NATIONAL TRANSPORTATION SAFETY BOARD
Office of Aviation Safety
Washington, D.C. 20594

Airworthiness Group Chairman's Factual Report of Investigation

July 20, 2016

A. ACCIDENT DCA16FA013

Location:	Fort Lauderdale-Hollywood International Airport, Florida
Date:	October 29, 2015
Time:	1232 Local Time
Aircraft:	Dynamic International Airways flight 405, a Boeing 767-200ER, registration N251MY

B. GROUP

Chairman:	Tom Jacky National Transportation Safety Board Washington, D.C.
Member:	John Biekman Federal Aviation Administration Orlando, Florida
Member:	Bill Gray Dynamic International Airways, LLC High Point, North Carolina
Member:	Patrick Langlet The Boeing Company Seattle, Washington

C. SUMMARY

On October 29, 2015, about 1233 eastern daylight time (EDT), a Boeing 767-200ER, N251MY, operating as Dynamic International Airways flight 405, caught fire while taxiing for departure at Fort Lauderdale-Hollywood International Airport (FLL), Fort Lauderdale, Florida. One passenger received serious injuries and the remaining 89 passengers and 11 flight crewmembers received minor injuries or were not injured. The airplane sustained substantial thermal damage from the fire. Flight 405 was a scheduled charter flight en route to Caracas, Venezuela, operating under the provisions of 14 Code of Federal Regulations Part 121 supplemental. Visual meteorological conditions prevailed at the time of the accident.

The group met at the accident site from October 30 to November 2, 2015 to document the relevant airplane systems and structures. Aside from the fuel fitting in the Number 1 (left) engine pylon, no systems or structures failures were found during the group's activities.

No parts were removed for further testing by the group.

At the conclusion of the examination, all pertinent documentation and photographs were provided to each of the parties.

D. DETAILS OF INVESTIGATION

The accident airplane had been moved from the accident site and parked at an area near the Signature Flight Line prior to the arrival of the group. Therefore, the group documented the airplane at the parking spot.

The group documented the pertinent aspects of the airplane systems and structures as follows:

1. AIRPLANE SYSTEMS

The group identified and documented the relevant and noteworthy systems of the airplane, according to the following categories:

A. Equipment & Furnishings

The following flight deck emergency equipment was noted on board:

- SMOKE GOGGLES: 4 total (not used)
- EMERGENCY OXYGEN WITH FULL FACE MASK
  - 2 total, with bottle pressure noted at 1,800 PSI (not used)
- CREW MEMBER Personal Breathing Apparatus: 1 total (not used)
- CRASH AXE
- FIRE EXTINGUISHER
- EMERGENCY FLASHLIGHTS, 2 total
- FIRST OFFICER'S ESCAPE ROPE – Removed from compartment

B. Fire Protection

Both engine fire suppression bottles were examined in the forward cargo bay. For further information, please refer to the Powerplants Group Chairman's Factual Report of Investigation.

All of the other airplane fire suppression systems were found undischarged.

C. Flight Controls

C.1 Primary Flight Control Systems

The circumstances of the accident did not warrant extensive documentation of the primary flight control systems. The roll control primary flight controls surfaces and actuators on the left wing were thermally damaged by fire; documentation of the damage is noted in Section D.2, Airplane Structures.

No thermal or physical damage was noted on the primary flight control systems on the right wing, right horizontal stabilizer, or the vertical stabilizer.

C.2 Secondary Flight Control Systems

C.2.1 Wing Leading Edge Slats

The airplane has 12 leading edge slats, 6 on each wing. The leading edge slats were examined and documented.

All 12 leading edge slats were noted in a similarly-extended position. According to Boeing, the position (or amount of extension) was equivalent to a mid-extension. The configuration was consistent with a takeoff configuration and a Flaps 5 flight deck selection.

The left wing leading edge slats exhibited thermal damage. See Section D.2, Airplane Structures.

The right wing leading edge slats did not exhibit any visual evidence of thermal or physical damage.

