KUWAIT AIRWAYS

FLIGHT SAFETY

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EDITORIAL

We hope you enjoyed reading the April issue.

In this issue, we look at the FedEx B727 collision with trees on final approach and crashing short of runway, seriously injuring the flight deck crew and destroying the aircraft. This is yet another example where the accident resulted due to crew fatigue and noncompliance with the company flight procedures. We have an article on fatigue and how to manage it, which is critical for flight safety.

We look forward to your feedback, suggestions and contributions in the form of articles, anecdotes, pictures, etc. which can be sent to our office address given in this page.

Happy reading and many more safe landings.

In this issue

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PHOTO OF THE MONTH

Strong case for Electronic Flight Bags?! *Cockpit seems to be full of manuals and other documents. Even a mobile phone ! - cockpit is suppose to be tidy.*

And cockpit visibility? The reason for the first officer to put his head out?

Flight Safety/aircraft Accident Links

kacops.kuwaitairways.com
www.ntsb.gov
www.bea-fr.org/anglaise/index.htm
www.bst.gc.ca/en/index.asp
www.bfu-web.de
www.aaib.gov.uk/home/index.cfm
www.atsb.gov.au/

FEDEX B727 COLLISION WITH TREES ON FINAL APPROACH

Based on Aircraft Accident Report NTSB/AAR-04/02

On July 26, 2002, at 0537 eastern daylight time, FedEx flight 1478, a Boeing 727-232F, N497FE, struck trees on short final approach and crashed short of runway 9 at the Tallahassee Regional airport (TLH), Tallahassee, Florida. The flight was operating under the provisions of CFR part 121 as a scheduled cargo flight from Memphis International Airport (MEM), Memphis, Tennessee, to TLH. The Captain, First Officer (FO) and Flight Engineer (FE) were seriously injured, and the plane was destroyed by impact and resulting fire. Night VMC prevailed for the flight which operated on an IFR flight plan.

The accident flight crew reported to duty an hour before the scheduled departure of 0412. There was a slight delay in the departure due to the adjustment of a cargo pallet. As per the CVR, FDR, ATC records and the post accident pilot interviews the climb and cruise phases of flight were routine and uneventful. The FO was the flying pilot and the Capt. was performing non-flying duties for this flight.

Following is the sequence of events leading to the accident along with CVR extracts.

At 0511, FE received the TLH weather information from the Gainesville Flight Service station which he related to the Capt. and the FO and asked which runway they would use at TLH. A minute later the Capt. stated that they would land on runway 27 at TLH.

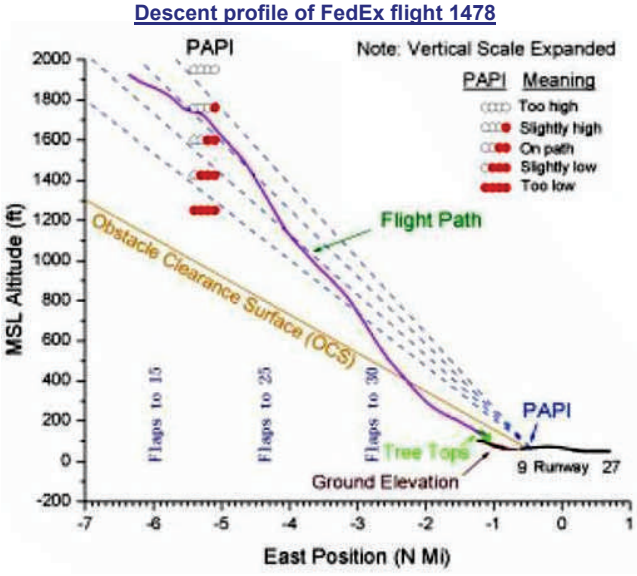
At 0513:13, Atlanta Air Route Traffic Control Center cleared the flight 1478 to descend to FL240 at their discretion. The Capt. acknowledged the clearance. The FE subsequently contacted FedEx ramp personnel at TLH and advised that the flight 1478 was 25-30 min from TLH, *"looking for parking spot & power".* TLH ramp personnel advised them to use gate no.2 and to park facing South. The FE briefed the Capt. and FO on this and according to company procedures, advised them that FedEx considered TLH a moderate Controlled Flight Into Terrain (CFIT) risk.

