SUBMISSION OF THE
ALLIED PILOTS ASSOCIATION
TO THE NATIONAL TRANSPORTATION
SAFETY BOARD

AMERICAN AIRLINES FLIGHT 2253
Jackson Hole Airport
Jackson Hole, WY, USA
29 DECEMBER 2010

NTSB **DCA11IA015**

In accordance with 49 CFR 831.14, the Allied Pilots Association (APA) a designated Party to the National Transportation Safety Board (NTSB) investigation of the accident, respectfully submits to the Board its findings and recommendations.

Communication with respect to this submission may be addressed to:

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# EXECUTIVE SUMMARY

On December 29, 2010, at 1138 Mountain Standard Time, a B-757-200 (N668AA), operated by American Airlines (AA) as Flight 2253 from Chicago O' Hare International Airport, IL, attempted a normal landing at Jackson Hole Airport (JAC), Jackson Hole, WY, the planned destination. Instrument meteorological conditions prevailed and an instrument flight rules flight plan was filed for the 14 CFR Part 121 scheduled domestic flight. The two Federal Aviation Administration (FAA)-licensed airmen flew the aircraft observing rules and regulations mandated by Federal Aviation Regulation (FAR) Part 121. The pilots also adhered to rules and procedures stipulated by the FAA, the aircraft manufacturer, Boeing, and the certified carrier, AA. The aircraft ran off the departure end of the runway and came to rest in packed snow. After landing, the flight crew, flight attendants, and passengers deplaned via portable air stairs and no injuries were reported among the 181 passengers and crew.

# ALLIED PILOTS ASSOCIATION'S ROLE IN THE INVESTIGATION

The National Transportation Safety Board (NTSB) is leading the investigation into Flight 2253 Departure from a Prepared Surface Accident. Assisting the NTSB in their investigation are the FAA, the Allied Pilots Association (APA), Boeing, and other designated parties.

As a party in this investigation, APA's role is to participate in all aspects of this investigation.

The NTSB requested that all parties submit proposed findings drawn from the evidence revealed during the course of the investigation.

APA has responded to the NTSB's request with this document, which:

- Provides an assessment of the evidence and other pertinent data.
- Identifies findings and recommendations from the factual evidence in the investigation.
- Lists future APA actions.
- Offers a conclusion and recommendation based on findings and analyses.

# PROBABLE CAUSE AND CONTRIBUTING FACTORS

## PROBABLE CAUSE

APA believes that the probable cause of this mishap was the failure of the armed auto-spoilers to deploy on landing and the corresponding failure of the captain to manually deploy the spoilers.

## CONTRIBUTING FACTORS

1. The captain's misperception, while serving as the pilot monitoring (PM), that the speed brake handle had in fact moved to the deployed position as evidenced by the his "DEPLOYED" call-out.
2. The 757/767 fleet is the only AA fleet type that does not require both pilots to check or verify spoiler deployment, as procedurally identified in AA 757/767 Operations Manual Volume 1, Approach-Landing-Go Around, Landing Procedures, page 50.1, dated 7-3-10.
3. Upon touchdown, the mishap aircraft's Weight on Wheels (WOW) air ground logic switch shifted from "air" to "ground" back to "air" then stabilized in "ground" mode.
4. The first officer's (PF) commanded deployment of the thrust reversers when the WOW was in the "ground" mode. The WOW reverted to "air" mode causing an auto-protection command to stow the thrust reversers. These simultaneous events created a "Race Hazard," or out of sequence input, which locked up a normally functioning reverser electro-mechanical system.

The data presented is collated from the NTSB Factual Reports and other groups' reports of the mishap and can be found at:

http://dms.ntsb.gov/pubdms/search/hitlist.cfm?docketID=50468&CFID=146242&CFTOKEN=69707473

We believe this submission addresses those areas found to be causal or contributing factors to this accident. We are confident the NTSB will determine probable cause consistent with the findings found in the Factual Reports and put the forth appropriate recommendations to resolve these flight training issues.