C.2.2 Wing Trailing Edge Flaps

The wing trailing edge flaps were documented. The airplane has 4 trailing edge flaps, 2 on each wing. Each wing has an inboard and outboard trailing edge flap.

All 4 trailing edge flaps were extended to the same position, the 5 unit position. According to Boeing, the position was consistent with a Flaps 5 flight deck selection. This configuration agrees with flap handle/selector position on flight deck, which was in the 5-unit detent.

The left inboard and outboard trailing edge flaps exhibited thermal damage. See Section 2.D, Airplane Structures.

The right inboard and outboard flaps did not exhibit any visual evidence of thermal or physical damage.

D. Fuel

D.1 Fuel Flight Deck Indications

The following flight deck fuel system indications, from the forward overhead panel (P5)

were observed[1]:

- Fuel Heat AUTO (See Figure 1)

Figure 1 - Fuel Heat Panel

- Fuel System Control Panel ALL PUMPS ON, R CTR OFF (See Figure 2)

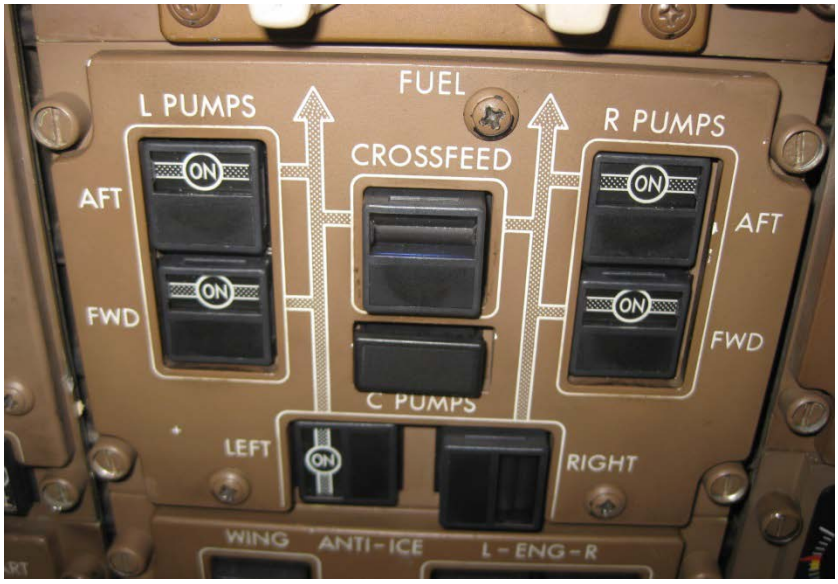

Figure 2 - Fuel System Control Panel

The electronic Fuel Quantity Panel did not provide an indication due to no power on the airplane. See Figure 3.

[1] For more information regarding flight deck observations, please see Section 1.J, Indicating/Recording Systems.

Figure 3 – Electronic Fuel Quantity Panel

D.2 Flight Deck Annunciations Related to Fuel System

Flight deck annunciations related to the configuration of the fuel system[2] are located on the P5 Forward Overhead Panel and the airplane's engine indication and crew alerting system (EICAS) displays, located on the pilots' center instrument panel.

The annunciations are summarized as follows:

1. <u>FUEL CONFIG on the Fuel System Control Panel</u>

The "FUEL CONFIG" light on the Fuel System Control Panel will illuminate when at least one of the following conditions is present:

- Low fuel quantity: defined as when the total usable fuel in either the Left or Right Main Fuel Tank drops below approximately 2,200 lbs.
- Fuel imbalance: defined as when the difference between the Left and Right Main Fuel Tank quantities is greater than 2,000 lbs. +/- 500 lbs.
- Both Center Tank Fuel Pump switches are OFF with more than 1,200 pounds of fuel in the Center Tank.

2. <u>FUEL CONFIG EICAS Advisory Message</u>

The EICAS Advisory message "FUEL CONFIG" will be displayed when at least one of the following conditions is present:

- Fuel imbalance: defined as the difference between the Left and Right Main Fuel Tank quantities greater than 2,000 lbs. +/- 500 lbs.
- Both Center Tank Fuel Pump switches are OFF with more than 1,200 pounds of fuel in the Center Tank.