At 0515:32 Atlanta ARTCC instructed pilots to contact Jacksonville ARTCC and the Capt. acknowledged. At 0515:52.3 Capt. stated *"Jacksonville center uh good morning, FedEx 1478, two nine oh, Discretion to two four oh."* Jacksonville ATC responded " *FedEx 1478, Jax center Roger, descend at pilot discretion maintain niner thousand, Tallahassee altimeter three zero one zero."* The Capt. acknowledged the clearance and announced the target air speeds for the approach to FO.

At 0516:38, the Capt. questioned the FE about the weather, stating *"one thousand scattered, ten miles, uhh is that what it said ...there?"* At 0516:43 as Capt. was finishing his statement, the FO began approach briefing for runway 27 at TLH, stating in part, *"we will plan on a visual to runway 27 … we will back it up with this … ILS runway 27 full procedure ...272 is the final approach course inbound."* The FO stated that the minimum safe altitude was 3300ft MSL *"all the way around … missed approach will be as published and we will talk to them and see if we can get something better....runway is 8000 ft long, plan on rolling out to the end ...got PAPI on the left hand side...pilot-controlled lighting, so if you can ...click it seven times I'd appreciate it."* At 0518:30, the FO stated *"all right, start on down,"* and the Capt. responded, *"all right".* The Capt. then radioed Jacksonville ARTCC, stating, *"uh, Atlanta FedEx uh fourteen seventy eight, leaving two nine oh for uh, nine thousand."*

At 0519:38, the FO asked, *"you wanna land on nine if we see it? We got a PAPI on nine, too."* The Capt. responded *"yeah, maybe ..be a longer taxi for us, but… way we're coming in probly two seven be about as easy as any of them."* The FO said *"Okay."*

Descent profile of FedEx flight 1478



The pilots initiated the in-range checklist at 0521:57 and completed it at 0522:20.

At 0522:46, Jacksonville ARTCC cleared the pilots of flight 1748 to descend to 3000ft MSL at their discretion. At 0523:33 the ATC instructed the pilots to contact him on another frequency. At 0523:49 the Capt. reported on the new frequency stating, *"FedEx fourteen seventy eight with you, one thirty five thirty two."* The ATC asked if they had TLH weather, and the Capt. confirmed that they did. At 0524:03, the controller advised them to expect a visual approach into TLH and to report when they had the airport in sight.

At 0524:23, the Capt. stated, *"runway nine … PAPI on the left side ...I don't know, you wanna try for nine?"* The FO responded, *"We're pointed in the right direction, I don't know, like you said … kinda a long ...taxi back."* The Capt. said *"Yeah, that will be all right."* The FO further stated, *" I always thought you were suppose to land with prevailing wind .. at an uncontrolled…"* and the Capt. responded, *" well, at 5 knots, it really … the only advantage you have, landing to the west you have the ...glide slope...which you don't have to the east."* The Capt. asked the FO if he was familiar with TLH and the FO replied that he was not.

At 0527:47, the FE advised TLH ground personnel that flight 1478 was 5 minutes out. The ramp agent indicated the availability of ground power for the airplane and that he would arrange for them to the layover hotel. Consistent with the FedEx policy, the FE asked the Capt. and FO if they wanted to perform the approach checklist. The Capt. responded, *"Yeah, we can do nine if you want to."* About 0528:26, the FO asked, *"Okay, runway nine, visual runway nine PAPI on the left side...approach check."* The FE asked, *"Briefing?"* and the FO responded, *"complete for runway nine."* At 0528:57 the pilots completed the approach checklist. At 0529:53, the Capt. asked the FO if he wanted to tell the ARTCC controller that they had TLH in sight. The FO responded, *" yeah, I don't see the runway yet, but I got the beacon."* At 0530, the Capt. told the ARTCC controller that they had TLH in sight. Jacksonville ARTCC then cleared them for visual approach into TLH and asked if they were aware that runway 18/36 was closed. The Capt. responded, *"no sir, but we're gonna use runway nine."* Jacksonville ARTCC repeated visual approach clearance, adding, *" report your down time…… change to advisory [frequency] approved."*

