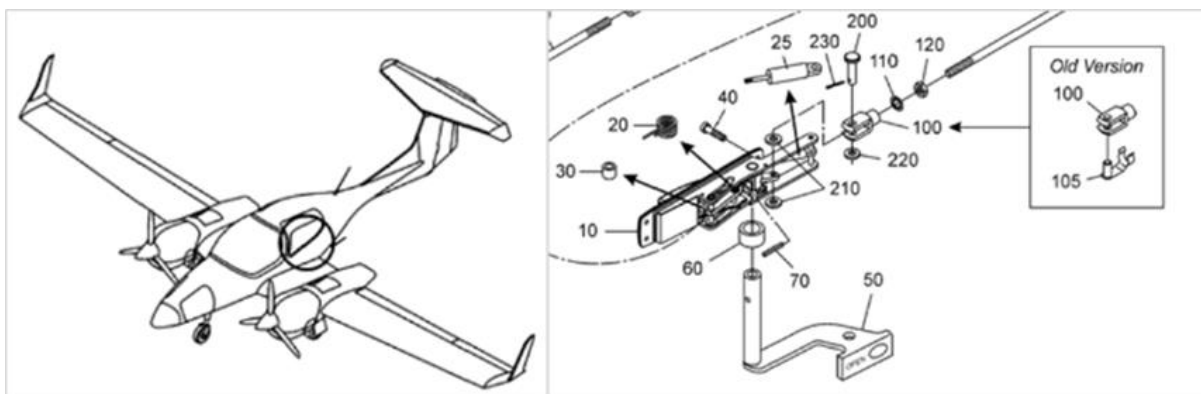


Figure 6. Passenger door locking mechanism and secondary safety latch

2.3 Human Factors

Due to the high temperature operating environment in the United Arab Emirates, the cockpit canopy was normally left partially open at the cooling gap position to allow ventilating air to circulate in the cockpit during the pre-flight and engine start up and taxi. This practice had developed and become normalized in the operation over time, particularly during the very high temperature months. The practice caused the 'door open' warning to be continuously active during taxi on each flight. The canopy was then closed just prior to takeoff.

The crew members use headsets for communication and the crew alerting system (CAS) audible warnings are also heard through the intercom/headset system. The CAS provides a visual

door open warning on the PFD, and an aural warning through the headset. The door open warning is not specific to the forward or rear doors.

At the start of the takeoff, the SP had advanced the throttles in a rapid action. The FI was aware that this rapid advancing of the throttles could result in an ECU warning during the takeoff, potentially leading to a rejected takeoff. The FI allowed the SP to continue the takeoff while he remained prepared to deal with a possible ECU warning. As the FI was concerned about a potential spurious ECU warning during takeoff, the door open indication warning, which should have stopped when the canopy was closed, continued but was not noticed due to FI fixation on the possibility of an ECU warning, and the potential requirement to reject the takeoff.

Fixation, and high workload during the departure, together with the need to monitor the SP's actions, combined with the normalized practice of taxiing with the canopy partially open resulted in the takeoff being accomplished with the door open audio/visual warning active, as the rear door was unlatched, these factors, taken together, contributed to the door open warning being missed prior to and during the takeoff.

The SP was under instruction at a basic level of the instruction process. It is the task of the FI to manage all extraneous crew resource management (CRM) that could divert the SP's attention from completing the basic tasks, including potential alerting and ECU warnings that incorrect application of the throttle setting could cause.

The Garmin G1000 PFD provides a clear warning in red to notify the crew of a door open indication. There is also an audible warning tone to alert the crew to a potential problem.



Figure 7. Crew alert warning and failsafe catch

The red failsafe/latch is installed to prevent the door from opening completely, if the door locking mechanism is not secured.



2.4 Emergency Procedures Checklist – *Unlocked Doors*

Diamond Aircraft *Emergency Procedure 3.12.2 – Unlocked Doors*, describes specifically the vital actions required when a 'Door Open' indication annunciates.

The vital actions are:

“WARNING:

Do not try to lock the rear passenger door in flight. The safety latch may disengage and the door opens.

Usually this results in a separation of the door from the airplane.”