# FINDINGS AND RECOMMENDATIONS

APA's assessment of the evidence is based upon observations of the aircraft, accident site, post-accident examination of aircraft systems and components, the air carrier's maintenance records, log book, and manuals, Boeing flight operational and maintenance manuals, flight data recorder (FDR) data, the cockpit voice recorder (CVR) transcript, flight crew interviews, and mechanics interviews.

## *FDR FACTUAL REPORT ANALYSIS*

### Findings

1. During initial touchdown, the mishap FDR WOW trace indicates a rapid shift from "air" to "ground" to "air" and finally stabilized in "ground" mode.
2. During the landing, FDR analysis reveals the armed auto-spoilers failed to deploy when air-ground logic indicated "ground" mode.
3. The FDR trace records a slight movement of the spoiler handle from "ARMED" to "STOWED" to "ARMED." The spoilers never deployed during the event.
4. FDR data recorded actuation of reverse thrust levers immediately following WOW "ground" mode.
5. The FDR trace records thrust reverse lever actuation during the initial period of the WOW to "ground" mode. This actuation initiated a "DEPLOY" command of the thrust reversers. An aircraft auto-protection feature will command thrust reversers to "STOW" when the WOW reverts to "air" mode.
6. FDR landing trace 12 indicated a critical oversight of the auto-spoiler deployment anomaly similar to the mishap flight. The auto-spoiler did not deploy with WOW in "ground" mode. Typically, the auto-spoilers deploy in less than one second. The flight crew failed to detect this anomaly and make a corresponding E-6 logbook discrepancy entry.
7. FDR landing trace 9 demonstrates the initial movement of the speed brake lever occurring after clear and stable WOW "ground" logic, as recorded on the FDR. Next, the FDR trace records the spoiler handle returning to the stowed position. The Thrust Lever Angle (TLA) trace records touchdown with the left and right TLA above idle. This caused the ground spoilers to drive to the stowed position with WOW to "ground" mode. The FDR trace indicates the crew manually deployed the spoilers.
8. FDR landing traces 3, 4, 6, 7, 8 and 11 recorded flight crewmembers rapidly commanding reverse thrust prior to full spoiler deployment or simultaneously at spoiler deployment.

### Recommendations

See Operational/Human Performance Group recommendations.

## *OPERATIONAL/ HUMAN PERFORMANCE GROUP FACTUAL REPORT ANALYSIS*

## Findings

1. On touchdown, the PM misperceived the spoiler handle movement from “Armed” to “Stow” to “Armed” as spoiler deployment and verbalized “DEPLOYED.”
2. CVR HOT-1 recorded “TWO IN REVERSE” near the time of the PF’s attempt to deploy the reversers. This is a non-required callout.
3. The PF did not feel deceleration from the auto-braking system; the PM stated“MAX BRAKING” and both the PF and PM then initiated maximum manual braking.
4. The Operations/Human Performance Group reported the expected increase to landing distance of 1200-2800 feet for an aircraft without ground spoilers and with thrust reversers not deployed. The mishap flight crew interviews indicate they became aware of the spoilers non-deployed position only after returning to the cockpit after the event.
5. The mishap flight crew and a previous flight crew for the mishap aircraft were unaware of auto spoiler deployment anomalies as found in the FDR recovered data.(See Maintenance Record Review section analysis.)

## Recommendations

Based on these findings, APA recommends:

1. AA standardize the Landing Procedures Duties and Responsibilities section of AA 757/767 Operations Manual Vol. 1, Approach-Landing-Go Around, page 50.1 to conform with the all other fleets that require both the PM and PF to check for spoiler deployment upon landing.
2. AA ground school and simulator training needs to emphasize and incorporate performance penalties for factors affecting landing distance (AA 757/767 Operations Manual Vol. 1, Approach-Landing-Go Around, page 50.29) in conjunction with a special landing distance analysis chart for AA Special Authorized Airports.
3. AA simulator training needs to incorporate scenario based training for the “rejected landings” procedure.
4. AA ground school system training must ensure flight crew’s knowledge and understanding of the WOW air-ground logic with respect to spoiler deployment/non-deployment, auto-braking activation and thrust reverser activation.

