Appendix 4

Group Chairman's Factual Report

Human Performance

DCA06MA009

Southwest Airlines
2005 Autobrake Training Materials Evaluation

Sampling of Pilot Narrative Comments

FIRST EVALUATION COMMENTS

Initial Evaluation

Overall Concerns Prior to Use

"I asked check-airman I was flying with, 'How did the autobrake affect my landing as far as lowering nose to the runway.'"

"However I have a question about addressing direction control after braking has started. I experienced a pull to the left on A/C N661 as auto braking started. FO experienced the same on the same."

"I was curious if the braking required to disengage the autobrakes felt 'different.'"

"Amount of pressure required to override (the autobrakes) on roll-out. When do I start taking effect?"

How much pressure is needed to override the brakes? What to do if you land long using MIN brakes?"

"Guidance does not make mention of when manually disconnect if normal procedures do not automatically disconnect the system."

"I don't understand the effect of rudder inputs, during landings with high cross winds, and the autobrake system. I am assuming you are recommending its use in these situations?"

"My big concern is the transition from autobrakes to manual braking."

Interpretation of 500' Margin Guidance

"Why must the runway be "not dry"? Why don't we use autobrakes anytime stopping margin <500 regardless of runway conditions?"

"I'm not clear on whether or not we must use autobrakes on a runway that is dry with less than 500 stop margin."

"Clarify criteria when autobrakes are required. Manual talks about when stopping Mar (2?) <500, and later clarifies that it is mar <500."

"It was initially unclear that autobrake level 2 was equal to minimum braking level 3 for Medium, and MAX for MAX. Also, I thought autobrakes were required if either the runway was not dry or the margin was <500."

"There is a lot about 500' and less and 500' and more. It can be a little confusing. It would be clearer to me if you gave more examples of exactly what you want me to set."

"I felt the information was concise, yet I had to review the 500' requirement after reading it twice (e.g., using the least amount setting of auto braking versus the setting on the landing output page)."

"Would like to see some OPC graphics as examples when choosing between mode 2 and 3 based on lowest setting at least 500'."

"I did not grasp, from reading, that you select the lowest AB setting that provides >500 margin."

"Some confusion in the way info written such as, 'If a 500' margin cannot be achieved'…can I use it or can't I…or I can if…(writing 'style' just needs to be clearer)."

Training Information Summary Preferred

"Lots of information. Realistically most pilots will breeze over the minutiae and will look for a short page 'cheat sheet' to summarize."

"Would have liked to see a summary, either before or after the training information."

Approach and Landing Flow

"Monitoring the autobrake-disarm light on an actual HGS landing will take away from monitoring the instruments."

"On the -700s the autobrake disarm light is not as easily in the crosscheck as a 300. Easier to miss."

"Took an unusually large amount of brake pressure to disarm the autobrakes on landing. More than I expected. Easy to forget thrust reversers while caught up in the autobrake landing sensations, getting the nose down early, and lightshows."

"(The information) did not address the 'blending' effect between captain and FO (e.g., transfer of brake control, where, and when)."

Post Evaluation

Thrust Reverse and Flow

"Recommend stressing the possibility of 'forgetting' to apply reverse thrust due to aircraft decelerating with autobrakes. At least during initial transition phase, 3 first officers were late in applying reverse thrust (out of 19 landings)."

Approach and Landing Flow

"FO's had trouble consistently with turning the switch off in their flow."

"Both pilots need to be able to pay attention outside during land roll."

"'Autobrake Disarm' callout by captain when the PM is difficult, as assuming control is primary concern, and light is not in field of view."

Difficult to Determine if Working and Concerns of Failure

"On some landings (about 1/2) it was difficult to determine if the autobrakes were working. (All autobrake events were position 2 w/ lots of runway. Other landings it was clear we were braking. The only commonality was that the more noticeable braking seemed to occur with a true 'power at idle' landing (i.e. calm winds/winds down the runway.) It will be interesting to see how many people tap the brakes on rollout to make sure they are working and subsequently disengage autobrakes."