[2] The information presented was summarized from Section 12 of the 767 Flight Crew Operations Manual (FCOM).

3. FUEL CONFIG EICAS Caution Message

The EICAS "FUEL CONFIG" caution message will be displayed when the following condition is present:

- Low fuel quantity: defined as when the total usable fuel in either the Left or Right Main fuel tank drops below approximately 2,200 lbs.

D.3 Assessment of Fuel Used and Lost

Based on information available, an assessment was conducted of the fuel quantity onboard the airplane was conducted. The following are the results:

- Flight DYA406 aircraft N251MY arrived in FLL @ 01:55Z on 10/28/2015
- FUEL ONBOARD UPON ARRIVAL: 48,000 LBS
- APU BURN: 1,000 LBS
- FLIGHT PLAN FUEL DYA405 10/29/2015: 47,000 LBS
- DEFUELED (11/1/15) : 6,200 GAL X 6.7 LBS/GAL= 41,540 LBS
- FUEL USED & LOSS: 5,460 LBS

Personnel from the Broward County Aviation Department measured the perimeter of spilled fuel in the area of the departure/pushback. The measurements, provided on photographs of the spill area and a plan view of the airport, were scanned and provided to the group. The measurements were made using a measuring wheel. Please see Section 3.0, LEFT MAIN LANDING GEAR TRACK.

D.4 Boeing Assessment of Fuel System Flight Deck Annunciations

The NTSB asked Boeing to assess whether any of the three flight deck annunciations would have been presented to the flightcrew, given the loss of fuel. Boeing provided, via email, the following information response:

The center fuel tank left pump was noted as being ON during the post-event inspection of the flight deck; therefore an annunciation due to the condition of both center tank fuel pumps switched OFF with excess of 1,200 lbs. in the center tank would not be expected.

Given the amount of fuel offloaded from the airplane following the event, fuel quantity in both the left and right main tanks would have exceeded 2,200 lbs., so an annunciation due to the condition of low fuel quantity would not be expected.

An annunciation due to the condition of a fuel imbalance would be expected if the leak resulted in an imbalance of at least 2,000 lbs. +/- 500 lbs. This could be evaluated by comparing the quantity of fuel offload from the left and right main tanks, however these discrete values don't appear in the defuel work order.

E. Indicating/Recording Systems

At the time of arrival at the accident scene of FAA group member on 10/29/2015, at 14:30 Local Time, the Captain's L1 Window was closed, the First Officer's R2 Window was open, and the First Officer's escape rope was hanging out the R2 Window. The parking brakes were set.

The following indications were observed during the flight deck inspection of N251MY's overhead panel switch positions:

- IRU, L-C-R — NAV MODE
- EEC, L-R — ON
- PRIMARY HYD — L / R ENG, C1/C2 ON
- DEMAND HYD — L/C/R AUTO
- BATTERY — OFF
- STBY POWER — AUTO
- UTIL BUS — L/R AUTO
- GEN CTRL — ON
- GEN DRIVE DISCONNECT — L/R SWITCH COVER NOT SECURED
- APU — OFF
- EMERGENCY LTS — ARMED
- ENG START — 1/AUTO
- FUEL HEAT — AUTO
- FUEL PANEL — ALL PUMPS ON, R CTR OFF
- WING/ ENG ANTI-ICE — OFF
- POSITION/ANTI COLLISION LIGHTS — ON
- NOSE GEAR LIGHTS — ON
- PAX SIGNS — NO SMOKING/SEATBELTS ON
- SEL CAL — VHF L
- CABIN CALL (NO POWER) — UNABLE TO IDENTIFY SWITCH POSITION
- CABIN PRESS — LNDG 0230 SELECTED/ MODE SELECT AUTO
- EQUIPMENT COOLING — AUTO
- INDICATION LTS — BRT (Bright)
- CARGO HEAT — FWD/AFT/BULK ON
- CABIN TEMP SEL — COLD
- FLT DECK TEMP — COLD
- TRIM AIR — ON
- RECIRC FAN — L/R ON
- PACKS — L/R AUTO