Emergency Procedures	 Diamond AIRCRAFT	DA 42 NG AFM
3.12.2 UNLOCKED DOORS		
1. Airspeed	reduce immediately	
2. Canopy	check visually if closed	
3. Rear passenger door	check visually if closed	
4. Front baggage doors	check visually if closed	
Canopy Unlocked		
5. Airspeed	below 140 KIAS	
6. Land at next suitable airfield.		
END OF CHECKLIST		
Rear Passenger Door Unlocked		
5. Airspeed	below 140 KIAS	
6. Land at next suitable airfield.		
WARNING		
Do not try to lock the rear passenger door in flight. The safety latch may disengage and the door opens. Usually this results in a separation of the door from the airplane.		
Note		
If door has been lost the airplane can be safely flown to the next suitable airfield.		

Figure 8. Diamond aircraft emergency procedure 3.12.2 – *Unlocked Doors*



3. Conclusions

3.1 General

Findings The findings are statements of all significant conditions, events or circumstances in this Accident sequence. The findings are significant steps in the Accident sequence, but they are not always causal or indicate deficiencies.

Causes are actions, omissions, events, conditions, or a combination thereof, which led to this Accident.

Contributing factors are actions, omissions, events, conditions, or a combination thereof, which, if eliminated, avoided or absent, would have reduced the probability of this Accident, or mitigated the severity of the consequences of this Accident. The identification of contributing factors does not imply the assignment of fault or the determination of administrative, civil or criminal liability.

3.2 Findings

- (a) The flight crew were licensed, medically fit and qualified for the flight in accordance with the existing *Civil Aviation Regulations* of the United Arab Emirates.
- (b) The Aircraft had a valid Certificate of Airworthiness and had been maintained in compliance with the *Civil Aviation Regulations* of the United Arab Emirates.
- (c) The Aircraft was airworthy when dispatched for the flight.
- (d) The center of gravity was within limits.
- (e) There was no evidence of airframe failure or system malfunction prior to the Accident.
- (f) The door micro-switch was serviceable and functioning.
- (g) The audible warning system functioned when tested.
- (h) There was no evidence of an intercom/head set malfunction.
- (i) There was no damage or failure of the passenger door locking mechanism.
- (j) The attention of the Flight Instructor became fixated on the expected results of the Student Pilot's throttle handling during takeoff.
- (k) The Academy's *Door Open Warning* checklist did not comply with the manufacturer's *Door Unlocked* checklist in that the Academy's checklist ignored a warning of re-attempting to close an unlocked door in flight.
- (l) The Pilots did not adequately perform the pre-flight inspection check of the passenger door.
- (m) The probable attempt of the FI to close the door in-flight.

3.3 Causes

The Air Accident Investigation Sector determines that the causes of the canopy door separation were:



- (a) Inadequate pre-flight supervision by the Flight Instructor in physically confirming that all external door locks had been closed as per the pre-flight check.
- (b) Non-adherence to *SOPs* and pre-takeoff checklist requirements regarding the cockpit canopy.
- (c) The Flight Instructor's fixation to the expected results of the Student Pilots' action when the Student Pilot advanced the throttles quickly, which introduced the potential for an ECU warning and potential rejected takeoff. The fixation caused a lapse in carrying out the pre-takeoff scan to confirm no warnings or cautions were present.
- (d) The probable attempt to close the rear door in-flight against the manufacturer's warning that in-flight door closure may cause latch disengagement and allow the door to open.

3.4 Contributing Factors

A contributing factor to the Accident was the practice of leaving the cockpit canopy open until just prior to takeoff.



4. Safety Recommendations

4.1 General

The safety recommendations listed in this Report are proposed according to paragraph 6.8 of *Annex 13* to the Convention on International Civil Aviation, and are based on the conclusions listed in section 3 of this Report. The Air Accident Investigation Sector expects that all safety issues identified by the Investigation are addressed by the receiving States and organizations.

4.2 Final Report Safety Recommendations

The Air Accident Investigation Sector recommends that the General Civil Aviation Authority (GCAA) of the United Arab Emirates assures that all Diamond DA 42 NG operators in the United Arab Emirates:

SR75/2016

Modify the operator emergency checklist item concerning the 'rear passenger door unlocked' aligns with the manufacturer's standard.

SR76/2016

Reinforce, through their safety information processes, and continuous improvement procedures, the requirement to observe the emergency checklist instruction to land as soon as possible and not to attempt to close the door in-flight.

This Report is issued by:

**Air Accident Investigation Sector
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