Flight Safety

Published for the pilots of American Airlines

NOV. / DEC. 1999

FLIGHT SAFETY

NOVEMBER/DECEMBER, 1999 Volume 1, Number 1

2

5

From Captain C.D. Ewell
Vice President Flight and Chief Pilot

It is often a difficult decision whether or not to publicize details of incidents and accidents. In many cases, valuable information does not get disseminated widely due to concerns of inappropriate use or misinterpretation, especially by the media. Be that as it may, I have come to believe that all information concerning incidents and accidents is most valuable and important to the men and women who fly our planes. I urge you to read this and future editions of FLIGHT SAFETY carefully and learn from these experiences.

FLIGHT SAFETY

Published by the Flight Safety Department and distributed to the pilots of American Airlines

American Airlines Flight Safety Department
P.O. Box 619617, MD 849, DFW Airport, TX 75261
FAX: (817)931-8948
www.aasafety.com

Captain K. Scott Griffith
Managing Director Flight Safety
scott_griffith@amrcorp.com
(817)967-5167

Tommy McFall
Managing Director
Safety & Environmental
tommy_mcfall@amrcorp.com
(817)967-1068

Curt Lewis, P.E., CSP
Manager Flight Safety
curt_lewis@amrcorp.com
(817)967-1066

Captain Joe Oyler
Manager Flight Safety
joe_oyler@amrcorp.com
(817)967-5732

Captain Don Wilson
Manager Flight Safety
don_wilson@amrcorp.com
(817)967-5174

Randy Engberg
Flight Safety Technology Specialist
randy_engberg@amrcorp.com
(817)967-1060

John Darbo
Senior Administrator Flight Safety
john_darbo@amrcorp.com
(817)931-4825

Shannon Hardy
Flight Safety Investigator
Cabin Safety Specialist
shannon_hardy@amrcorp.com
(817)967-9002

Robert Ruiz
Flight Safety Investigator
Latin America Specialist
robert_ruiz@amrcorp.com
(817)931-4417

Sergio Sales
Flight Safety Investigator
Latin America Specialist
sergio_sales@amrcorp.com
011-55-21-292-0899 (GIG)

Tammy Smart
Flight Safety Investigator
tammy_smart@amrcorp.com
(817)967-3954

Denise Deegan
FAA Liaison & Line Ops.
denise_deegan@amrcorp.com
(817)967-5141

Penney Pollard
ASAP Coordinator
penney_pollard@armcorp.com
(817)967-5674

Priscilla Carder
FAA Compliance Analyst
pricilla_carder@amrcorp.com
(817)967-5056

Reyna Torres
Staff Assistant
reyna_torres@amrcorp.com
(817)967-1829

MANAGING EDITOR
Curt Lewis, P.E., CSP

CONTRIBUTORS
Tom Chidester, Ph.D.

John Darbo

Captain K. Scott Griffith

Tommy McFall

Robert Ruiz

PRODUCTION
PS Services

captain k. scott griffith, managing director flight safety
and
tommy mcfall, managing director safety & environmental

Safety is the Bottom Line

American Airlines' corporate vision is to be the world leader in flight safety. So what is the "Bottom Line?" We think the answer is self-evident. Dependability, on-time performance, costs and revenue passenger miles are all measured precisely. But by any measure, an airline must operate safely to succeed. In fact, when you think about it, safety is the single most important asset of our business: corporate shareholders, customers and employees alike depend on safety for success.

As line pilots, you must continuously prioritize your objectives. *American Airlines Flight Manual Part 1* states the operational priorities as:

1. **Safety**
2. **Passenger comfort and convenience**
3. **On-time departure and arrival**

Implied within this policy statement is the recognition that choices are to be made out on the flightline. At times, operational pressures may compete with safety in the "real world." The pilot-in-command of the aircraft possesses the final authority to make decisions to ensure the safety of flight. That authority carries with it an enormous responsibility. It is imperative that each of you be aware of the threats to safety encountered in day-to-day operations; and most importantly, how to avoid them. Forearmed with knowledge and awareness, good judgment will always lead to conservative choices. Although these choices might be second-guessed because of resultant delays, cancellations, or other inconveniences, the end result must always be measured against the consequences of failure. In essence, we cannot afford to take safety for granted.

The Flight Safety Department is committed to the proactive prevention of accidents and incidents. We have developed this publication in response to feedback from line pilots who requested more safety-related information. It will concentrate on the facts surrounding "real world" events. We will draw upon many sources for our articles, including de-identified information from the Airline Safety Action Partnership (ASAP) program of American Airlines. In most cases the facts will speak for themselves. In some instances we may choose to offer our perspective on the lessons learned. We welcome your input and hope that you will find the information valuable. In any event, we invite you to share our commitment and recognize that safety really is everyone's business.

Captain K. Scott Griffith
American Airlines
Managing Director Flight Safety

Captain Griffith was hired as a pilot for American Airlines in 1984. During his career he has flown the B-727, MD80, B-757, B-767, and is currently a captain on the B-767 / 757. Captain Griffith previously served on the National Safety Committee for the Allied Pilots Association from 1988 to 1994, and was the APA Safety Committee chairman from 1991 to 1994. He helped develop the Airline Safety Action Partnership (ASAP) program and now oversees that program at American Airlines, in addition to his other duties as Managing Director Flight Safety. He currently serves as chairman of the industry ASAP Task Force. Captain Griffith holds an MS degree in Physics from Texas A&M University and a BA in English and Physics from Texas Christian University.

Tommy McFall
American Airlines
Managing Director Safety & Environmental

Tommy McFall has been the Managing Director Safety & Environmental for American Airlines (AA) since October 1995. Prior to AA, Mr. McFall was an Aircraft Accident Investigator and then served as the Regional Director of the National Transportation Safety Board (NTSB) for the South Central Regional Office located in Arlington, Texas from 1983 to 1995. Prior to the NTSB, Mr. McFall was a pilot for Braniff International Airways, corporate pilot, and a former U.S. Naval Aviator. Mr. McFall is a graduate of Oklahoma State University. He is also past chairman of the Air Transport Association's (ATA) Safety Council.

curt lewis, P.E., CSP, manager flight safety

Flight 1420

Little Rock Update

On June 1, 1999, American Airlines Flight 1420 overran the runway and impacted the approach lighting system during landing in Little Rock, Arkansas. The accident involved a McDonnell Douglas MD-82 originating from Dallas-Fort Worth. The aircraft carried 6 crew and 139 passengers. One hundred thirty-four people survived the accident including a two-year-old in a child-restraint system.

The flight crew was finishing the last leg of a three leg trip, originating in Chicago (ORD), stopping in Salt Lake City (SLC) and Dallas-Fort Worth (DFW) before arriving in Little Rock (LIT). The flight crew was on duty for roughly 13.5 hours and flew approximately 8 hours. The scheduled departure time for the LIT leg was 8:28 p.m. but the flight was delayed until 10:40 p.m.

When the scheduled aircraft became unavailable due to ATC and weather delays, the captain requested another aircraft and dispatch provided a revised route and flight plan to LIT due to weather, taking the flight south of a line of thunderstorms. In addition to the revised route and flight plan, the crew was provided with a current TAF, METAR, Significant Weather Watch (WW) 357, Sigmet 11C, which is presented below, and a weather map containing the location of the front, its movement, the airmass types, and thunderstorm outlooks. The forecasted weather in the LIT area called for light rain and thunderstorms and broken cumulonimbus clouds at 1500 feet. The winds and visibility were forecasted to be variable at 25 knots with gusts to 40 knots and 3 miles visibility.

CONVECTIVE SIGMET 11C
VALID UNTIL 0455Z
AR OK TX
FROM 2OENE RZC-40SE LIT-6ONW GGG-40S MLC-2OENE RZC
AREA SEV TS MOV FROM 30020KT. TOPS ABV FL450.
HAIL TO 2 IN...WIND GUSTS TO 70 KT POSS.

While en-route, dispatch sent an ACARS update with weather information on the storms, a new METAR, which is seen below, and a description of the radar showing thunderstorms to the left and right of the airport but a clear spot over it. The crew acknowledged that their radar showed the path through the storms noted by dispatch.