At 0530:32, CVR recorded sounds similar to a microphone being keyed five times within about 1.3 seconds. Seven seconds later, the Capt. radioed *"Tallahassee uh FedEx fourteen seventy eight uh extended uh left base leg for runway nine."* The FO indicated that he thought he saw the runway about 0530:56; he called for flaps 2 at 0531:10 and flaps 5 about 12 seconds later. At 0532:34, the FO stated, *" I hope I'm lookin' in the right spot here."* The Capt. responded *"see that group of bright lights kinda to the south down there and you see the beacon in the middle of it? Right over there.. You're kinda on about ...ten mile left base or so."* FO then indicated that he had been looking at the wrong ..flashing light. AT 0533:05, FO repeated *" I was looking at the wrong light"* and the Capt. responded, *"yeah okay, yeah."* FO added *"yeah, with the direction I took, we coulda used runway 27, eh?",* and the Capt. responded, *"yeah, it didn't matter Yeah, it's about ten miles south of VOR."*

At 0534:11, the Capt. stated, *" I guess the lights came on, if not I'll click 'em again here…..when we get a little closer."* Twenty seconds later CVR recorded sounds similar to a microphone being keyed five times within about 1.5 seconds.

At 0534:11, Capt. stated, *"there we go."* At 0535:24 FO requested *"flaps 15."* Six seconds later FO stated *"gear down, before landing check."* Two seconds later CVR recorded sound similar to landing gear being operated followed by a sound similar to nose gear door opening.

At 0535:42 Capt. advised TLH traffic that flight 1478 was turning onto final for runway 9. At 0535:54, FE began before the landing checklist stating "landing gear" to which Capt. responded, "down in three green." At 0535:59, FE stated *"autobrakes"* and Capt. responded, *"not installed" At 0536:06, FO asked for "flaps 25" and Capt.* acknowledged the request. At 0536:08 FE asked *"autospoilers"* and the Capt. response was *"not installed."* At 0536:10, FE queried " flight and nav instruments?," and Capt. responded *"cross checked –no flags."*

At 0536:20, FO said, *"sorry 'bout that ..linin' up on that paper mill or something."* As the FO started speaking, CVR recorded GPWS announce that the airplane passed through 1000ft AGL. At 0536:23, Capt said, *"that 'all right, no problem."*

At 0536:37, the airplane was slightly more than 2.5 nautical miles from an angled base-to-final leg to line up with the runway. At this time, PAPI would have been displaying one white and three red lights when viewed from cockpit (see the descent profile). At 0536:43, the PAPI would have shown four red lights. About this time, the power on the three engines increased, then at 0536:41, the power decreased. At 0536:43, as the airplane approached 500 ft, the Capt. asked FO if he wanted flaps 30 and FO responded, *"please."* At 0536:47.8, CVR recorded GPWS announcing the passage of 500ft AGL. At 0536:49, the Capt. stated "stable." The FO stated," *'m gonna have to stay just a little bit higher.. I'm gonna lose the end of the runway."* At 0536:52, the FE asked, *"flaps"* and the Capt. responded, *"thirty thirty green light."* At 0536:56, the FE asked, *"Landing clearance?"*, and Capt. responded, *"clear to land runway ...nine."*

As per FDR data at 0536:58, the engine power began to increase. At 0536:59.7, Capt. advised TLH that flight 1478 was on short final for runway 9. at 0537:09, *"it's starting to disappear in there a little bit, isn't it? Think we will be alright, yeah."*

At 0537:13, the FE announced the completion of before landing checklist. This was the last flight crew statement recorded by CVR. At 0537:14, GPWS announced passing 100 ft AGL. At 0537:20.3, as GPWS announced passing through 40 ft AGL no.2 and 3 engine power began to increase rapidly. AT 0537:20.7, CVR recorded the sound of a crunch and at 0537:21, The GPWS announced 30 ft. AGL. At 0537:22, CVR recorded another crunch, and the no.1 engine EPR began to increase rapidly. At 0537:22.6, the GPWS announced *"bank angle bank angle."*

The airplane collided with trees in a right-wing-low, slightly nose-up attitude during the approach to runway 9 then impacted the ground, coming to rest on a heading of 260 deg. about 1556 ft west-south-west of runway. The post impact fire ensued, but the three crew members exited the airplane before fire reached the cockpit.

