NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

April 9, 2018

Group Chairman's Factual Report

SURVIVAL FACTORS

DCA17FA076

A. ACCIDENT

Operator	:	Ameristar Air Cargo, Inc. dba Ameristar Charters
Airplane	:	McDonnell-Douglas MD 83 [N786TW]
Location	:	Ypsilanti, Michigan
Date	:	March 8, 2017
Time	:	~ 1452 eastern standard time (EST)[1]
NTSB #	:	DCA17FA076

B. SURVIVAL FACTORS GROUP[2]

Chairman	:	Peter Wentz National Transportation Safety Board Washington, DC
Member	:	Tiffany LaTour Federal Aviation Administration Chicago, IL
Member	:	MaryAnne Cipperly Ameristar Charters Adison, TX
Member	:	Kelley France The Boeing Company Seal Beach, CA
Member	:	Mike Kret Zodiac Aerospace Wall Township, NJ
Member	:	Paul Lacy Zodiac Aerospace Wall Township, NJ

[1] All times in this report are eastern standard time, based on a 24-hour clock.
[2] Not all group members were present for all activities.

C. SUMMARY

On March 8, 2017, about 1452 EST, Ameristar Air Cargo, Inc. dba Ameristar Charters flight 9363, a Boeing MD-83, N786TW, ran off the end of runway 23L after executing a rejected takeoff at Willow Run Airport (YIP), Ypsilanti, Michigan. (The MD-83 was manufactured by McDonnell Douglas, which merged with Boeing in August 1997.) All 110 passengers and 6 crewmembers evacuated the airplane. One passenger was reported to have received a minor injury. The airplane sustained substantial damage (no post-crash fire occurred). The airplane was operating under the provisions of 14 Code of Federal Regulations (CFR) Part 121 as an on-demand charter flight and was destined for Washington Dulles International Airport (IAD), Dulles, Virginia. Daytime visual meteorological conditions prevailed at the time of the accident.

D. DETAILS OF THE INVESTIGATION

1.0 Airplane Configuration

The airplane was configured with 147 travel-class passenger seats, 2 cockpit flight crew seats, 1 cockpit observer seat, and 5 retractable flight attendant (F/A) jumpseats. There were 8 emergency exits on the airplane (see figure 1). These included 4 floor-level door exits (3 Type I exits in the cabin and 1 Type A exit in the aft tailcone); and 4 overwing Type III exits.

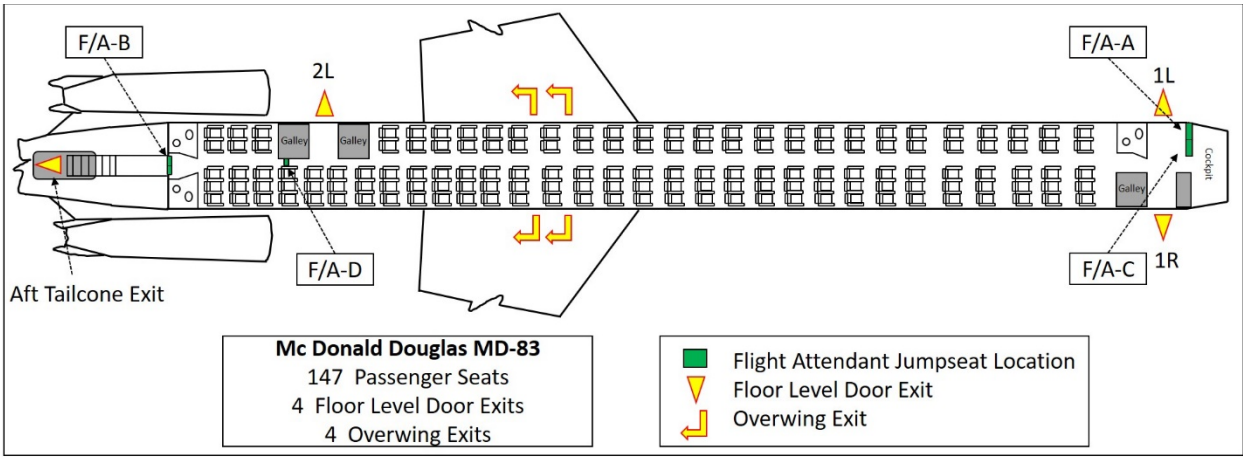


Figure 1 - Cabin configuration for N786TW.

2.0 Flight Attendants

Flight 9363 was operated with 4 F/As. Table 1 provides the F/A position, jumpseat location, F/A initial new hire and last recurrent training dates[3].