AN N2I5AA/GL DFW- /FLT 1420 DFW-LIT
LIT KLIT 020357
020301
METAR KLIT 020253Z 18009KT 7SM TS SCTO5OCB BKNO75 OVC12O 26/23
A2984 RMK AO2 TSBOOE24B52RAE24 SLP103 TSE MOV E OCNL LTGICCC
S-SW TS S-SW MOV NE P0004 60004 T02560233 50016

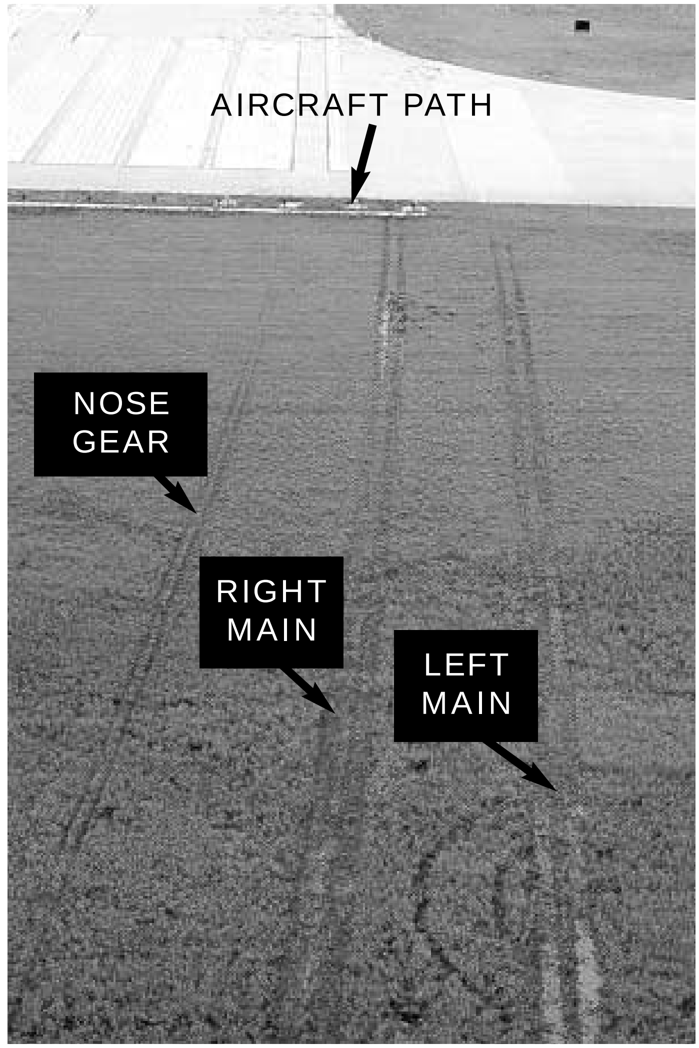
Little Rock accident site

Below is the ATIS:

Good evening, Little Rock Adams Field information Romeo 0422 Zulu special observation, wind one niner zero at one four, visibility seven, thunderstorm, a few clouds at seven thousand, cumulonimbus, ceiling one zero thousand broken, temperature two five, dew point two three, altimeter two niner eight eight, frequent lightening in cloud, cloud to cloud, west through northwest, moving northeast. ILS runway two two left approach in use. Notices to Airmen, Runway two two right, four left out of service. Attention all aircraft, hazardous weather information for the Little Rock area available on HIWAS, flight watch or flight service. Departing aircraft contact tower one one eight point seven for clearance and taxi. Advise on initial contact you have .... Repeat of Atis....

Below is an edited version of the FAA ATC transcript.
(Non-pertinent information removed.)

	AAL1420	American 1420
	LC1	LIT Local Control
	ZME	Memphis Center
0434:06	AAL1420	American uh fourteen-twenty uh eleven three for ten thousand
0434:13	LC1	American fourteen twenty little rock approach roger we have a thunderstorm just northwest of the airport moving uh through the area now the wind is two eight zero at two eight gust four four and uh I'll have new weather in just a moment I'm sure [22 kt crosswind]
0434:25	AAL1420	Now we can see the uh lightning and uh you want to repeat the winds again
0434:29	LC1	Right now the wind current wind is two niner zero at two eight gusts four four [25 kt crosswind]
0434:44	LC1	American fourteen twenty expect an ILS runway two two left
0434:48	AAL1420	Two two left we got that american fourteen twenty
0435:39	LC1	American fourteen twenty descend at pilot's discretion maintain four thousand
0435:46	AAL1420	Down to four thousand american uh fourteen twenty
0439:00	LC1	American fourteen twenty descend and maintain three thousand
0439:05	AAL1420	Out of four for three uh american fourteen twenty
0439:09	LC1	American fourteen twenty uh your equipment's a lot better than what I have how is the final for two two left lookin'
0439:13	AAL1420	Okay we can uh see the airport from here we can barely make it out but uh we should be able to make two two uh that's storm is moving this way like your radar says it is but a little farther off than you thought
0439:24	LC1	American fourteen twenty roger would you want to just a shoot a visual approach
0439:28	AAL1420	Uh at this point we can't really make it out we're going to have to stay with you as long as possible
0439:33	LC1	American fourteen twenty roger and the winds kind of kicked around right now its three three zero at a one one [11 kt crosswind]
0439:40	AAL1420	Okay well that's a little bit better than it was
0439:45	LC1	And uh right now I have a wind shear alert centerfield wind is three four zero at one zero north boundary wind is three three zero at two five northwest boundary wind zero one zero at one five
0439:59	AAL1420	Is it possible to get runway four
0440:02	LC1	American fourteen twenty yes sir we can do runway four if you would prefer to do that
0440:08	AAL1420	(Unintelligible) we would rather do the headwinds sir
0440:10	LC1	I'm sorry say again american fourteen twenty
0440:12	AAL1420	Yeah we're going to want the headwinds of course..runway four
0440:19	LC1	American fourteen twenty uh turn right heading of a two five zero vectors for the ILS runway four right final approach course
0440:26	AAL1420	Okay a right turn to two five zero uh the long way around
0440:32	LC1	Uh yes sir you're a little close to the airport
0440:34	AAL1420	Two five zero that'll work
0441:22	LC1	American fourteen twenty uh maintain three thousand three hundred for now please
0441:26	AAL1420	Three thousand three hundred we just saw it thanks
0442:27	LC1	American fourteen twenty it appears we have uh a second part of the storm moving through the winds now three four zero at one six gust (unintelligible) [15 kt crosswind]
0442:39	ZME	Little rock helena on the sixty eight line
0442:39	AAL1420	Roger that
0442:40	LC1	Did you call
0442:42	ZME	Pine bluff high memphis are you guys
0442:43	LC1	This little rock
0442:47	ZME	Landin'
0442:50	LC1	This is little rock uh
0442:52	ZME	Are you guys still being still getting' in there
0442:53	LC1	Well we have a guy trying it right now uh I'll let you know in a minute
0442:54	ZME	Are you landin' to the southwest
0442:55	LC1	No we're landing right now I've got us to the north hold on a second okay
0442:57	ZME	All right
0442:58	LC1	American fourteen twenty did you call me
0443:00	AAL1420	Well we got the airport we're going between clouds I think its right off my uh three o'clock low about four miles
0443:03	LC1	American fourteen twenty that headin' you want to shoot the visual approach or do you want to go out for the ils
0443:10	AAL1420	We'll we'll shoot the visual we we can do it