"Have there been any accidents / incidents from using autobrakes related to brake or system failure? Who disarms if they fail?"

Interpretation of 500' Margin Guidance

"All our landings were with lots of stopping margin. It will be very interesting to try this the first few times w/ margins less than 500'... I don't know how to train for this. Obviously landing within 1500' is key, especially with small stopping margins. I'd like to see this emphasized, along with a note about what sort of error factors are built into the stopping distances in the OPC. My concern is that we start moving one position up to ensure we stop with enough room."

Training Information Summary Preferred

"The volume of information was difficult to digest. The information needs to be presented in 'Reader's Digest' format. The information presented is difficult to get through in an academic situation, let alone an operational situation."

"OPC guidance seemed difficult to interpret."

"A short summary would have been helpful."

"Well written, but needs to be as short and sweet as possible. Include a Jepp size fact tab of important info - it would probably be the only thing some pilots read before attempting autobrake use."

Suggestions for Initial Use

"I was surprised by how much brake pressure I had to apply to disarm the autobrakes. My speed was much lower than I wanted before the autobrakes disarmed. I thought I might be causing a lurch. I wouldn't want to use them the first time on a wet runway. I may expect more of a braking action."

"Maybe add in, Pilot make first autobrake landing on long runway to gain confidence."

"Once the information is digested, the procedures are easy to understand and follow. The biggest issue is getting comfortable with the system (i.e., when to use and how to disengage)."

Landing Summary: Pilot Flying (PF)

Thrust Reverser and Flow

"Mainly pilot error. I initially forgot to deploy the thrust reversers immediately but (the) check pilot caught it. Thrust reversers were deployed. I seemed to focus on the autobrakes landing."

"I landed hard on first landing and did not do very well (BWI). The second landing was MDW with a nice landing but I failed to apply 65% reverse thrust. I only went to approximately 30%. The brakes, however, worked very well."

Transition from Auto to Manual Braking

"From position 3 auto braking did not release with my application of brakes. Did not release until the captain took the brakes and added thrust."

"Required more pressure than expected to disengage."

"It felt a little uncomfortable stepping hard to release the autobrake."

"At times forced to brake more than desired to ensure override took place."

"Takes some getting used to."

"In one case, I didn't realize the AB had not disengaged and quite a bit of more force was applied to go manual causing a lurch. In another case, the amount of force to go manual caused the same problem."

"Autobrake did not turn off when brake applied. Even had enough to slow from 80kts to taxi speed. Noticeable lurch."

"Seemed like it took a lot of manual force to disengage, but as I gained experience it seemed to become easier/more natural to be aggressive enough to disengage autobrakes."

"First landing waited too long (well below 80kts) just watching the system using level 2 then had to brake more firmly than I wanted to get the system to engage - well below 80kts. When I started braking at 80kts per the FOM the system felt great."

"Much more brake pressure was required than I expected, especially with med (3). Even with min(2) selected the braking is not smooth when trying to deselect autobrake. In fact, since a greater deceleration is required to disarm the autobrakes then the autobrake is providing, I don't think a smooth transition is possible."

"First couple of times, I had problems getting the autobrakes to disarm, it required considerably more pressure than the autobrakes were applying. After doing it several times, disarming became no problem. I began applying steadily increasing pressure at 80kts until I saw the disarm light illuminate."

"For smoothness and making turnoffs it helps to practice overriding the autobrakes."

"Manual disarming with applied braked pressure occurred at lower speed than desired. Thought I might experience an autobrake lurch or cause one myself."

"Crews need to be ready for it. The problem I found was that when the autobrake setting was slowing me down (-700 only) to a speed slower than I wanted - after missing a turn off - I had to apply much more brake pressure than desired then had to add power to go to next taxiway - this as experience was gained became less of a problem."

"In the -700 you really have to apply more brake pressure than expected (more than expected even with the comment in the handout).

"I found on the -700 (we did not fly the -300) more pressure than anticipated was required. If you push the throttles forward to disarm it was too abrupt."