F/A Position	Jumpseat Location	Initial New Hire Date	Last Recurrent Training Date
A - Lead	1L door side	October 2013	November 2016
B	Aft tailcone	October 2013	November 2016
C	1L aisle side	November 2014	August 2016
D	2L	October 2013	November 2016

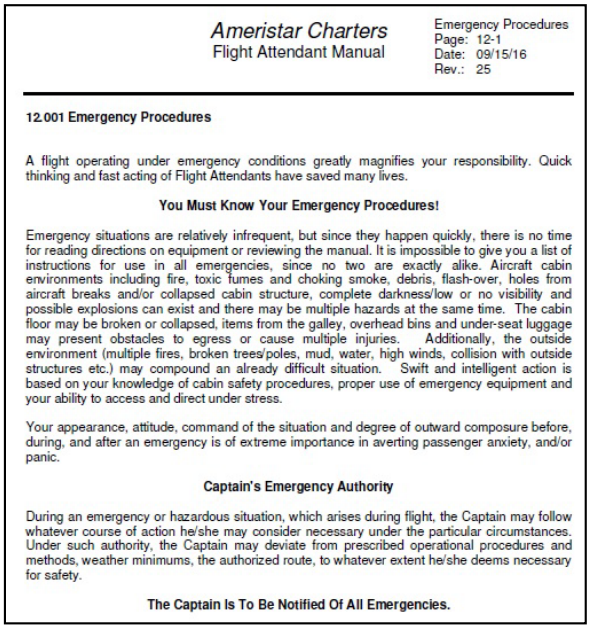
Table 1 - Flight attendant position, location and training dates.

2.1 Flight Attendant Training

Ameristar Charters F/As attended initial new hire and recurrent classroom training at the Ameristar Charters headquarters in Addison, TX. Aircraft emergency door training was conducted at the American Airlines training facility in Fort Worth, TX.

2.2 Flight Attendant Manual

Ameristar Charters provided a copy of a flight attendant manual dated 12/20/2016[4] that was current at the time of the accident. Pertinent sections are shown below.



Ameristar Charters
Flight Attendant Manual

Emergency Procedures
Page: 12-1
Date: 09/15/16
Rev.: 25

12.001 Emergency Procedures

A flight operating under emergency conditions greatly magnifies your responsibility. Quick thinking and fast acting of Flight Attendants have saved many lives.

You Must Know Your Emergency Procedures!

Emergency situations are relatively infrequent, but since they happen quickly, there is no time for reading directions on equipment or reviewing the manual. It is impossible to give you a list of instructions for use in all emergencies, since no two are exactly alike. Aircraft cabin environments including fire, toxic fumes and choking smoke, debris, flash-over, holes from aircraft breaks and/or collapsed cabin structure, complete darkness/low or no visibility and possible explosions can exist and there may be multiple hazards at the same time. The cabin floor may be broken or collapsed, items from the galley, overhead bins and under-seat luggage may present obstacles to egress or cause multiple injuries. Additionally, the outside environment (multiple fires, broken trees/poles, mud, water, high winds, collision with outside structures etc.) may compound an already difficult situation. Swift and intelligent action is based on your knowledge of cabin safety procedures, proper use of emergency equipment and your ability to access and direct under stress.

Your appearance, attitude, command of the situation and degree of outward composure before, during, and after an emergency is of extreme importance in averting passenger anxiety, and/or panic.

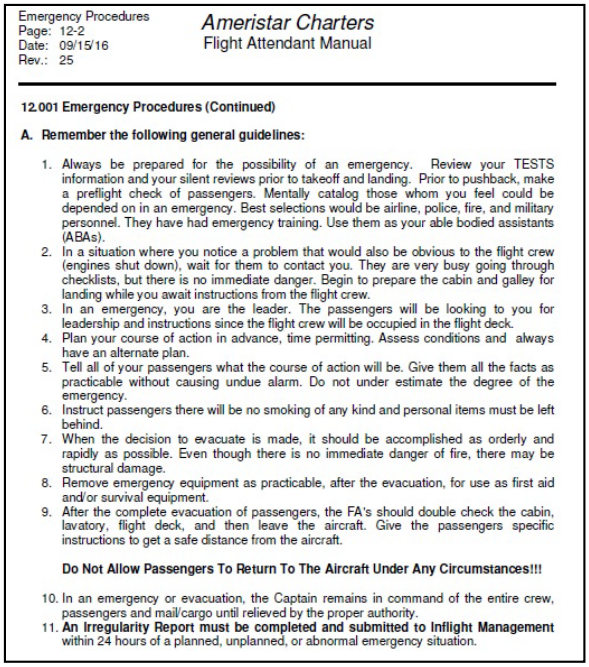
Captain's Emergency Authority

During an emergency or hazardous situation, which arises during flight, the Captain may follow whatever course of action he/she may consider necessary under the particular circumstances. Under such authority, the Captain may deviate from prescribed operational procedures and methods, weather minimums, the authorized route, to whatever extent he/she deems necessary for safety.

The Captain Is To Be Notified Of All Emergencies.

Figure 2 – Emergency procedures.

[3] F/A training dates were obtained from Ameristar Charters employee training records.
[4] The date shown in the top corner of the page reflects the revision date for each individual manual page.