- ENG ISLN VALVE L/R OFF
- APU ISLN VALVE ON
- ENG BLEED L/R ON
- APU BLEED ON
- IAS/MACH 136 (Mode Control Panel)
- HDG 276 (MCP)
- ALT 3000 (MCP)
- CAPT SPEED BUGS 126/132/168/208
- F/O SPEED BUGS 64/124/130/170/210
- GEAR HANDLE DOWN
- INST SOURCE SEL CAPT, F/O ALL NORMAL
- FLAP HANDLE 5 Position
- FLAP POS IND 5 Position
- ALTN FLAPS NORMAL
- EICAS CONTROL AUTO
- HSI RNG 20, EXP MAP, WEATHER/TERR OFF.
- STAB TRIM CAPT 7-7
- STAB TRIM F/O 7-7
- SPEED BRAKE FWD/DWN
- THROTTLES IDLE
  (Left throttle advanced ~½-knob from right throttle)
- T/R LEVERS STOW
- FUEL CONTROL L/R CUT OFF
  (Both engine run/cutoff switches were noted in the cut off position. See Figure 4)

Figure 4 - Engine Fuel Run/Cut Off Switches

- L FIRE HANDLE DISCH 1
- R FIRE HANDLE NORMAL

Note: the flight deck left engine fire handle was found actuated (pulled up) and rotated to the bottle 1 discharge position. The right engine fire handle was not pulled – found in normal position. See Figure 5.

Figure 5 - Flight Deck Engine Fire Handles

- APU FIRE HANDLE NORMAL
- L AUDIO SEL PANEL BOOM, INT, NO MIC SELECTED
- R AUDIO SEL PANEL BOOM, L VHF, R VHF, C VHF, INT. MIC L VHF

Note: On the overhead panel there are two toggle switches, labelled “VIDEO” and “AUDIO”. Both switches were noted in the “ON” position.

All circuit breakers on panels P6-1, P6-2, P6-3, P6-4, P6-5 panels were noted in (closed). On the overhead P-11 panels the following circuit breakers were deactivated, INOP or pulled (opened):

- AIDS DC, VIP COMM, AFT TV, Mid TV, FWD TV (Deactivated)
- RAIN REP RT (INOP)
- FLT REC AC/DC, VOICE REC. (Pulled per NTSB request)

The airplane’s flight data recorder (FDR) and cockpit voice recorder (CVR) were removed for examination by the NTSB.

F. Landing Gear

The airplane has a nose gear and two main landing gears. Each of the three landing gears was documented.

Upon arrival of the group, the main landing gear doors were closed. The doors were opened for inspection.

F.1 LEFT MAIN LANDING GEAR

The left main landing gear exhibited thermal damage. The tires, trunnion, and strut structures all exhibited thermal damage. See Figures 6 and 7.

Figure 6 - Left Main Landing Gear, Outboard View. Note thermal damage to tires.

Figure 7 - Left Main Landing Gear, Looking Aft

On the left gear there was heavy soot accumulation over the entire main gear assembly. Paint on the shock strut outboard surface was blistered and peeling adjacent to the truck. The outboard sides of the tires were charred and sidewall markings are no longer visible. The hydraulic line common to the side brace lock actuator was leaking fluid. The thermal fuses common to all four tire/wheel assemblies were intact. See Figure 8.

For each of the wheel brakes there was visible brake wear pin indicator, all within operational limits.