During the post accident interviews, all three crew members described a normal flight until last seconds of approach. The Capt. said that the airplane was established on final as it descended through 800ft.

The NTSB concluded that the probable cause of the accident was the Capt.'s and FO's failure to establish and maintain a proper glide path during the night visual approach to landing. Contributing to the accident was a combination of the Capt.'s and FO's fatigue, the Capt.'s and FO's failure to adhere to company flight procedures, the Capt.'s and Flight Engineer's failure to monitor approach, and the FO's color vision deficiency.

Role of fatigue in the accident

Let us see how the fatigue of the flight deck crew affected this accident.

The Capt. had not slept well the previous night and had the emotional stress of euthanizing his beloved pet dog.

The FO was on reserve status, involving alternating sleep-disturbing day/night shifts. He had not expected the call to fly near the end of his reserve duty day.

The FE had slept for an hour before takeoff, having been awake since about 1.30p.m. the day before.

So, in spite of the fact the crew, each of whom had thousands of hours of flying experience, were suffering from varying degrees of insufficient and off-cycle sleep at the time of accident.

Runway 27 was the original choice, and the approach briefing was done for the same. Runway 27 featured ILS, PAPI, touchdown zone (TDZ) lights, approach zone lights and runway lights, while runway 09 featured only PAPI. The wind was negligible, yet, the FO choose runway 09. *The Capt. did not override this decision even though the FO had not previously flown to Tallahassee.* The approach was early in the morning around 0530 when it was still dark and the effect of a sleepless night can be most pronounced.

Added to the fatigue was the FO's color vision deficiency. The Capt. did not know that the *FO was flying on a waiver for the color vision deficiency.* This was indicated in FO tracking the paper mill light for the beacon. When FO lined up on runway 9 he was too low and PAPI would have been all four red indicating he was too low for nearly 40 seconds before impacting the treetops.

When descending over dark terrain bereft of ground lights, black hole effect can seduce pilots to fly more concave approach than a straight three degree one. In this situation, reliance on the PAPI lights was all the more important. FO's color vision deficiency put a limitation on him distinguishing red from white. *The Capt. and the FE who had good color vision and were both looking ahead would have seen the red PAPI lights, said nothing.* Such is the dumb complacency that can attend fatigue.

FedEx required pilots to be established on the runway centerline no later than four miles from the threshold. Here the flight path was established on the centerline at 2.5 miles from the threshold at just 750 ft above the ground.

FedEx procedures also required pilots to be stabilized at 500 ft above ground, which implies that correct power and a rate of descent no greater than 1000 fpm. If these are not met, a go-around is required.

In this case, *the airplane was well below the 3 deg. Glideslope as it passed through 500 ft at a descent rate of 1300 fpm and the Capt. called "Stable", one of the required call-outs of the landing procedure. He should have called "unstable" and commanded a go-around.* He had made many errors throughout the descent. He had not responded to the low EPR, or to the excessive descent rate-further indication of the insidious effect of fatigue.

The company had sound policies for stabilized approaches, yet they were not followed. Another effect of fatigue – the tolerance for omissions and errors goes up.

The Capt. gave all the right reasons not to use runway 9 and yet he allowed the approach to runway 9!?

The choice of runway 9 and failure to discontinue a poor approach are indications of deterioration in situational awareness due to fatigue.

Fatigue and how to manage it

Dr.M.S.Rajamurthy

Like in the FedEx accident above, fatigue has been blamed for many commercial aviation accidents. Fatigue is a threat to aviation safety and is a major safety concern in long-haul flights.

Pilot's duties in cockpit require care, vigilance, physical and mental well-being. Cockpit noise, vibration, long flights, irregular work schedules or too little sleep can result in fatigue, which can compromise pilot's performance.

As we saw in the FedEx accident, fatigue can defeat pilot's proven performance records, progressive company policies & proven procedures.

Formally defined, fatigue is a non-pathologic state resulting in decreased ability to maintain function or workload due to mental or physical stress. In simple terms, fatigue is the subjective feeling of tiredness that makes concentration on a task difficult. Fatigue is used to describe a sleepy, tired or exhausted state.