Emergency Procedures
Page: 12-2
Date: 09/15/16
Rev.: 25

Ameristar Charters
Flight Attendant Manual

12.001 Emergency Procedures (Continued)

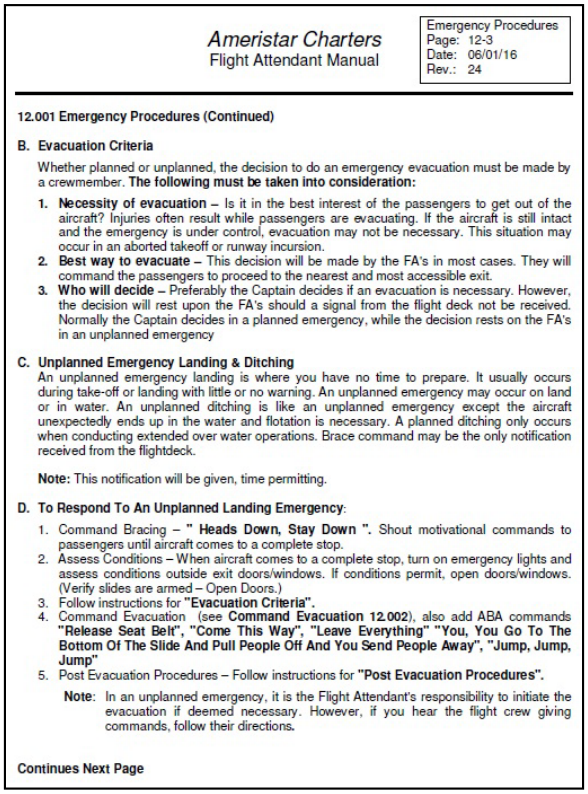
A. Remember the following general guidelines:

1. Always be prepared for the possibility of an emergency. Review your TESTS information and your silent reviews prior to takeoff and landing. Prior to pushback, make a preflight check of passengers. Mentally catalog those whom you feel could be depended on in an emergency. Best selections would be airline, police, fire, and military personnel. They have had emergency training. Use them as your able bodied assistants (ABAs).
2. In a situation where you notice a problem that would also be obvious to the flight crew (engines shut down), wait for them to contact you. They are very busy going through checklists, but there is no immediate danger. Begin to prepare the cabin and galley for landing while you await instructions from the flight crew.
3. In an emergency, you are the leader. The passengers will be looking to you for leadership and instructions since the flight crew will be occupied in the flight deck.
4. Plan your course of action in advance, time permitting. Assess conditions and always have an alternate plan.
5. Tell all of your passengers what the course of action will be. Give them all the facts as practicable without causing undue alarm. Do not under estimate the degree of the emergency.
6. Instruct passengers there will be no smoking of any kind and personal items must be left behind.
7. When the decision to evacuate is made, it should be accomplished as orderly and rapidly as possible. Even though there is no immediate danger of fire, there may be structural damage.
8. Remove emergency equipment as practicable, after the evacuation, for use as first aid and/or survival equipment.
9. After the complete evacuation of passengers, the FA's should double check the cabin, lavatory, flight deck, and then leave the aircraft. Give the passengers specific instructions to get a safe distance from the aircraft.

   Do Not Allow Passengers To Return To The Aircraft Under Any Circumstances!!!

10. In an emergency or evacuation, the Captain remains in command of the entire crew, passengers and mail/cargo until relieved by the proper authority.
11. **An Irregularity Report must be completed and submitted to Inflight Management** within 24 hours of a planned, unplanned, or abnormal emergency situation.

Figure 3 – Emergency procedures, general guidelines.



Ameristar Charters
Flight Attendant Manual

Emergency Procedures
Page: 12-3
Date: 06/01/16
Rev.: 24

12.001 Emergency Procedures (Continued)

B. Evacuation Criteria

Whether planned or unplanned, the decision to do an emergency evacuation must be made by a crewmember. **The following must be taken into consideration:**

1. **Necessity of evacuation** – Is it in the best interest of the passengers to get out of the aircraft? Injuries often result while passengers are evacuating. If the aircraft is still intact and the emergency is under control, evacuation may not be necessary. This situation may occur in an aborted takeoff or runway incursion.
2. **Best way to evacuate** – This decision will be made by the FA's in most cases. They will command the passengers to proceed to the nearest and most accessible exit.
3. **Who will decide** – Preferably the Captain decides if an evacuation is necessary. However, the decision will rest upon the FA's should a signal from the flight deck not be received. Normally the Captain decides in a planned emergency, while the decision rests on the FA's in an unplanned emergency

C. Unplanned Emergency Landing & Ditching

An unplanned emergency landing is where you have no time to prepare. It usually occurs during take-off or landing with little or no warning. An unplanned emergency may occur on land or in water. An unplanned ditching is like an unplanned emergency except the aircraft unexpectedly ends up in the water and flotation is necessary. A planned ditching only occurs when conducting extended over water operations. Brace command may be the only notification received from the flightdeck.

Note: This notification will be given, time permitting.