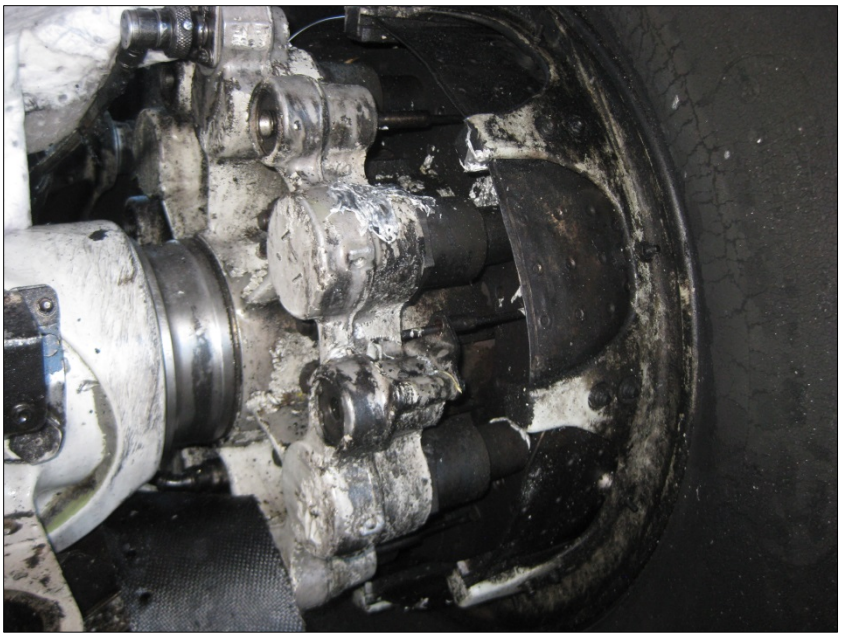

Figure 8 - Close Up View of Left Main Gear Wheel Brake Structure

The left main gear overhaul data plate was found during an examination of the taxiway in the area of the fire.

F.2 RIGHT MAIN LANDING GEAR

No thermal or physical damage was noted to the right main landing gear. For each of the wheel brakes there was visible brake wear pin indicator, all within operational limits. See Figures 9a and 9b.


Figures 9a and 9b - Right Main Landing Gear

F.3 NOSE LANDING GEAR

No thermal or physical damage was noted to the nose landing gear. See Figure 10.

Figure 10 - Nose Landing Gear

2. AIRPLANE STRUCTURES

The group identified and documented the relevant airplane structures, according to the following categories:

A. Doors

Each of the four main cabin doors was opened either during the evacuation or before the group's arrival. Each of the doors was successfully opened and closed during the on-scene investigation.

A.1 LEFT MAIN LANDING GEAR DOOR

On the Left Main Landing Gear Door, the paint common to the entire exterior surface was burned and blistered. Two areas in the middle of the panel were noted where the exterior composite plies were delaminated. No penetration of the outer skin panel was evident and no damage was visible on the interior of the panel. See Figure 11.

Figure 11 - Left Main Landing Gear Door, Exterior

The doors mounted to the Left Shock Strut, Left Trunnion and Left Drag Brace were burned and delaminated over the entire surface. Aluminum seal retainers along the leading edge of the shock strut door were melted along the free flange and some of the molten aluminum was puddled on the #1 brake assembly.

A.2 RIGHT MAIN LANDING GEAR DOOR

The Right Main Landing Gear Door was covered with light soot on the exterior surface.

The doors mounted to the Right Shock Strut, the Right Trunnion and the Right Drag Brace all showed no signs of fire or heat effects.

B. Fuselage

The left side of the fuselage was affected by the fire, while the right side was not. See Figures 12 and 13.

Figure 12 - Forward Left Side of Fuselage

Figure 13 - Aft Left Side of Fuselage

B.1 Fuselage Skin

Forward of the wing, light soot covered the fuselage skin between Body Station (BSTA) 500 and the wing leading edge and extended upwards to the window line. Aft of the wing, light

soot covered the fuselage skin between the wing trailing edge to BSTA 1250 and extended upwards to the window line.

B.2 Wing to Body Fairings

Paint common to the left side of the wing to body fairing assembly was burned and blistered below the wing. The composite fairing panel exterior plies were delaminated outboard of the left ram air inlet and extended aft to the wing trailing edge. See Figures 14A and 14B.