"On the -700 pressure used to disengage was substantially greater than on the 300 and 400 but was acceptable. I was forewarned by checkairman and have thousands of autobrake landings, but someone new to autobrake will definitely have to pay attention to disengage next on -700 to prevent lurching."

"Now that I know what to expect I would be able to use proper back pressure."

"Once during landing rollout, the autobrakes did not disengage. We turned off the autobrakes with the switch to avoid a lurching stop. Brake pressure greater than what was being used would have been alarming to the passengers."

"The first one or two transitions to manual were learning the 'feel' of the transition, after that - no problems."

"Hard to override the autobrakes (especially in the 700). Had to use more pressure than I'm accustomed to. Took some time to develop technique for a smooth transition to manual braking."

Autobrakes Disarm Light

"Using MAX autobrakes did not release/autobrake disarm light, did not illuminate until I added thrust."

"I found that both pilots were fixated inside waiting to see when light would come on."

"Unless I have the F/O call out whenever A/B disarm light comes on - I have to divert my attention inside to make sure A/B is disengaged, particularly in the -700."

"(We) never got the disarm (light) until well below 60kts, even though we tried on later flights."

"I noticed my eyes going to the autobrake disarm light for confirmation that I was in control. Could distract your attention from centerline so suggest doing it at slow speed."

"Insuring that autobrakes disarm as desired is a major distraction."

"(I) was looking outside. Hard to see autobrake disarm light illuminate."

Landing Summary: Pilot Monitoring (PM)

Thrust Reverse and Flow

"Landing in level 2 on a long, dry runway, pilot flying (FO) was very late to actuate reverse thrust (probably due to his distraction performing his first autobrake landing)."

"Due to my monitoring for 'disarm light' I noticed the lack of reverse later than I normally would have. I will now brief as a reminder to do everything as we always have (e.g., thrust reversers, confirm speedbrake deployment, etc.) Again, I think this occurred simply due to the distraction and anticipation of determining how the aircraft would brake."

"Forgot reverse initially."

"All three FO's when trying autobrakes for the first time were so engrossed with it that they did not apply thrust reversers on landing and had to be reminded. PM's need to be warned and ready for PF's 1st time to land with autobrakes."

"Trying to take to aircraft I found the FO did not start stowing the thrust reversers. Maybe the speed to transfer control (80kts) is too early."

"I'll need to incorporate turning the autobrake to 'off' as part of my clearing runway (after landing) flow."

Transition from Auto to Manual Braking

"Braking down to taxi speed did not override autobrakes until speedbrake stowed. Lurching felt. Braking was applied with enough force autobrakes should have disengage."

"The aircraft lurches uncomfortably when manual brakes are applied hard enough to deactivate the autobrake."

"Setting three-brake required to disarm made for a more jerky braking than without autobrakes."

"We made any callout for autobrake disarm including manual takeover <80kts. This may be a good adjustment to the procedure so the pilot flying knows he's overridden the autobrake without having to look inside. I'd recommend trying autobrake for the first time on a runway with no performance issues (long/dry) using Min (2) setting. Then normal procedures but don't initiate manual braking as reversers are stowed. This will allow you to experience the autobrakes coming on for a perspective. My first 2 landings with 2 selected I never felt the brakes come on automatically, so I didn't feel I knew what to expect until I tried it the way I described it above."

Autobrakes Disarm Light

"If you sit too high you can have problems seeing it!"

"My height (6'1") and seat position do not allow me to view the disarm light. I will have to lower my seat from my normal position in order to see the light."

"I missed the 80 knot call once or twice due to focusing on the autobrake light."

"The light is not a normal part of my scan."

"I think there should be more for the pilot monitoring to be concerned with beside just rather or not the autobrake disarm light illuminated prior to 80 knots. I would suggest the pilot monitoring be prepared to move switch to off if required. Call if autobrake is still armed or engaged after the pilot flying has initiated manual braking."