## *SYSTEMS GROUP FACTUAL REPORT ANALYSIS*

## Findings

1. The final determination of the Systems Group indicates a failure of the “No Back” clutch mechanism located within the center pedestal speed brake assembly.
2. Many cycles of the entire speed brake assembly were successful; however, intermittent failures to sequence properly were finally observed.
3. The speed brake deployment failure became predictable when the “No Back” clutch was isolated.
4. A destructive inspection of the “No Back” clutch uncovered an improperly installed clutch component internal to the assembly.
5. No additional mechanical discrepancies were detected that would prevent a flight crew’s manual selection and deployment of the ground spoilers.
6. Ground spoilers would have deployed when manually selected and dumped the positive lift vector being created by the wings.
7. A Boeing subject matter expert estimated a negative one “g” of lift is generated by the wings with the ground spoilers deployed at touchdown speeds. This negative lift vector virtually doubles the force of the wheels on the runway and significantly improves braking action.
8. The simultaneous “DEPLOY” and “STOW” commands to the thrust reverser electro-mechanical system caused a “Race Hazard.” A “Race Hazard” is an out of sequence input which jammed a normally functioning electro-mechanical system.

## Recommendations

See Maintenance Records Factual Report recommendations.

## *MAINTENANCE RECORDS FACTUAL REPORT ANALYSIS*

## Findings

1. A review of maintenance records did not reveal any discrepancies entered by flight crewmembers regarding improper deployment sequence of auto-spoilers. FDR data indicates two previous additional auto-spoiler anomalies. The first on FDR trace 9 and the second on FDR trace 12.
2. A review of maintenance records and the Systems Group investigation indicate no issues were discovered that would affect flight crew manual spoiler deployment.
3. The Maintenance Records Factual Report did not include a spoiler non-deployment or thrust reverser discrepancy reported after the mishap. Subsequent removal of the entire center pedestal speed brake assembly occurred in San Francisco, California in March 2011 following a similar failure that was entered in the E-6 log book by a flight crew.
4. Previous maintenance actions based on reported discrepancies appear to be appropriate.
5. No E-6 logbook reported discrepancies would cause suspicion of the “No Back” clutch anomaly.

## Recommendations

Based on these findings the APA recommends:

1. AA Maintenance use the FDR engineering packet downloads to further troubleshoot anomalies when reported in the E-6 logbook with respect to WOW air ground logic, spoiler deployment/non-deployment and/or thrust reverser activation. Engineering packet downloads are similar to the FDR traces and would have illustrated the same information explained in the Flight Data Recorder Factual report.

## *SURVIVAL FACTORS FACTUAL REPORT ANALYSIS*

### Findings

No injuries were reported among the flight crew and passengers.

### Recommendations

Based on these findings the APA recommends:

None.

# APA ACTIONS

As a principal party to the investigation, APA will initiate the following actions:

APA stands ready, willing and able to assist AA, the FAA, Boeing and the NTSB with respect to incorporating any safety enhancements or recommendations that will prevent future runway excursions.

# CONCLUSION

According to both Boeing and Aviation Safety Information Analysis and Sharing (ASIAS) data, runway excursions are one of the two leading causes for hull loss incidents/accidents worldwide since 1987. AA can dramatically reduce this potential hazard by incorporating the recommendations provided by this submission. AA ground school training should be enhanced to provide flight crews with a better working knowledge of aircraft performance with respect to spoiler deployment, braking effectiveness and thrust reverser usage, and the corresponding penalties for failures of each during the landing phase. AA simulator training should include pre-flight briefings with respect to these systems, landing data analysis and aircraft performance during the landing phase. AA simulator training should modify initial, transition, R-9 or R-18 scenarios that incorporate failures of auto-spoilers or thrust reversers, as well as teach rejected landings procedures. AA currently operates five aircraft types and will be adding the Airbus to its fleet in the near future. Standardization amongst all fleets with respect to nomenclature, procedures and training during the landing procedure will greatly improve our airline safety during this critical phase of flight operations.

APA has stated findings and recommendations we believe address those areas found to be causal or contributing factors to this accident. We remain confident the NTSB will determine the probable cause consistent with our findings and put forth the appropriate recommendations.