Figures 14a and 14B - Wing to Body Fairing, forward wing area

The area of the fairing panel above the wing was burned and blistered adjacent to the deployed position of the left over wing escape slide. See Figure 15.

Figure 15 - Wing to Body Fairing in the aft wing area

B.3 Main Landing Gear Wheel Wells

The left wheel well had heavy soot accumulation on all surfaces and components. There was no indication of paint damage common to bulkheads or the pressure deck. The underside of the composite panels between the rear spar and the landing gear support beam was burned and the face sheets were delaminated. The panel cores and upper face sheets were intact. The clamp blocks and clamp cushions common to hydraulic and electrical installations were intact. See Figure 16.

Figure 16 - Thermal Damage to Left Main Gear Wheel Well

The right wheel well had light soot accumulation on most surfaces and equipment with the most significant adjacent to the opening to the left wheel well.

C. Nacelles/Pylons

Damage to the left pylon and engine was included in the Powerplants Group Chairman's Factual Report.

The right nacelle/pylon showed no visible signs of thermal or physical damage.

D. Stabilizers

The left stabilizer was sooted and had blistered paint common to the leading edge and the inner spar skin lower surface from tip to approximately 10' inboard of the tip. No evidence of delamination was noted during visual inspection. See Figure 17.

Figure 17 - Sooting on Left Horizontal Stabilizer

The right horizontal stabilizer, vertical stabilizer, and rudder showed no visible signs of fire or heat effects.

E. Windows

On the left side of the fuselage, passenger windows aft of BSTA 1109 were crazed and exhibited indications of thermal damage. The window in the L2 Door (aft service door) was also thermally crazed. See Figure 18.

Figure 18 - Example of Thermally Crazed Window

F. Wings

F.1 Left Wing

The examination of the left wing revealed that soot covered the entire lower wing surface between wingtip and midway between the #1 and #2 flap track fairings. The soot was heaviest at the inboard position and lighter going outboard to the wingtip. Blistered paint was noted on the forward inboard corner of the #1 flap track fairing.

The inboard flight control surfaces sustained the most damage. The Left Inboard Aileron was thermally damaged, with the skin scorched, delaminated, or consumed. See Figures 19A and 19B.

Figure 19A and 19B - Left Inboard Aileron, Top View (19A) and Bottom View (19B)

Spoiler Panels #5 and #6 exhibited thermal damage. The panels were scorched, delaminated, or consumed. See Figure 20.

Figure 20 - Spoiler Panels 5 and 6

Along the trailing edge, the paint on the fixed panels was blistered and peeling from midway between the #1 and #2 flap track fairings inboard to the #2 flap track fairing. Delamination and charred core were common to the exterior surfaces of composite panels aft of engine #1; however, the core and inner face sheets were intact. From the #3 flap track fairing extending inboard to the side of body, the composite panels lower face sheets were burned and delaminated but the panel cores were intact. Both of the left trailing edge flight control surfaces exhibited similar damage. See Figures 21A and 21B.

Figure 21A and 21B - Underside of Left Wing, Number 1 Trailing Edge Flap Canoe (Left) and Number 2 Trailing Edge Flap Canoe

Along the leading edge, soot covered the fixed panels extending inboard through the #4 slat. Inboard of the #4 slat, the fixed leading edge composite panels were charred but the exterior surfaces were intact and the panel core was intact. Inboard of engine #1, the fixed leading edge composite panels were charred but the exterior surfaces were intact and the panel core was intact. See Figures 22A and 22B.

Figure 22A and 22B - Examples of Leading Edge Damage Inboard of #4 Slat (20A) and Inboard of Engine #1 (20B)

The inner spar skin was heavily sooted inboard of the #1 flap track fairing and the soot was noted to be increasingly heavier moving towards the side of body. In the area inboard of #1 engine, the paint was scorched.

F.2 Right Wing

No physical damage, fire or heat effects were noted during the visual inspection.