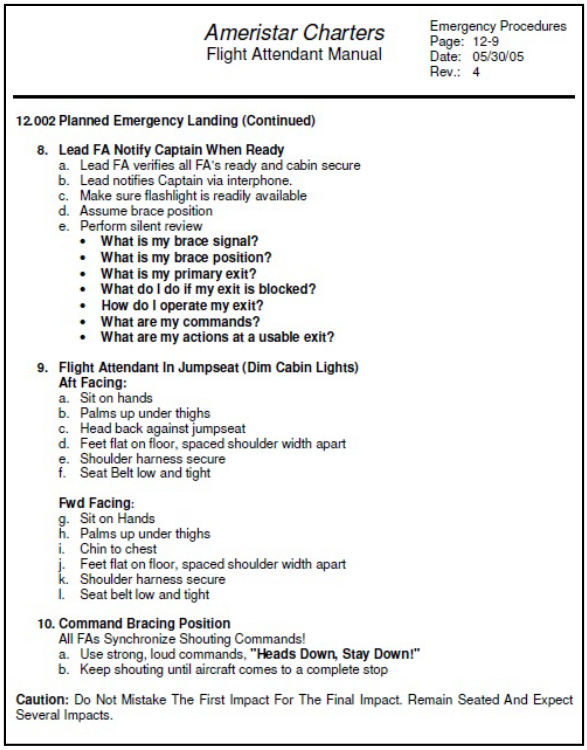
D. To Respond To An Unplanned Landing Emergency:

1. Command Bracing – **" Heads Down, Stay Down ".** Shout motivational commands to passengers until aircraft comes to a complete stop.
2. Assess Conditions – When aircraft comes to a complete stop, turn on emergency lights and assess conditions outside exit doors/windows. If conditions permit, open doors/windows. (Verify slides are armed – Open Doors.)
3. Follow instructions for **"Evacuation Criteria".**
4. Command Evacuation (see **Command Evacuation 12.002**), also add ABA commands **"Release Seat Belt", "Come This Way", "Leave Everything" "You, You Go To The Bottom Of The Slide And Pull People Off And You Send People Away", "Jump, Jump, Jump"**
5. Post Evacuation Procedures – Follow instructions for **"Post Evacuation Procedures".**

   Note: In an unplanned emergency, it is the Flight Attendant's responsibility to initiate the evacuation if deemed necessary. However, if you hear the flight crew giving commands, follow their directions.

Continues Next Page

Figure 4 – Emergency procedures, evacuation criteria.



Ameristar Charters
Flight Attendant Manual

Emergency Procedures
Page: 12-9
Date: 05/30/05
Rev.: 4

12.002 Planned Emergency Landing (Continued)

8. **Lead FA Notify Captain When Ready**
   a. Lead FA verifies all FA's ready and cabin secure
   b. Lead notifies Captain via interphone.
   c. Make sure flashlight is readily available
   d. Assume brace position
   e. Perform silent review
      - **What is my brace signal?**
      - **What is my brace position?**
      - **What is my primary exit?**
      - **What do I do if my exit is blocked?**
      - **How do I operate my exit?**
      - **What are my commands?**
      - **What are my actions at a usable exit?**

9. **Flight Attendant In Jumpseat (Dim Cabin Lights)**
   Aft Facing:
   a. Sit on hands
   b. Palms up under thighs
   c. Head back against jumpseat
   d. Feet flat on floor, spaced shoulder width apart
   e. Shoulder harness secure
   f. Seat Belt low and tight

   Fwd Facing:
   g. Sit on Hands
   h. Palms up under thighs
   i. Chin to chest
   j. Feet flat on floor, spaced shoulder width apart
   k. Shoulder harness secure
   l. Seat belt low and tight

10. **Command Bracing Position**
    All FAs Synchronize Shouting Commands!
    a. Use strong, loud commands, **"Heads Down, Stay Down!"**
    b. Keep shouting until aircraft comes to a complete stop

Caution: Do Not Mistake The First Impact For The Final Impact. Remain Seated And Expect Several Impacts.

Figure 5 – Emergency procedures, general guidelines.

3.0 Evacuation Summary

In addition to written statements (attachment 1), three of the four flight attendants[5] were interviewed by the Survival Factors Group. This section summarizes the information they provided about the evacuation.

Flight 9363 was an on-demand charter flight from YIP to IAD. The airplane was charted by the University of Michigan men's basketball team. The coaches and their families were seated in the forward portion of the airplane, followed by the men's basketball team and then the cheerleaders and band members who were seated in the back. The take-off roll started normally until the airplane's brakes were suddenly being applied. The airplane continued to "shake" and eventually ran off the end of the runway, through the perimeter fence, across a road and over a ditch before stopping.

All four F/A's stated they felt the brakes being applied suddenly. F/A-A recalled the terrain outside of the airplane changing and he and F/A-C started yelling "heads down, stay down." until the airplane came to a stop. In the back of the airplane F/A-D felt the airplane "jump and jerk" while F/A-B recalled sudden braking, both stated the captain made an announcement to evacuate shortly after the airplane came to a stop.

F/A-A and C didn't recall hearing the captain's announcement to evacuate the airplane after it came to a stop. F/A-A initiated the evacuation by assessing conditions and opening the 1L door, it took him two pulls on the manual inflation handle before the slide inflated, and once it inflated he started evacuating passengers out of the airplane. F/A-C assessed the 1R door and opened it. She reached down and pulled the manual inflation handle, but the slide did not inflate, so she pulled the handle again and the slide deployed from the slide pack hanging on the 1R door but did not inflate. Because the slide was not usable she blocked the exit and re-directed passengers to use an alternate exit. F/A-B assessed the aft tailcone door and opened it. The door only opened a few inches before becoming stuck by a seatbelt on the jumpseat that was wedged under the door. He pushed the door back closed, removed the seatbelt and reopened the door to assess the tailcone area. Noticing the tailcone and slide had not jettisoned, he proceeded to the end of the catwalk and pulled the manual jettison handle. The tailcone fell and the slide inflated. He then went back to the cabin to start the evacuation, but everyone had already exited the airplane. F/A-D assessed her door, then opened it and started evacuating passengers. At first, she thought the engine was still running, but later realized it was just the wind pushing the engine blades.