Tracks showing aircraft in a nose right skid departing runway's left side

0443:12	LC1	American fourteen twenty cleared visual approach runway four right if you lose it need some help let me know please
0443:16	AAL1420	I'll stay with you as long as possible okay all right
0443:21	LC1	I'm working everything american fourteen twenty
0443:22	AAL1420	Works for me
0443:25	LC1	All right
0443:30	LC1	Yep
0443:32	ZME	I've got a couple of aircraft comin' in there wantin' to know if they're going to be able to get in
0443:37	LC1	Uh well I don't know american uh he came in from the south there he's on a visual approach right now but it's uh it's kind of rocking and rolling here
0443:38	ZME	All right
0443:44	LC1	So you might want uh put it off a little bit if they can it its gots about uh because my radar is not that good the weather uh
0443:46	ZME	Better than ours
0443:48	LC1	Well then then you need (unintelligible) it looks like it maybe should be out of here I don't know thirty minutes or so it's movin' kind a quickly it looks like
0443:50	ZME	Be there in thirty minutes or leavin' in thirty minutes
0443:52	LC1	Well hopefully out of here by thirty minutes don't hold me to that because I'm not sure
0443:54	ZME	I got it
0443:56	LC1	All righty
0443:58	ZME	(Unintelligible)
0444:03	LC1	Kk
0444:05	LC1	American fourteen twenty you can monitor one one eight point seven runway four right cleared to land the wind right now is three three zero a two one [20 kt crosswind]
0444:07	AAL1420	Eighteen seven we'll monitor clearance american fourteen twenty cleared to land runway four
0444:29	AAL1420	Hold on and uh approach american fourteen twenty
0444:30	LC1	American fourteen twenty yes sir
0444:33	AAL1420	There's a cloud between us and the airport we just lost the field and uh I've uh on this vector here I have the uh the basically last vector you gave us we're on a kind of a dog leg it looks like
0444:40	LC1	American fourteen twenty fly heading two two zero that will take you out for the ils
0444:44	AAL1420	Two two zero is fine
0444:45	LC1	All right and it will be just probably just one turn on to final from downwind to final for the ils
0444:50	AAL1420	That's how it's going to have to be thanks
0444:54	LC1	American fourteen twenty descend and maintain two thousand three hundred
0444:57	AAL1420	Two thousand three hundred american fourteen twenty
0445:47	AAL1420	And approach american fourteen twenty we know you're doing you're best but we're getting pretty close to this storm we'll keep this in tight if we have to
0445:53	LC1	I'm sorry american fourteen twenty uh turn right of uh heading two seven zero
0445:59	AAL1420	Two seven zero american fourteen twenty
0446:00	LC1	And uh when you join he final you're going to be right at the just a little bit outside the marker if that's going to be okay with you
0446:06	AAL1420	It's okay with us
0446:07	LC1	American fourteen twenty roger
0446:26	LC1	American fourteen twenty turn right heading three zero zero
0446:29	AAL1420	Right turn three zero zero american fourteen twenty
0446:39	LC1	American fourteen twenty is three miles from the marker turn right heading zero two zero maintain two thousand three hundred until established on the localizer cleared ils runway four right approach
0446:48	AAL1420	Two thousand three hundred american fourteen twenty cleared ils approach
0446:52	LC1	American fourteen twenty right now we have uh heavy rain on the airport the current weather on the atis is not correct I don't have the current weather for you but the visibility is uh less than a mile the runway right four right rvr is three thousand
0447:05	AAL1420	Roger that three thousand american fourteen twenty runway four right correct
0447:08	LC1	American fourteen twenty that's correct sir uh runway four right cleared to land the wind three five zero at three zero gust four five [25 kt crosswind]
0447:15	AAL1420	Three five zero at four five american fourteen twenty [38 kt crosswind]
0447:54	LC1	Windshear alert centerfield wind three five zero at three two gust four five north boundary wind three one zero at two niner northeast boundary wind three two zero at three two
0448:12	LC1	American fourteen twenty the runway four right rvr now is one thousand six hundred
0448:26	AAL1420	American fourteen twenty we're established inbound
0448:27	LC1	American fourteen twenty roger runway four right cleared to land and the wind three four zero at three one north wind north boundary wind is three zero zero at two six northeast boundary wind is three two zero two five and the four right rvr is one thousand six hundred
0448:41	AAL1420	And uh american fourteen twenty thanks
0449:12	LC1	Wind is three three zero at two eight [27 kt crosswind]
0449:33	LC1	Wind three three zero at two five [24 kt crosswind]
0449:54	LC1	Wind three two zero at two three [23 kt crosswind]
0450:55	LC1	American fourteen twenty report clear of the runway please
0451:16	LC1	American fourteen twenty tower
0451:31	LC1	American fourteen twenty tower
0452:00	LC1	American fourteen twenty tower
0452:23	LC1	American fourteen twenty tower

Flight 1420 touched down on Runway 4R in rain at 11:51 p.m. local time at a speed of about 143 kts., NTSB officials said. The aircraft touched down in a left crab, and, as it proceeded down the runway, it hydroplaned right to the downwind side of the runway, corrected left through centerline and went into a right crab drifting left where the main gear exited the runway on the left side, 1,000 feet from the end. As the aircraft proceeded off the end of the runway still in a crab, the speed was about 86 kts. (See photo page 3)

The NTSB investigation is on-going and a public hearing is scheduled for early 2000. Many issues remain to be resolved including spoiler deployment, hydroplaning, autobraking, aircraft rescue and fire fighting and Terminal Doppler Weather Radar. Updates to the investigation will be provided.

Research by: Ginnie Hazard, Flight Safety Intern

curt lewis, P.E., CSP, manager flight safety
and
john darbo, senior administrator flight safety

Avoiding Tailstrikes:
Energy Management

Tailstrikes happen when an airplane's tail comes in contact with the runway on takeoff or landing without benefit of a tailwheel. According to studies conducted by the Douglas Products Division, they can happen for many reasons, but are, of course, more frequent under certain circumstances. There are some aircraft types that experience a larger percentage of its tailstrikes during takeoff, and others that have a higher percentage when landing. Efforts have been made by manufacturers to reduce tailstrikes as much as possible. Adding tailskids, changing procedures, and enhancing training are just some of the ways that the airlines are solving the problem of tailstrikes. The critical factor in tailstrike avoidance is the pilot's adherence to standard procedures.

Although strides have been made in trying to train pilots to avoid these problems, there is no substitute for experience. That is why it should come as no surprise to know that most tailstrikes are usually incurred by pilots with fewer than 100 hours of flight time in an aircraft type. The largest number of tailstrikes happen to pilots during their first heavyweight operations in the new aircraft during bad weather. Despite this trend, tailstrikes are not limited only to transitioning pilots. Our records show that they can happen to pilots with extensive experience in any aircraft type. The following sections will discuss factors that contribute to tailstrikes on takeoff and landing, and energy management.

TAKEOFF

Tailstrikes that occur during takeoff can usually be attributed to one of four things. They are:

- Mistrimmed stabilizers
- Rotating at improper speed
- Excessive rotation rate
- Improper use of the flight director

Of course, these are not the only situations that will cause a tailstrike during takeoff, but they have been found to be present at some time during a large number of tailstrikes.

Mistrimmed Stabilizer

A mistrimmed stabilizer which increases the chances of a tailstrike during takeoff, may occur for a number of reasons: incorrect data, miscalculated weights, an incorrect center of gravity (CG), or incorrectly entering information to the flight management system. Any of these will put the stabilizer in the wrong position. A crew with a great deal of familiarization with the aircraft type and its weight range will be more likely to catch mistakes by checking the information against past experience. Mistrimming the stabilizer nose-down has the potential to cause problems during takeoff, but will rarely cause a tailstrike. On the other hand, mistrimming the stabilizer nose-up can greatly increase the chances of incurring a tailstrike. A stabilizer mistrimmed nose-up will require less force on the yoke to initiate a rotation, as does an aft-center of gravity position. The pilot might not expect the nose to rise so quickly and exceed the rotation rate causing a tailstrike. When this happens, the aircraft usually passes through the critical rotation angle before the necessary changes in attitude can be made. There is also a chance that the nose

The critical factor in tailstrike avoidance is the pilot's adherence to standard procedures.

will rise without any control input from the pilot, and the aircraft rotating on its own.

Rotating at improper speed

Miscalculation of data can also cause the pilot to determine V1 and VR speeds that are too low for the weight and flap settings of the aircraft. Errors can also occur when placing the data into the flight management system. This can cause the computer to display the wrong rotation speeds.

Excessive rotation rate

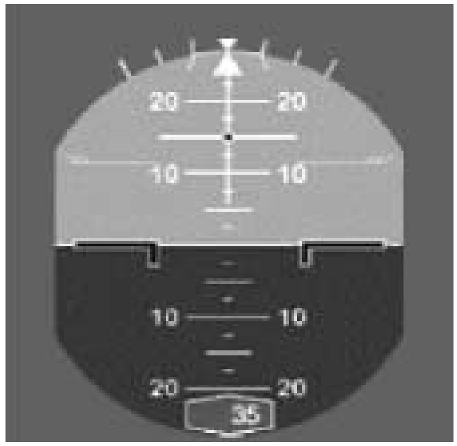
Another problem faced by pilots transitioning to a new aircraft type is the tendency to use an excessive rotation rate. This can be a noticeable problem when the pilot goes from an aircraft with unpowered flight controls to an aircraft with hydraulic assistance. They usually do not expect such a drastic change in the control feel. Loading the CG at its aft limit will also cause a greater tendency for the aircraft to pitch higher and sooner than anticipated.

Improper use of the flight director

A misunderstanding of the flight director can also cause a pilot to put the aircraft into an excessive rotation rate causing a tailstrike. On some fleets, the flight director will only display accurate pitch guidance when the airplane is airborne and passing through 35 feet. A pilot who tries to follow the flight director right after takeoff may be exceeding the aircraft's critical rotation angle, especially at high rates of rotation.