"You have to divert attention to the light to make sure you see it come on. Would a callout from the pilot flying that 'brakes are coming on' help?"

"No autobrake disarm light after pilot flying applied brakes. Some confusion resulted."

"Too bad the light is not closer to the windscreen so you don't have to be so 'heads down' but I can learn to live without it."

"When the autobrake light is at a low position (-300) it is hard to see."

"Remembering to bring the 'autobrake disarm light' into the landing roll crosscheck the first few times."

"Should be no problem, I was busy taking in the autobrake experience. Just forgot to make the call."

"Under certain conditions, I would rather not have to look for a light. It does redirect your attention."

"Forgot 80kts (callout) because I was focused on the light."

SECOND EVALUATION COMMENTS

Post Evaluation

Thrust Reverse and Flow

"Had 2 FO's seem to forget we still use reverse thrust."

"I used the reverser a little late on the first landing because I was so focused on the procedure. Okay since."

Transition from Auto to Manual Braking

"Initially did not really feel slowdown in #2. Therefore, wondered whether system was activated or not."

"I didn't apply enough pressure when transitioning, but will get better with practice."

"It took a couple of landings to get used to the amount of pressure to disarm autobrake."

"No real problem. I was still a little unsure as to what to expect on first landing. The delay seems longer than the FOM says. Again, only first time."

"The only possible problem is that one might delay braking action in a manual brake landing if one gets too used to autobrake."

Autobrake Disarm Light

"Autobrakes disengaged, but no light."

"I did not see the light come on twice."

"In the -700, the light can be hidden by the glareshield. However, I am 6'3"; it worked fine when I lowered the seat."

"It took a couple of times to include (the light) in the scan and make the proper callout. After that, no problems."

"Autobrake Disarm light sometimes not in view (FO)."

"I'm simply not used to looking forward to catch the light, but practice will correct it."

"Occasionally we were looking at the high speed turnoff, tower was telling us to switch to end, and our heads were out of the cockpit looking at the taxiway."

"If one is short, it is easier to see the light illuminate (captain)."

"I missed the call "Autobrake disarmed" 95% of the time. At this point in the landing, I made sure spoilers deployed and glanced down to see if the reverse thrust engaged. After this, were outside to make sure adequate runway remains and that the centerline is maintained. I did not notice or am not trained to use my peripheral vision to the light illuminate. On HGSIII approaches I feel that there are many things for the FO to monitor. Getting used to bringing the Autobrake Disarm light into my scan when the weather is low will be hard. With "hydroplaning," I like to get a feel of what is happening with deceleration with manual brakes. I have not had any experience with Autobrake when hydroplaning or skidding sideways with a good crosswind on a contaminated runway. I would not want to be surprised when I take over braking manually."

"Difficult to concentrate on the transition when captain is PM to make 'Autobrake Disarm' callout. All issues except captain-PM Autobrake disarm callout have been addressed."

"The FOM guidance states to concentrate on the centerline and AIII information during Autobrake AIII events; it will be interesting to see it in action."

<u>FOM Guidance</u>

"I needed clarification of when to use #2 or #3 autobrakes after reading the FOM guidance."

"Good FOM guidance."

"The FOM guidance was at times redundant because of the wording. For the most part, the instructions were understandable."

"Don't make the specific mode selection (2, 3, MAX) so rigid. Allow the crew to choose, as long as minimum stopping distance requirements have been met."

"The FOM guidance needs an addition about continuous scan: If 700RVR and FO is focused on Autobrake Disarm light and doesn't notice ADI runway symbol as captain is starting to go off the runway. Problems the first time, but fine now. Low IFR/CATIII, we need to look at primary instead (especially ADI) in rollout, not focus on 'Autobrake Disarm.'"

"The 4-page handout does not address how selecting an Autobrake setting of 2, 3, or MAX 'achieves' a stopping margin of less than 500'! The handout directs us to 'use the lowest Autobrake setting resulting in a stopping margin of 500' or more.' Until the OPC offers values that actually account for Autobrake usage, such a statement is without meaning."