At the end of the evacuation, F/A A, B and C walked through the airplane to check that all passengers had evacuated the airplane, F/A-C stated she checked the lavatories to make sure no one was left behind. Once outside the airplane all 4 F/A's gathered all the passengers together to conduct a head count.

[5] F/A-D was unavailable to interview after the accident.

3.1 Evacuation Route Survey

A survey was conducted to identify the evacuation routes used by the passengers onboard Ameristar flight 9363. Of the 8 emergency exit routes, only 4 were used (5 exit routes were available for use during the evacuation). Evacuation slides were located at Doors 1L, 1R, 2L and the tailcone exit. The 4 overwing exits were not equipped with evacuation slides. Sixty-seven percent of the passengers (74 of 110) participated in the survey, the results are tabulated in table 2.

Exit	Number of Passengers Reporting Using Exit
Door 1L	27
Door 1R	Blocked[6]
Forward left overwing exit	23
Aft left overwing exit	Exit was not opened[7]
Forward right overwing exit	12
Aft right overwing exit	Exit was not opened
Door 2L	12
Aft tailcone exit	0[8]

Table 2 –Evacuation route survey results (74 of 110 passengers responding).

4.0 Tailcone Exit Jumpseat

F/A B reported that the tailcone emergency exit (photograph 1) was temporarily restricted from opening during the evacuation when one of the two jumpseat lift latch seatbelt buckles became stuck under the door. Page 3-17 (G)(4) of the flight attendant manual stated, *"Stow jumpseat with seat belt/shoulder harness buckled"*. Photograph (2) was taken post-accident and shows the jumpseat in the down position with both right and left seatbelts unlatched.

[6] F/A-C blocked exit after slide did not function.
[7] Overwing exits are operated by passengers screened and briefed by F/As before taxi to assist with the Exit Row Program. The two aft overwing exits were not opened.
[8] The tailcone exit was opened and available but not used.

Photograph 1 – Tailcone emergency exit and jumpseat.

Photograph 2 – Tailcone jumpseat with both seat belts unbuckled.

5.0 Evacuation Slide – 1R

5.1 1R Slide Teardown

Members of the Survival Factors Group met at Zodiac Aerospace[9] in Wall Township, NJ on April 5, 2017 to conduct a teardown of the door 1R slide assembly. The 1R slide (part number D29982-107, serial number 0218) was manufactured by Air Cruisers in January of 1986.[10] The reservoir valve assembly (RVA part number D37013-121) located in the slide packboard was comprised of a reservoir and valve (photograph 3). Table 3 shows each component's part and serial number along with a part number for the RVA.

Component	Part number	Serial number
Reservoir	64535-1	ALT789-1641
Valve	D18294-107	B291-6216

Table 3- RVA component part and serial numbers.

Photograph 3 – Reservoir and valve assembly (RVA) in slide packboard.

[9] Zodiac Aerospace is the parent company of Air Cruisers located in Wall Township, NJ.
[10] Service Bulletin 304-25-20 was noted on the slide at the time of the teardown.

The operation of the inflation valve (figure 6) is based on a 'ball type' valve design. On the valve assembly, a pulley is used to turn the internal ball from a closed position to a fully open position when release of the inflation gases from the reservoir is required to inflate the evacuation slide. When the inflation valve is rigged for use, the inflation cable is inserted into the pulley housing and wound onto the pulley as the valve is moved from an open position to a closed position. With the valve closed and the inflation cable in place, the reservoir is then charged with the appropriate amount of compressed gas. The reservoir and valve assembly is then connected to the evacuation slide and the system is packed. When the evacuation system is deployed, the packed slide releases below the aircraft door. The inflation cable is manually pulled and then releases out of the pulley housing on the inflation valve. The withdrawal of the inflation cable rotates the pulley in the inflation valve to the open position, releasing the inflation gas into the slide assembly and inflating the evacuation slide.