LANDING

Unstable approaches are the cause of most tailstrikes. Other significant factors that airframe manufacturers found to be evident during most tailstrikes are: holding off in the flare, over-rotation during go-around, mishandling crosswinds, and improper handling of bounced landings.



The pitch attitude given by the flight director might lag behind an aggressive rotation for takeoff or go-around, risking a tailstrike, especially if there is insufficient thrust.

Tailstrikes that occur during landing usually cause more damage than those incurred on takeoff. The most damaging incidents occur when the aircraft's tail makes contact with the runway before the landing gear. This causes the tail to absorb large amounts of energy and often damages the rear pressure bulkhead.

MD80 tailskid damage

Unstable approach

Tailstrikes that occur during an unstable approach are usually the most damaging to an aircraft, the most costly, and the most time consuming to repair. One of the causes of an unstabilized approach is the pilot's miscalculation or misunderstanding of reference, target, and touchdown speeds.

The reference speed, or V_{ref}, is the speed used for a certain flap configuration. This calculation is the basis for computing V_{app} for specific flap configurations, and provides adequate stall and maneuvering margins. Target speed or V_{app} is the speed at which the approach should be

CAUTION

DO NOT ALLOW THE AIRSPEED TO DECAY BELOW V_{app} PRIOR TO THE FLARE MANEUVER.

Tailskid strike in runway

flown. It is computed by taking the reference speed and adding half of the steady headwind component plus the full gust value. The minimum V_{app} speed, regardless of wind direction and speed, should be the reference value plus five knots, unless a special procedure in effect is to be followed. Twenty knots should be used as the maximum wind correction.

The most frequent problem is seen when there is a tailstrike is the mistake of allowing the airspeed to decay below the V_{app} speed prior to the flare. Clearly, flying the approach at the right speed is crucial to a successful landing. During the final 200 to 300 feet of descent, it is not unusual for the headwind component to decrease, sometimes abruptly, due to surface friction between the ground and the atmosphere. This is a much more common condition than the violent convective windshear and can occur in relatively stable air. ***It is suggested that after the aircraft reaches 200 feet during the descent, power should be added if needed, but there should be a reluctance to reducing thrust during this critical phase of the approach prior to the flare maneuver.*** If autothrottles are used on the final approach, the throttles should be guarded closely to prevent large power reductions.

Misuse of pitch-trim during landing

Trimming the stabilizer while in the flare can cause a change in the way the elevator feels and responds. Pilots do this attempting to soften the touchdown, which is not the best decision. If a pilot needs to adjust the trim, it is recommended that it be adjusted in the approach, but not in the flare.

Holding the aircraft off in the flare

A nice, smooth landing is always desirable – and the passengers love it; but at what price? Increasing pitch in the flare maneuver is like buying too much with your credit card; at the end of the cycle there can be a real crunch! A smooth landing is the result of a well-executed, stabilized approach to a touchdown after decreasing the vertical speed to near zero. Pulling the nose of the aircraft higher and higher will rapidly eat up remaining runway and risk a tailstrike. Each aircraft has a critical pitch angle at which the tail will strike the ground. This angle varies within each fleet by:

- Series; B767-300 has a lesser critical angle than the – 200
- Weight; heavier = lesser critical angle
- Configuration; less flaps = lesser critical angle

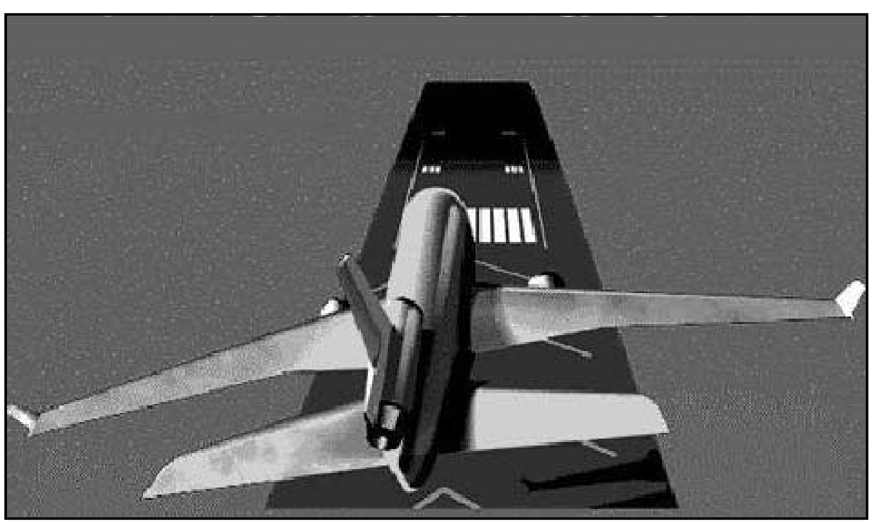
Depending on the fleet, a touchdown attitude of 4 to 6 degrees following a deliberate and limited flare maneuver is the right technique. Check your equipment manual for fleet specific numbers.

Over-rotation

Rapid or over-rotation while initiating a go-around late in the approach, during the flare, or after a bounce can also cause tailstrikes. The common problem faced by most pilots is trying to keep up with the flight director. Just as the bars are displayed for an aggressive pitch on takeoff, they are also placed in much the same position on a go-around. The pilot must always keep in mind that while thrust is needed don't be too aggressive with pitch attitude. Pilots will also over rotate trying to avoid wheel contact during go-around, even though it does not present any real adverse effect on the go-around procedure.

Crosswind Factors

Landing in a crosswind will also increase the chances of incurring a tailstrike, especially in gusty conditions when the wind direction is close to 90 degrees. This is because with little headwind component, the airplane flies the final approach with a rapid rate of closure on the runway. This results in a faster ground speed and higher descent rate, upward to 900 feet per minute. This can be magnified if the crosswind shifts to a tailwind as the final approach nears the ground. Another effect of a crosswind is the necessity of slipping the airplane to maintain centerline in the flare. This transition to cross-control reduces lift, increases drag, and may increase the rate of descent as the



An inability to remain on the glide slope is a cause of tailstrike.

controls are manipulated. If the boundary layer close to the ground is turbulent, particularly if the wind is shifting toward a tailwind, the stage is set for a tailstrike.

ENERGY MANAGEMENT

Flying an approach is basically an exercise in energy management. Touchdown airspeed has a strong effect on touchdown pitch attitude. A common misunderstanding is the amount of power that needs to be added if airspeed begins to decay. The kinetic energy equation tells us that $KE = {}^1/_2 mv^2$. In this equation, "m" is the mass of the aircraft and "v" is the velocity. When the velocity is decreased, or power is reduced, the energy contained in the aircraft is not decreased by a like amount, but by its square. To show the relationship between velocity and energy, consider a simple example:

$$V_1 = 3 \qquad V_2 = 1$$

$$KE = {}^1/_2\, mv^2$$

$$KE_1 = {}^1/_2\,(1)\,(3)^2 \qquad KE_2 = {}^1/_2\,(1)\,(1)^2$$

$$KE_1 = 4.5 \qquad KE_2 = .5$$

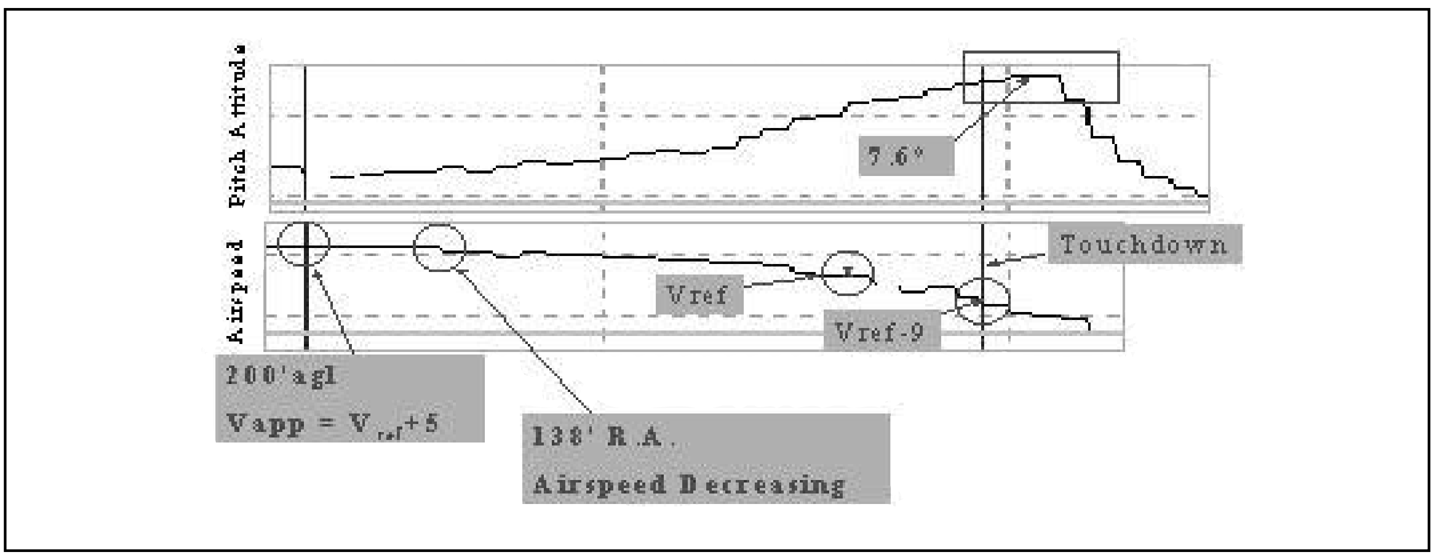
$$\frac{KE_1}{KE_2} = \frac{4.5}{.5}$$

Or

$$9:1$$

This is just to illustrate how a small loss in velocity can result in a substantial loss of energy. By this example we see that changing the velocity by a factor of three changes the energy contained in the aircraft by a factor of nine. The following flight-data-recorder trace is an example of a tailstike in which the aircraft airspeed dropped below the approach, contributing to an unstablized approach.

The aircraft lost 18 knots in velocity during the final 200 feet until the aircraft actually touched down. This 18 knot loss in velocity through 200 feet occurred in 25 seconds and resulted in a ***53,000,000 foot pound*** loss in kinetic energy. The engines would have to produce ***over 9,000 pounds of additional thrust*** during this descent to return to the target speed — V_{app} — needed for the land-



Flight-data-recorder trace

...there has never been a landing accident after a successful missed approach.

ing. The engines cannot usually produce this amount of thrust on short notice and the low airspeed usually results in a higher pitch angle requirement to maintain glideslope. This higher pitch angle, in turn, puts the aircraft in the position for a possible tailstrike. So, in conclusion, proper energy management is a key to a safe touchdown. Other important techniques include:

- The pitch attitude may increase slightly during the actual landing, but avoid over-rotation.
- Each aircraft has a different critical angle for tailstrike — you should know yours.
- Be sure you're configured correctly; a reduced flap setting reduces tail clearance.
- Do not increase pitch attitude after touchdown.
- Avoid rapid control column movements or trimming during the flare to avoid increasing the pitch attitude after touchdown.
- Do not attempt to achieve a perfectly smooth touchdown — grease jobs are for automobiles, not airliners.
- Do not allow the aircraft to float, but fly the airplane onto the runway.
- After main gear touchdown begin to smoothly "fly" the nose onto the runway by relaxing aft control column pressure.

LANDING TAILSTRIKES ELIMINATED

Finally, let's reflect on *American Airlines Flight Manual Part 1* regarding the ultimate solution to landing tailstrikes. Section 10, paragraph 5.1 states, **"American Airlines has a no-fault go-around policy, recognizing that a successful approach can end in a missed approach."** Let's face it – there has never been a landing accident after a successful missed approach. The missed approach maneuver is the last of many tools in your kit bag that you can, and should use, along with the other techniques we covered in this article. Of course you should refer to your individual airplane's Operating Manual for clarification of any of these concepts, or call your Fleet Manager if you have any question not answered there.

www.aasafety.com

Curt L. Lewis, P.E., CSP
Manager Flight Safety
American Airlines

Curt Lewis has been with American Airlines (AA) for thirteen years as the Manager Flight Safety. Prior to American, he served as Chief Corporate Pilot, System Safety Engineer, and Safety Director for various industrial corporations.

He has more than 26 years of safety experience as a professional pilot, safety engineer/director, and air safety investigator with over 10,000 hours of flight experience. In addition, he has earned technical degrees in Aeronautical Engineering and Physics. He has earned the designation of Certified Safety Professional (CSP) by the Board of Certified Safety Professionals (BCSP). Mr. Lewis is a Registered Professional Engineer (P.E.) in the discipline of safety engineering.

He is the former Chairman of the Air Transport Association (ATA) Flight Safety Committee. He currently serves as the United States Councillor & President to the U.S. International Society of Air Safety Investigators (ISASI).

John H. Darbo
Senior Administrator Flight Safety

For more than 35 years, Mr. Darbo has been engaged in military, commercial, and general aviation at various levels and venues. A qualified air traffic controller, flight engineer, and flight attendant, he has served as vice president of operations for world wide charter jet operations and FAA pilot examiner and safety counselor. He has served in various operational management positions at AMR Corporation for 15 years, including AMR Combs, American Eagle and his present position in the Flight Safety Department.

With over 11,000 hours of flight experience, he holds an Airline Transport Rating in transport category jets, as well as aircraft maintenance technician and certified flight instructor certificates. A graduate of the National Transportation Safety Board's accident investigation course, he is member of the System Safety Society and the International Society of Air Safety Investigators. He earned System Safety certificates from Embry-Riddle Aeronautical University, Georgetown University, as well as Human Factors Training certificate from the University of Southern California.

robert ruiz, flight safety inspector – latin america specialist

A Tale of Three Tails

The A300 fleet has suffered three major tailstrikes since 1997, two of these resulted in sufficient damage to the aircraft to be classified as accidents by the NTSB. Each airplane was Out-Of-Service (OTS) for approximately 4-6 weeks and incurred about 3-5 million dollars worth of damage to each airframe; this did not include loss of service time. In an effort to increase tailstrike awareness and to prevent them from recurring, we will look at the common causal factors between these events and what actions can be done to prevent them. Although this may seem like a problem for only the A300 pilots, the principles reviewed will apply to all the fleets. Synopses of each event were taken from NTSB reports and not company documents.

A300 tailstrike damage

Each airplane was Out-Of-Service for approximately 4-6 weeks and incurred about 3-5 million dollars worth of damage to each airframe.

Photo courtesy Nigel Prince, used with permission

A300

Antigua

The first accident (NTSB DCA-97LA027) occurred while landing in Antigua on runway 07. The landing was during daylight in VMC, winds 080 at 17 knots, with the Captain flying. The approach appeared normal to the crew until approximately 30 feet. The Captain sensed that the timing of the callouts from this altitude were slightly faster than normal. He recalled that initially he flared at about 30 feet and reduced power to idle. In an effort to cushion the descent, he increased pitch attitude just before touchdown. The touchdown was reported firm and resulted in a bounced landing. During this bounce the Captain advanced the power and maintained pitch attitude. A second touchdown and bounce followed with the throttles retarded and the pitch attitude increased to 10.89 degrees. The Digital Flight Data Recorder (DFDR) recorded a 2 "g" vertical acceleration, then deployment of the spoilers 1-2 sec before the final touchdown.

Montego Bay

The second event, categorized as an NTSB incident, (NTSB ATL-98IA024) occurred while landing in Montego Bay. According to the Captain who was the pilot flying, the existing wind information was different from the planned wind information, resulting in a "circle to land" approach on runway 25. Meteorological conditions at the time were VMC, winds 300 at 12 knots. The downwind leg and turn to final were normal with the airplane in the proper configuration, on speed, and "in the slot." As per the final approach checklist, the pilot armed the spoilers for deployment. Upon touchdown, the airplane bounced and the pilot increased the pitch attitude of the airplane to soften the second touchdown. Post flight inspection revealed damage to the tailskid area on the underside of the airplane. According to the Operating Manual, the deployment of the ground spoilers induces a 2 degree additional pitch up and increases the sink rate of the aircraft, thereby contributing to the higher pitch angle that may result in tailstrikes.

New York

The third event and second accident (NTSB NYC99LA177) occurred while landing at John F. Kennedy International Airport, Jamaica, New York. Visual meteorological conditions prevailed for the flight with winds at 190 at 15 knots. The crew reported that the flight was uneventful until the landing on Runway 13L, at which point the tail struck the ground. According to the flight data recorder, the airplane made an initial touchdown on the right main landing gear. The airplane then bounced, and while airborne, the ground spoilers extended. The Captain increased the pitch attitude slightly to arrest the descent rate before the second touchdown. The airplane touched down the second time on both main landing gear and the tailskid, with +2.26 "g" load recorded on the DFDR. According to the Operating Manual, "the ground spoilers will extend if both throttles are at the flight idle position, and either main landing gear tilt switch transitions to the ground mode." If the aircraft subsequently becomes airborne, the spoilers will not retract automatically without the throttles being advanced.