Fatigue is a normal response to conditions common to flight operations because of sleep loss, shift work, and long duty cycles. It has significant physiological and performance consequences in the cockpit as the crew is required to remain alert and contribute to flight safety by their actions, observations and communications. When the flight deck crew are flying under fatigued conditions several warning signals could alert the dangerous situation.

These include - eyes going in and out of focus, head bobs involuntarily, persistent yawning, wandering or poorly organized thoughts, Spotty near term memory, short term memory loss and loss of initiative.

In terms of flying, there is

* increased reaction time
* reduced visual perception
* missed or erroneous performance of routine procedures
* sloppy flying
* degradation of control accuracy
* decreased ability to concentrate on multiple tasks

A fatigued PF may become unresponsive to a deteriorating situation, overly focused on one thing, or ignore PNF inputs. A fatigued pilot will also exhibit "uncharacteristic behavior." This could be mood change, becoming short or intolerant of otherwise useful and good inputs from PNF.

Management of fatigue in flight operations is the primary responsibility of the flight deck crew, but responsibility also lies with the operator and the government regulatory authorities.

The two major causes of fatigue are lack of sleep and disruption of the awakens-sleep cycle called the Circadian cycle. The other factors that influence fatigue are stress, anxiety and poor health. It can also cause these problems. Fatigue can also be a symptom of other problems like hypoxia and dehydration.

Sleep

To understand fatigue it is necessary to clearly understand sleep. We need sleep, like we need water and food.

- Most people need 8 hours of sleep per night and most only get 6-8 hours.
- Sleep is comprised of two different stages called NREM and REM.
  - NREM– Non Rapid Eye Movement sleep. This is physiological hibernation, commonly deep sleep.
  - REM – Rapid Eye Movement sleep. This is associated with an extremely active brain that is dreaming.
- NREM and REM sleep occur in a 90 minute cycle- 60 minutes of NREM sleep followed by 30 minutes of REM sleep.
- Most deep sleep (NREM stage 3 & 4) occurs in the first third of the night. This is the most "restorative portion of the sleep cycle.
- Most people fall asleep in 15-30 minutes, and sleep for 6 hours or more. If a person takes an hour and a half to fall asleep, and achieves only 4 hours

of actual sleep, there may be a fatigue issue.

Circadian Cycle/rhythm

Circadian cycle or rhythm is the biological clock that is built into us, which tells us that we should work when it is light (day) and sleep when it is dark (night). The word comes from Latin "circa" (about), and "dies" (day). Circadian is synchronized by light, very powerful, and mostly unalterable throughout flight deck crew's schedules & route structure. The primary window of circadian slow (WOCL) is 0300-0500 and the secondary WOCL is 1500-1700. Performance degradation may occur between 0200-0600 & 1400-1600. Circadian cycle changes make a person try to sleep when their mind is wide-awake and force them to remain awake when the mind wants them to sleep.

Transmeridian flights in excess of three time zones can result in significant disruption of circadian rhythm. When flying westerly direction the pilot's day is lengthened. When flying east, against the sun the pilot's day is shortened. Thus the physiological time and the local time can vary by several hours.

Adjustment to a new location requires about a day per time zone crossed. For the flight deck crew, the time can't be adjusted and so it is better to stay on "home time".

Medication

Medication does contribute to fatigue. If the flight deck crew is sick, flying should be avoided. When ill with cold or flu, flying is bad, and with antihistamines it isn't better either as they also increase fatigue.

Non-prescription sleep preparations are allowed by FAA for flight deck but requires waiting of 12-24 hours from last dose to flight duty. Many prescription medication are not allowed and the pilots have to wait 24-48 hours after the last dose for flying. Some dietary supplements help reduce sleep problems. FAA allows only dietary supplements that do not have side effects.

Fatigue management

Important elements of flight deck management strategy are communications, briefing, checklists, and monitor /cross check functions. These become more critical with a fatigued flight deck crew. Pilots are poor at estimating their own alertness and performance, accurately and reliably. *A fatigued crew may lack the human resource required to avoid an unsafe situation.*

Flight deck crew must do the self-assessment of their alertness. One should consider the sleep deficit in the past 24 hours, cumulative sleep loss in the past three days(significant if it is more than 5 hours). If continuously awake for more than 16 hours it affects the alertness.

Pilot fatigue can be managed in two ways: Preventive and operational.