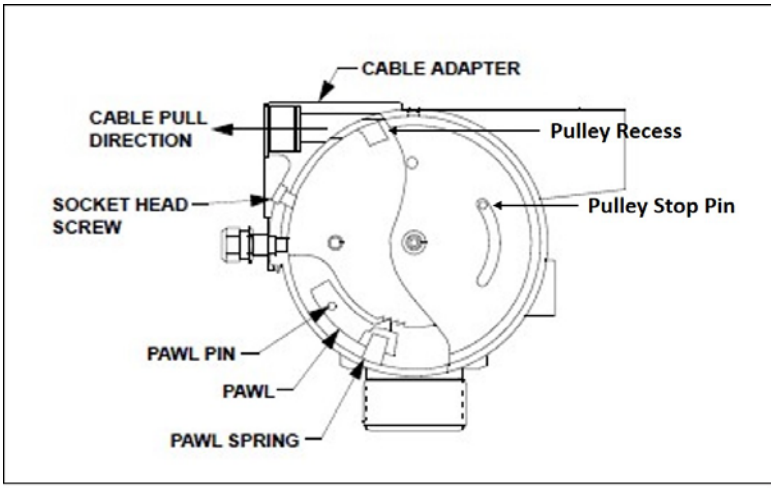
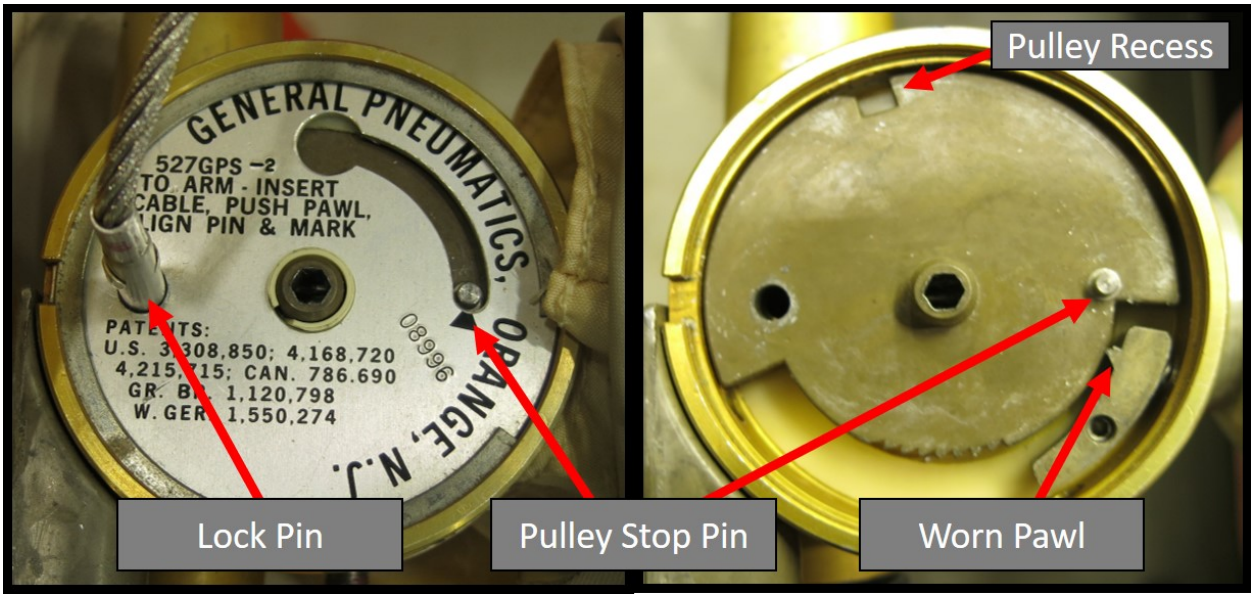


Figure 6 – Inflation valve.

The slide had partially deployed during the evacuation (photograph 4) with no evidence of gas flow from the RVA into the slide.

Photograph 4 – 1R door slide partially deployed.

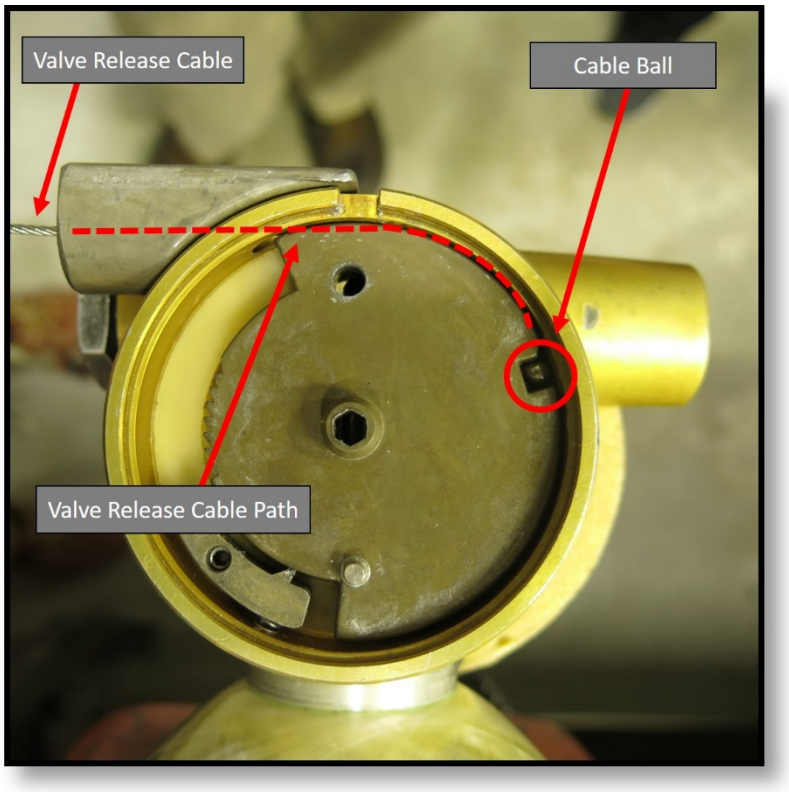
The RVA was inspected and found with a fully charged reservoir with the valve pulley in the closed position. The manual inflation release cable (pulled by the flight attendant during the evacuation) was located inside the shipping box. The cover plate on the valves internal mechanism was removed to reveal the pulley, pulley recess, lock pin and pawl[11] (photograph 5).