Common Factors

Why did these tailstrikes occur and what could be done to prevent this from recurring? Upon review of these three events, similarities were noted.

- The landings were all in VMC with a slight crosswind.
- All flying pilots had 1500 plus hours in type.
- The Captain was flying the aircraft.
- A loss of airspeed below 50 feet AGL.
- The tailstrikes occurred after a bounced landing.
- Flying pilot increased pitch attitude to arrest the descent rate of the bounce.
- The spoilers were in the ARMED mode and deployed while airborne during the bounce.
- Each crewmember stated that the bounce and increasing pitch angle occurred almost instantaneously.

Analysis of DFDR data revealed that each aircraft bounced after a loss of airspeed that occurred below 50-ft AGL. The initial pitch increase is accompanied by auto-spoiler deployment, which then increases pitch another 2 degrees. The excessive pitch results in a tailstrike. From the *American Airlines' A300 Operating Manual*, Techniques, Page 6, "On landing, the deployment of the ground spoilers actually increases the deck angle by 2 degrees. This will happen at touchdown with the auto-spoilers armed…."

Pilots who fly BOEING products may question why the auto-spoilers deployed even though the aircraft was still airborne during the bounce. On landing, the A300's auto-spoilers function when the following conditions are met:

- Both throttles are at idle.
- One of the main landing gear is not tilted.
- Radio altimeter is below 5 feet.

Once these conditions are met, the spoilers will activate. In these events, all requirements were fulfilled on the initial touchdown and the auto-spoiler deployment was initiated. It takes about 2 seconds for the spoilers to actually deploy as the system goes through its logic. This delay caused them to activate during the bounce. During the first touchdown in the Antigua event, the main gear tilt switches were not activated for unknown reasons. This factor, coupled with the power increase, prevented the spoilers from deploying during the first bounce, even though the aircraft remained in the air for nine seconds. The aircraft then had a second bounce and it was during this sequence that the spoilers deployed and the tail contacted the runway. Our Boeing and Boeing/Douglas products use different conditions for auto-spoiler deployment than the Airbus. It is important to understand how these systems work and what conditions activate them. Review the Operating Manuals of your particular fleet type.

Corrective Actions

Numerous actions have been taken by the Flight Department to alert crewmembers in an effort to correct and prevent additional tailstrikes. Informational/Technical bulletins have been issued to the A300 fleet, the latest being "Avoiding Tailstrikes" Bulletin Number 3, March 1, 1998. This bulletin discusses both Take-off and Landing tailstrikes. Following are some highlights from some of the tailstrike "Landing" avoidance techniques, "Deviation from NORMAL Landing."

- Allowing the speed to decrease below V_{APP} prior to flare.
- Holding the aircraft off the ground for a "smooth" landing.
- Flare started too high.
- Failure to fly the nose gear on to the runway after touchdown.

After the last accident, the A300 Fleet Supervisor sent a letter to all A300 Check Airmen, Simulator Pilots, and Ground School Instructors on the subject of tailstrikes. Following are some of the recommendations.

- Stress stabilized approach concept during ALL phases of training.
- The only reasonable conclusion to a destabilized approach is a Go-Around.
- Training emphasis should be placed on crosswind landings and energy management during the approach and flare to touchdown.
- Brief and review the proper response to a "bounce" on landing, i.e. hold the pitch attitude, add some power, and/or go-around. In no case is increasing pitch attitude an option. (The addition of power also has another benefit; it impedes the deployment of the auto-spoilers.)
- Touchdown should occur with the indicated airspeed between V_{APP} and V_{ls} or V_{ref}, not lower than V_{ls} or V_{ref}. (V_{ls} – landing speed)

During the month of October a revision will be issued to the A300 Operating Manual, which will include the following guidelines for handling a bounced landing (Techniques 6, rev 76, 10-6-99).

- In the event of a light bounce (5 feet or less), maintain pitch attitude and complete the landing. Use power as

Photo courtesy Andrew Abshier, used with permission

required to soften the touchdown. **CAUTION:** Do not increase pitch attitude. This may result in a tailstrike.

- In the event of a high bounce (more than 5 feet), maintain pitch attitude and landing configuration. Initiate a go-around by advancing the throttles while triggering TOGA Levers. A second touchdown is very probable as the go-around is initiated, but should be light. Once a positive rate of climb is safely established and no probability of touchdown exists, retract the flaps one notch and retract the landing gear.

CAUTION: A landing should not be attempted after a high bounce. The remaining runway may not be sufficient to stop the aircraft.

Conclusion

Tailstrikes are events that can lead to serious aircraft damage and/or injury. Fortunately, in these events none of our crewmembers or passengers were injured and it was just bent metal, which although expensive could be fixed. Tailstrikes can be avoided with correct anticipation of the aerodynamic, mechanical, and human conditions that may arise during the landing phase. Stabilized approaches are the key to avoiding these events. The approach must be flown its entire length in the slot and on-speed, especially from 500 ft AGL to touchdown. If the approach is not stabilized, go-around. If a bounce occurs, hold the pitch attitude, increasing pitch is never an option. It is important to comprehend the methodology and logic behind automated systems on the airplane, i.e. auto-spoiler deployment, and what happens to those systems when non-routine events happen, i.e. bounces. This includes understanding what is necessary for the system to deploy and how it affects the handling and aerodynamic characteristics of the airplane. Boeing, Airbus, and Boeing/Douglas products all have different system designs that affect the aircraft's performance during certain maneuvers. Fly safe.

Robert Ruiz
Flight Safety Investigator Latin America Specialist
American Airlines

Robert Ruiz has been with American Airlines more than 2 years during which time he has worked in the Flight Safety Department as an Flight Safety Engineer and Accident Investigator primarily focusing on Latin America issues. Prior to American, he worked at FAA headquarters for the Office of System Safety. He is a professional member of the International Society of Air Safety Investigators.

In 1993 he graduated from the University of Maryland with a BS in Aerospace Engineering. He earned an MBA in Aviation from Embry-Riddle Aeronautical University in Daytona Beach. He is also a licensed pilot.

AA Events

A300 Wheel Fire

While taxiing for takeoff, an A300 wheel assembly caught fire. The captain elected to use extra power for taxi due to upslope to the runway. During taxi, the flight crew noticed rising brake temperature. At this point, brake temperature on brake number 5 and 8 appeared to be 80 degrees C compared to the normal 35 degrees C. The crew contacted ground control and requested a taxi back to maintenance in order to check the brakes. Ground approved the taxi back via the active runway. As the crew taxied off the active runway, they noted the brake temperature had risen to approximately 700 degrees C. The aircraft was stopped to allow the brakes to cool and ground control was notified. After stopping the aircraft, the brake temperature ceased rising. The tower then called the aircraft to inform them that the left main tires appeared to be on fire. The crew called for a ground evacuation from the right side of the aircraft only. All passengers and crew were safely evacuated and airport fire and rescue extinguished the fire.

Later inspection showed that the number 5 wheel assembly had overheated with subsequent aft wheel bearing failure and the axle showed discoloration from the fire. Maintenance was performed on the wheel assembly including replacement of the axle sleeve, brake and number 5 axle and loom.

B767 Airframe Compromise/Hard Landing

An aircraft on approach to LHR reported a hard landing with compression buckling of the fuselage. An early morning flight into LHR was given runway 27R for landing. The crew was briefed for the approach. Manual brakes and spoilers were selected and speed was approximately 146 knots with a Vref of 140 knots due to winds of 220 at 11. Visual conditions prevailed below 3000 feet and autopilot was disconnected between 3000 feet and 2000 feet. Autothrottle was disengaged at approximately 500 feet and callouts were made to touchdown. The flare was reported to be at 30 feet and throttles were retarded to idle. The aircraft touched down on main gear then appeared to bounce. The throttles were left at idle. The aircraft appeared to touch again and then touchdown on all three gear, at which point thrust reverser and manual braking was applied. The crew was notified by ground crew workers of a severe wrinkle of the aircraft skin situated above the aft edge of the forward freight bay door. The aircraft was subsequently patched and ferried back to the U.S. for repairs.

Subsequent investigation found the approach to be smooth and accurate and that the aircraft bounced on the first touchdown. Damage appears to have occurred due to subsequent Pilot Induced Oscillations.

MD11 Entertainment Equipment Failure

Approximately 1 hour after takeoff on a flight from SEA-NRT, smoke and fumes were reported in the cabin. Two crewmembers checked on the report made by the flight attendant and clearly observed smoke and fumes emanating from an overhead compartment containing an entertainment video machine. The machine was turned off and HALON was discharged into the area. A return clearance to SEA was requested and received and emergency procedures checklists were performed. Fuel was dumped over the ocean to comply with gross landing weight and an emergency was declared; however, the landing was uneventful.