The former is used before duty and on layovers to reduce the effects of fatigue, sleep loss, and disruption of circadian rhythm. The latter is used when on duty, during flight to maintain alertness and performance. These have to be tailored to the individual needs.

Preventive strategies

- Nutritious and healthy food is very important. It should not be forgotten that circadian rhythm regulates digestion as well. High protein meals is the choice. High fat and high carbohydrates should be avoided. So also the junk food. Better have your own meal packed, receive catered meal from the company or get a healthy meal at the airport diner.
- Regular exercise, non smoking and spare use of alcohol reduces fatigue.
- Sleep scheduling
  - Keep a regular sleep/awake schedule and protect sleep time.
  - Avoid alcohol or caffeine before going to bed.
  - Get the best sleep at home before starting a trip.
  - On a trip maintain your "home" schedule of sleep time to awake time.
  - If not fallen asleep in 30 minutes, get out of bed.
  - Create a good sleep environment dark, quiet, temperate and comfortable room.
- Strategic napping before duty

Naps help decrease continuous wakefulness and can significantly restore alertness. Long naps of 3-4 hours, can significantly restore alertness for 12-15 hours. Short naps or 10-30 minutes can help restore alertness for 3-4 hours. A gap of 15-30 minutes should be allowed after awakening to be fully alert before resuming flight crew duties. If it is immediately before a duty period, nap should be limited to 45 minutes.

Operational strategies

- Engaging in conversation with others.
- Physical actions like stretching, getting out of the seat and moving about the aircraft for a few minutes.
- Strategic consumption of coffee helps in being alert and does not interfere with subsequent sleep on layover.
- Consumption of fluids especially water. Dehydration could occur due to exertion and low humidity in the cockpit, as well as due to consumption of coffee. Brains don't function well when dehydrated.

KAC POLICY ON FATIGUE

The KAC policy regarding fatigue is clearly spelled in the Operations Policy Manual (OPM). Following is the extract of Section 2.1 sub-part XIV ©:

A crew member shall not fly, and the Corporation shall not require him to fly, if either has reason to believe that he is suffering, or is likely to suffer while flying, from such fatigue as may endanger the safety of the aircraft or of its occupants. He is required to inform the Fleet of any flying duty periods undertaken by him whether professionally or privately, including any simulator hours.

The responsibility for being sufficiently rested before undertaking a flying duty remains with the individual crew member. If the individuals know or suspect that their physical or mental condition renders them temporarily unfit so to act, or if they know that they are, or are likely to be, in breach of the FDTL regulations, they will not act as an operating crew member.

It is worth reminding that many accidents attributed to pilot error have their origin in fatigue and failure to manage it. Safety is enhanced by actively mitigating the threat of fatigue. ***Fatigue is manageable and it is in the hands of the flight deck crew and the operators.***

CAFFEINE FACTS

Coffee is a stimulant and causes a temporary increased level of awareness. But caffeine is also diuretic i.e. it causes the body to discharge more fluids resulting in dehydration.

Three 250 ml servings of coffee will be 250-330 mg of caffeine, which is considered a moderate amount. 500mg of caffeine is considered excessive. Caffeine in the range of 100-600mg can be effective in maintaining cognitive performance particularly in situations of sleep deprivation.

The right amount is subjective and one has to find out what works for out right.

350 ml soda or a cup of tea will have about 40mg caffeine.

WEB WATCH

http://www.alertness-solutions.com - info. on alertness, gives jet lag & sleep debt calculators useful in managing fatigue

The Confidential Aviation Hazard Reporting System (CAHRS) provides a means of reporting hazards and risks in the aviation system before there is loss of life, injury or damage. It is open to anyone who wishes to submit a hazard report or safety deficiencies confidentially and non-punitively. Reports help to identify deficiencies and provide safety enhancement in areas of aviation. CAHRS forms can be collected at different location of KAC (i.e. Flight Dispatch) Premises. Completed forms can be dropped in FS&QA allocated box at Flight Dispatch or e-mailed to kwioeku@kuwaitairways.com or faxed to 00965-4749823 or mail to Flight Safety and Quality Assurance office, Operations Department, P.O. Box 394, Safat 13004, Kuwait Airways –Kuwait.