[11] The pawl was worn but maintained its ratchet function to keep the valve closed.

Photograph 5 – Valve assembly before and after removal of cover plate.

The valve was re-assembled, and the valve release cable was installed (photograph 6) by rotating the pulley to the 'valve open' position, inserting the cable ball end of the cable into the pulley recess, and then rotating the pulley back to the 'valve closed' position.



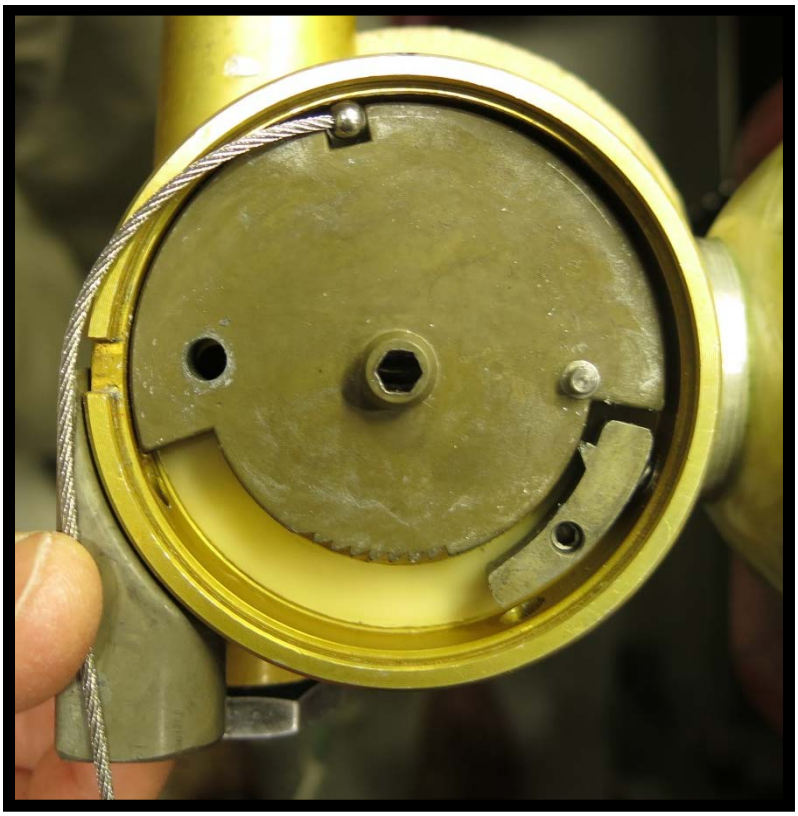
Photograph 6 – Valve release cable installed.

A test gauge was attached to the outlet fitting and the pulley was rotated to the "open" position by withdrawing the valve release cable. The pulley motion appeared smooth with no hesitation and the system pressure reading of 2,832 pounds per square inch gauge (psig) was noted on the test gauge. The expected value was 2,840 psig. per the assembly section of component maintenance manual[12] (CMM). The valve pull force reading was 15 lbs., the expected value per the testing section of CMM was 15 lbs. max. The pulley was rotated to the "closed" position and the RVA was re-attached to the slide assembly. A 'floor run' inflation of the slide assembly was performed by withdrawing the valve release cable from the RVA. The slide successfully inflated. The resulting internal slide tube pressure was 2.72 psig. The expected value per testing section of CMM is 2.3 to 3.25 psig.

The RVA was removed from the slide. The inflation valve was disassembled to simulate the potential for incorrectly installing the valve release cable assembly. The investigation revealed that the cable ball could be retained inside the housing without actually engaging the pulley recess.

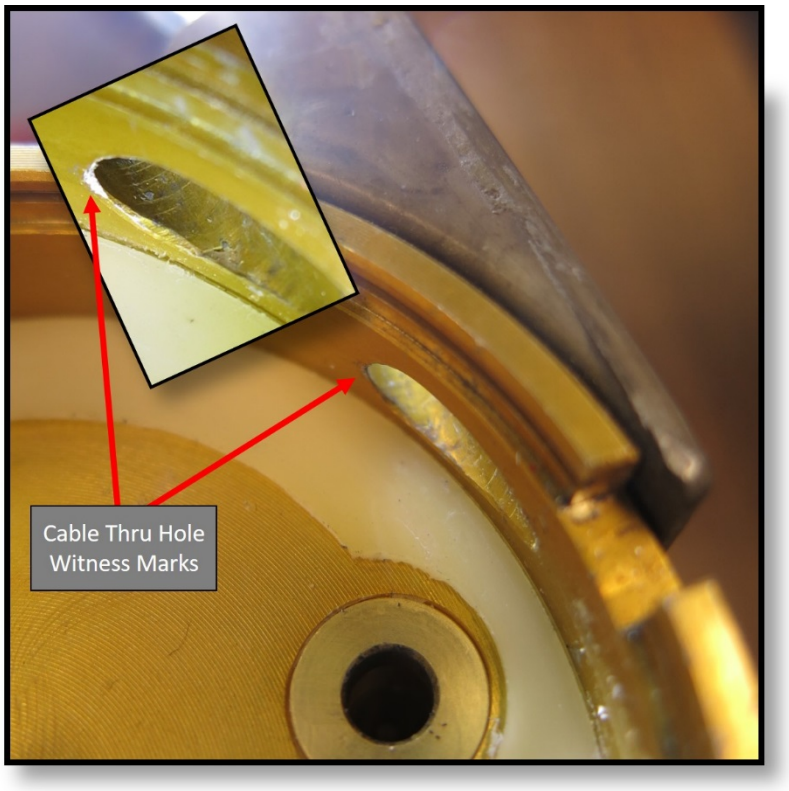
[12] The Component Maintenance Manual 25-65-11 is referred to in this report as the CMM.