On teardown of the entertainment system, damage was found to the overhead system units and 1 metal connector and backshell. Only the aft portion sustained damage.

B767 Wingtip Contact with B767

While taxiing for runway 32R at ORD, a B767 left wingtip collided with another B767 right wingtip. The taxiing aircraft had received clearance to taxi on taxiway 20 then turn onto taxiway B towards runway 32R. The aircraft stopped on the taxiway behind another aircraft. While stopped on the taxiway, ground vehicles were allowed to cross. As taxi was resumed, the crew felt the wing contact the other aircraft.

The second aircraft was being pushed back for taxi to a different gate. Clearance from the FAA was called for and received. The aircraft was pushed back into place and the tug was disconnected. The aircraft was held in position for taxiing traffic when the maintenance crew felt the wing contact from the taxiing B767.

Investigation has shown that the flight pushing back was appropriately cleared and completed properly; however, the right wingtip encroached into the taxiway B safety area. The taxiing flight was cleared around the stationary aircraft. Both aircraft were repaired and returned to service.

MD82 Evacuation/Engine Fire

An MD-82 sustained an uncontained engine failure during takeoff roll at DFW. While on takeoff roll on runway 17R, a thump was felt with a slight left nose pull. The onboard flight data recorder indicated that the pilots aborted the takeoff at 124.5 knots (V1 was 132 knots). The pilots taxied clear of the runway and came to a stop on taxiway L3. The flight attendants in the cabin area reported that there was “smoke and smoke odor” in the cabin. Several flight crews on the ground reported on the tower frequency that the incident airplane's left engine was on fire. After receiving these radio communications, evacuation was initiated. The left aft emergency exit was not used but the aircraft was evacuated successfully. The Airport Rescue and Fire Fighting (ARFF) personnel reported that the engine fire was confined to the tailpipe area and was extinguished in approximately 2 minutes.

Examination of the airplane revealed that all the turbine blade airfoils had separated from their roots in the number 3 and 4 turbine disks, and the engine case had one 12-inch by 3-inch hole in it on the inboard side of the turbine section.

The cowling was punctured, the lower side of the engine pylon had sustained "impact damage," and the unpressurized empennage area had two puncture holes each approximately one-quarter-inch square.

The teardown examination of the left engine revealed that the Low Pressure Turbine (LPT) shaft was deformed and fractured into two pieces. The adjacent 17-inch-long High Pressure Turbine (HPT) center tube was found twisted and broken into several pieces. Extensive coke deposits were identified on both the outer diameter of the LPT shaft, and the front and aft ends of the inner diameter of the center tube.

MD82 Evacuation/Smoke in Cabin

On taxiout at DFW, an MD82 experienced a loss of hydraulic fluid and smoke in the cabin. While waiting for departure on runway 18L, the crew noticed the left hydraulic fluid level was significantly lower than previously noted. Clearance to return to the gate was obtained and during the return, one of the flight attendants advised of smoke and fumes in the cabin. An evacuation was ordered and safely performed from the tail cone exit. Hydraulic fluid was noted on the ground underneath the right engine.

On subsequent investigation it was found that a hydraulic leak was coming from the B nut on the thrust reverser control valve. The fluid had leaked into the APU inlet and into the cabin, creating smoke and fumes. The leak was fixed and the aircraft was returned to service.

B757 Wing Contact with Ground Obstacle

While taxiing at BOG, the crew received four EICAS messages. The crew requested to hold on the taxiway to check the messages and call maintenance. When the error messages could not be resolved, the aircraft was advised to return to a remote parking area south of the gates. As the aircraft approached the ramp, the crew noticed at least one signalman. The aircraft proceeded to turn, parking just west of another aircraft. As the aircraft turned into position, the crew felt the aircraft lurch as the right wing contacted a concrete light pole. Once parked, the ground personnel noticed damage to the right wing and informed the crew.

Upon inquiry into the incident, the crew was not aware of the pole, directing their attention towards the guidemen and the other parked aircraft. One signalman was directing the nose of the aircraft while another ground crewmember was bringing the nose pin out to the aircraft. The aircraft was ferried back to the U.S. where it was repaired and returned to service.

Other Airline Events

MD90 Cabin Fire

On touchdown, an MD90 reported thick smoke in the cabin. At touchdown, statements indicated a loud noise came from the front of the cabin. Thick black smoke poured from one of the overhead luggage compartments on the right hand side of the plane. Smoke could be seen through a hole on the right side of the plane's fuselage. The aircraft was swiftly and successfully evacuated; however, firefighters battled the blaze for half an hour.

MD11 Landing Accident

The aircraft was approaching the runway in 27 knots crosswind conditions when the right wing dipped about 15 degrees. The approach was continued and just before touchdown, the wing dropped again, striking the runway. The plane then flipped upside down and slid down the runway in flames. At the time, tropical storm Sam was causing winds of more than 60 mph and conditions of windshear throughout the day. Of the 315 on board, there were 2 fatalities.

Boeing has sent an air safety investigation team to support the investigation into this accident.

B757 Landing Accident

A B757 skidded off a runway after landing during a thunderstorm. After three other aircraft had been diverted to the airport due to weather, the accident aircraft attempted one landing as the storms arrived at the airport. The B757 broke off the approach, went around, and made a second attempt to land. After landing, the aircraft apparently started to skid and left the runway about half way down. It continued slightly downhill approximately 1600 feet into a field. No fire was reported and the fuel tanks remained intact. The fuselage came to rest in three pieces. Of the 245 on board, 68 were injured.

B737 Takeoff Accident

A B737 crashed on takeoff. Before takeoff the crew reportedly experienced problems with the no.1 engine. Three engineers tried to fix the problem. The aircraft took off approximately 20 minutes later. As the plane was about 2 feet over the runway, it settled back on the runway. It overran the runway and started across the airport boundary. After crossing the avenue it came to rest on fire. Of the 103 on board, possibly 80 have died.

Initial investigation results suggest that the crew tried to takeoff with the wrong flap-selection for takeoff, despite a warning at the start of the takeoff. Boeing has sent technical experts to support the investigation into this accident.

An Update on ASAP

by Tom Chidester, Ph.D.

Changing Trends in Automation Events

Throughout the course of the ASAP program, pilots have reported events or deviations resulting from problems in working or controlling aircraft automation. Those reports have resulted in a number of changes in emphasis in FM1, operating manuals, and in training. But over the past few weeks, three issues have shown up in a series of events.

First, pilots on GFMS aircraft have reported a sense of lost standardization involving the use of that equipment. For example, one S80 pilot described observing very aggressive use and programming of the GFMS down to 5,000 ft. and failure to confirm with the other pilot the input and results of route changes. Both of these issues are discussed in FM1, but may not be properly applied by all pilots. Section 5.2.4 states that FMS/GFMS programming should be avoided during critical phases of flight. Section 5.2.2B emphasizes verification of FMS/GFMS entries between pilots prior to execution. Both of these problems arose very quickly with the introduction of FMS aircraft at American and other airlines. The automation policy of FM1 is intended to deal with them and it applies to GFMS-equipped aircraft. If you are flying the S80, DC10, or B727, recognize that your GFMS is a sophisticated piece of aircraft automation, and brings all the benefits, risks, and policies associated with automation into your cockpit. Take some time to review and apply the policies to your flight operations.

Second, choosing the right level of automation remains something of an art, according to recent reports. For example, a crew inbound to LAX on the PDZ arrival was changed to the CIVET arrival. While the Captain set up the arrival and approach in the CDU, the FO departed his assigned altitude. He had been watching and verifying the Captain's entries and was distracted from flying the aircraft. The Captain described the event as his own responsibility – being heads down when he should have been heads up. FM1, Section 5.2.4 emphasizes that updating FMS/GFMS and moving map displays for a clearance change in the terminal area is not required if data entry would distract from primary flight duties.

Third, pilots report some difficulty in responding to discrepancies discovered between the map display and raw data from ground-based NAVAIDS. Consider two examples. Numerous map shifts were encountered in the LA Basin recently when a nav database software correction for duplicate ILS DMEs was inadvertently deleted during a routine revision release. This was highlighted in an F4 message on flight plans. The crew of a B-757 discovered that the magenta line and flight director were providing different course guidance than the localizer, and the airplane symbol location relative to waypoints did not agree with their location by DME. The PF continued to fly the magenta line until the PNF called out full-scale deflection. Both pilots then recognized what had happened and acted to correct their track. In a similar event, a crew arriving into PAP noted a disagreement between the map display and VOR course, apparently resulting from a lack of updating due to the DME on the field being NOTAM'd out of service. They immediately adjusted to track the radial inbound, but had no DME reference to define descent points. The PF began an early descent, referring to the FMS displayed distance to the waypoint. The PF caught the error by referring to a crossing radial that defined the descent point. FM1 Section 5.2.3 emphasizes that such discrepancies must be resolved immediately. Once the FMS position has been determined to be inaccurate, it cannot be used for lateral or vertical navigation reference.

Driven to Distraction

Distractions at a critical point in flight have produced altitude deviations, navigation errors, runway incursions, and logbook errors. The word "distraction" usually implies that attention is drawn from critical tasks to irrelevant factors in the situation. That is rarely the case in these reports. While distractions include factors within the pilot's control such as timing of cabin communications and PAs, most are inherent in the operation, such as weather, ACARS messages, distractions related to autoflight systems, and minor mechanical problems. Most of these events have occurred at a point of flight where more than one duty must be accomplished. Pilots must therefore set priorities between primary and secondary tasks.

For example, the crew of a S80 deviated from assigned altitude while in holding, due to missing the altimeter changeover descending through 18,000 ft. Around the time of the error, the crew entered a holding pattern that conflicted with convective weather, obtained and entered a new holding pattern, began the descent checklist, and made a decision concerning whether or not to divert. Unfortunately, the descent checklist was only partially accomplished, resulting in the altitude deviation. As the reporting Captain commented, "Extreme vigilance is paramount to prevent outside factors from causing distractions. The FO and I thoroughly debriefed each other emphasizing the importance of adhering to procedure."

More on Time in Type

In the April 30th ASAP Update, the ERT identified an increase in events involving crewmembers with low time in type. With recent retirements and expansions, many pilots have less time in type than just a year ago. Pilots used to spend extended time in aircraft and seats. However, they are now beginning to move to larger equipment or to the left seat more quickly.

For example, the crew of an F100 arriving into ORD set up and flew the ILS on the runway parallel to the one for which they were cleared. As the new-hire FO briefed the approach, the Captain looked at the chart for the parallel runway and set up for the wrong approach. Note that in this case, the low-time-in type briefed it correctly, but never cross-checked the other pilot's work, while the more experienced pilot never got on the correct page. Anyone can make a mistake, but we rely upon each other to catch and correct it.

As a further example, the crew of a S80 on a short DFW-AUS flight, encountered a red unsafe gear indication on extension. Following a missed approach and entry into a holding pattern, the crew discovered the hydraulic pumps were in the low position. This had been a common error on the S80, and as a result, hydraulic pumps placed to high were added to the descent and before landing checklists. Both pilots had been on the aircraft less than six months and simply missed the item during a routine checklist.

What do these events say about low time in type? It creates a vulnerability for both or all of the pilots, not just the one who is new. Pilots with a great deal of time in type tend to make mistakes by misapplying habit patterns, having habit patterns interrupted, or becoming complacent. Pilots with low time in type are vulnerable to yet-to-be-established habit patterns, or routines developed for one pilot but not the other. This leads to assumptions about the less experienced pilot that may not be warranted. The ability to crosscheck and identify any mistake by the other pilot, for example, may be reduced. As the workload increases, all pilots need to maintain their vigilance to standard operating procedures, checklists, briefings and confirmation of clearances and actions between pilots, especially with low time pilots in either or both seats.

MORE UPDATES ON ASAP

Near Mid Air Collision Reporting Guidelines

A recent ASAP report described what the pilot believed to be a Near Mid Air Collision. The pilot called the ATC facility when they arrived at their destination, and was asked if he was filing a NMAC - Near Mid Air Collision report. The pilot stated he would not file a report. He advised the facility he would file an OF25 report through AA. **An OF25 or ASAP report by itself does not satisfy the NMAC reporting requirement.** If you experience a near mid air collision, the following steps must be accomplished. 1) Announce immediately over the radio to the air traffic controller that a NMAC is being reported. Be specific, as ATC will not interpret a casual remark to mean that a NMAC is being filed. The pilot should state, "I wish to report a near mid air collision." 2) If not reported by radio, the incident should be reported immediately by telephone to the nearest FAA ATC facility or FSS. 3) Submit a report in writing to the nearest FAA FSDO. Include the words NMAC or Near Mid Air Collision in your report. Reporting in this manner insures the facility will submit a report to the FAA Administrator and the ATC tapes will be pulled for review in the investigation.

MEL Responsibilities

Several reports have noted concerns over inoperative equipment or questions concerning Minimum Equipment List restrictions. In many cases, initial discussions between the Dispatcher, Tulsa Tech and the Captain result in a determination that the aircraft is acceptable for departure. However, once airborne and upon further review of the Minimum Equipment List, it is determined that the flight is not in full compliance. One recent report described a 757 with the nose snubbers placarded inop for an earlier write up that mentioned a metal on metal grinding sound on gear retract. The MEL stipulated that continued flight was acceptable as long as the snubbers were removed from the aircraft prior to flight in accordance with the Maintenance Procedures Manual (MPM). The Captain was given a copy of the applicable MPM by maintenance, and the flight departed. Further review during flight revealed the MEL was not properly complied with, since the snubbers were still installed. The MPM merely amplified what to check when the snubbers were removed. Another report described a 727 crew that took an aircraft with an inlet guide vane valve placarded inoperative. The crew departed without applying the required weight reduction per the MEL, and consequently took off overweight.

The ASAP ERT reminds all pilots that FARs hold the PIC and dispatcher jointly responsible for safe dispatch of the aircraft. The PIC and dispatcher may contact Tulsa or Alliance Tech for advice. However, that advice does not relieve pilots and dispatch of their responsibility for the airworthiness of the aircraft. Tech services acts in an advisory capacity. If any doubt exists about the requirement for a system, enter it in the logbook and obtain a mechanic's signoff. In all cases, carefully review the MEL prior to departure.

Tom Chidester, Ph.D.
Manager Human Factors & Safety Training
American Airlines

Tom began his career in human factors research and training at the University of Texas at Austin, where he earned Masters and Doctoral degrees. Working with Robert Helmreich on NASA-sponsored research, he studied mood and sleep consequences of short-haul and long-haul flight operations, and began his research into Human Factors training and pilot selection. In 1986, Tom began a National Research Council Resident Research Associateship at NASA-Ames Research Center, and subsequently was employed as a Research Psychologist with the Aerospace Human Factors Research Division. There, Tom led efforts to complete two full-mission simulation studies – the first examining the effects of leader personality on crew effectiveness, the second performance and workload consequences of aircraft automation. He also supervised several other research programs.

In 1990, Tom joined American Airlines. Since that time, he has led the re-development of classroom Human Factors programs for pilots and flight attendants and assisted in the development of Line Oriented Flight Training on all American's aircraft fleets. Tom also serves as the coordinator for the Airline Safety Action Partnership (ASAP) developed by American, the Allied Pilots Association, and the FAA, and as the chair of the Air Transport Association Subcommittee on Automation Human Factors.

Avoiding Tailstrikes PAGE 5

Operational Events in brief…

- **A300 Wheel Fire**
  While taxiing for takeoff, an A300…
- **B767 Airframe Compromise/Hard Landing**
  An aircraft on approach to LHR…
- **MD11 Entertainment Equipment Failure**
  Approximately 1 hour after takeoff…
- **B767 Wingtip Contact with B767**
  While taxiing for runway 32R at ORD…
- **MD82 Evacuation/Engine Fire**
  An MD-82 sustained an uncontained…
- **MD82 Evacuation/Smoke in Cabin**
  On taxiout at DFW…
- **B757 Wing Contact With Ground Obstacle**
  While taxiing at BOG…
- **MD90 Cabin Fire**
  On touchdown…
- **MD11 Landing Accident**
  The aircraft was approaching the runway…
- **B757 Landing Accident**
  A B757 skidded off a runway after landing…
- **B737 Takeoff Accident**
  A B737 crashed on takeoff…

See page 16 for An Update on ASAP

AmericanAirlines®

Flight Safety Information Newsletter

The Flight Safety Department provides daily newsletters via e-mail on issues concerning flight safety. The newsletter consists of article summaries from newspapers, web-sites, and other sources containing information on the latest accidents, incidents, recommendations, industry information, etc. If you are interested in receiving this daily newsletter, please send your e-mail address to:

Curt Lewis, Manager Flight Safety at
curt_lewis@amrcorp.com
or to the webmaster at
www.aasafety.com