The ball end of the cable was noted to have a permanent 'set' or bend which conformed to the circumference of the pulley (photograph 7).



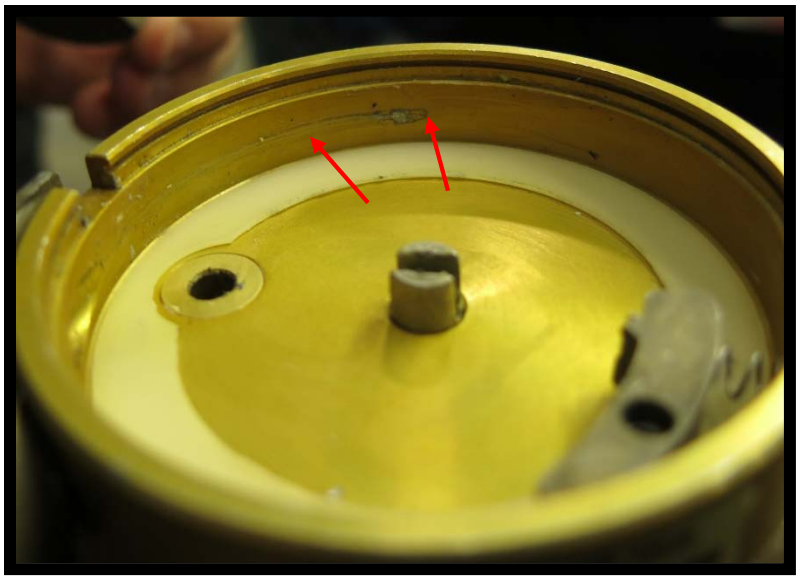
Photograph 7 – Permanent set to valve release cable.

Witness marks were found inside the pulley housing around the cable thru hole. This area would normally not be subjected to chafing during normal valve operation (photograph 8). The location was observed to be a potential "catch" point with the cable ball if the valve release cable was not properly installed into the valve pulley.



Photograph 8 – Cable thru hole witness marks.

Witness marks were found inside the pulley housing consistent with normal travel of the cable ball along the housing circumference (photograph 9).



Photograph 9 – Witness marks along normal path of the valve release cable ball.

5.2 Component Maintenance Manual

Zodiac Aerospace made modifications to the CMM valve testing procedures to ensure the cable ball is retained in the pulley recess in revision #29, dated July 14, 2017. Attachment 3 shows the CMM revision. The CMM was revised on page 711 (D) (5) to read, *Ensure valve is in the **fully** open position. Install ball end valve release cable (50B, 50D, 50F, 50I, 50J, IPL Figure 1; 50A 50B, 50C, IPL Figure 2) into pulley and cable adapter (260) until it is ~~pulled~~ **fully inserted** into pulley*. Page 711 (D)(6) adds ***Verify that the valve release cable is pulled into the pulley housing as the pulley is rotated to the valve closed position.*** (D)(7) is replaced with ***Gently pull or tug on the valve release cable. Looking closely around the gaps in the valve cover assembly on the inflation valve, verify that there is slight movement of the pulley and the lock pin due to the movement of the valve release cable. The valve release cable should not pull free of the inflation valve assembly. If the valve release cable can withdraw from the valve assembly, either the lock pin is not fully engaged or the inflation cable was not fully inserted into the pulley during the arming procedure. Repeat steps (5) and (6) to resolve unacceptable cable movement.***

CMM page 728 (B)(2) change the last sentence to read, *Slowly rotate pulley until stop pin is at opposite end of its arc of motion-**farthest away from the black triangular index mark on the cover plate.*** (B)(4) adds ***Verify that the valve release cable is pulled into the pulley housing as the pulley is rotated to the valve closed position*** and (B)(6) is replace with the same verbiage as page 711 (D)(7).

6.0 Injury Table

Injuries	Flight Crew	Cabin Crew	Passengers	Total
Fatal	0	0	0	0
Serious	0	0	0	0
Minor	0	0	1	1
None	2	4	109	115
Total	2	4	110	116

Table 4 – Injury table.

Peter Wentz
Survival Factors Investigator
National Transportation Safety Board

E. LIST OF ATTACHMENTS

Attachment 1: Flight Attendant Interviews
Attachment 2: Flight Attendant Statements
Attachment 3: Zodiac Aerospace CMM