3. FUEL SPILL, LEFT MAIN LANDING GEAR TRACK MEASUREMENTS

Photographs of the airport tarmac and taxiway, in the area where the airplane was pushed back from the terminal boarding gate (E9), showed two black trails from the area of the initial fuel spill. The trails of black material, attributed to the accident airplane's left main landing gear tires, were noted on the airport tarmac and taxiways from the position where the airplane's engines were started after pushback from Gate E9, in the area of spilled fuel to the location of the airplane at the time of the accident. See Figure 23.

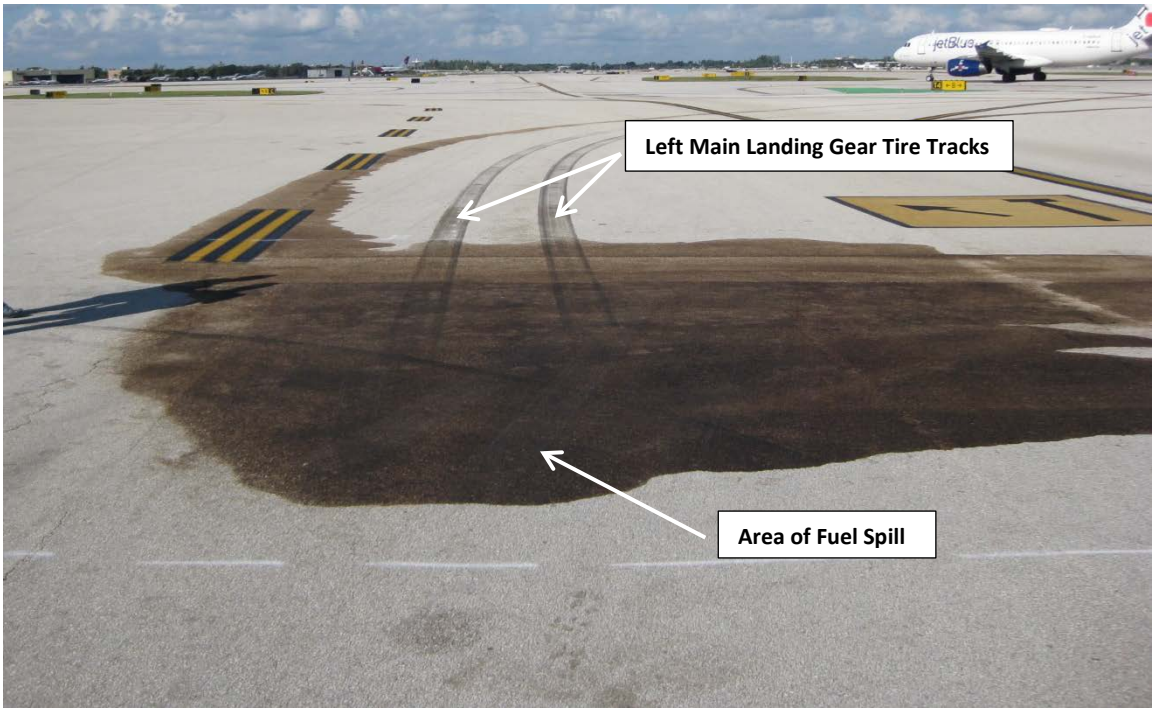

Figure 23 - Area of Fuel Spill and Landing Gear Tire Tracks

An examination of the ramp, taxiway and evacuation site at the east end of taxiway Bravo was conducted by the group. The spilled fuel stain was observed at the pushback area adjacent to Gate E9, where the engines of the accident airplane were started and taxi commenced. The stain measured approximately 51' x 57' (See Attachment 1). The stain covered an area of the ramp that was beneath engine #1, as well as an area between engine #1 and the fuselage. The stain continued under the aircraft to an area behind the right wing.

A continuous fuel stain from the engine start location to the evacuation site was observed. The length of the stain was approximately 1,000 yards and its width was approximately 15", although the width varied along the fuel path on the taxiway. There was also a continuous tire scrub mark coming from the left main landing gear outboard tires that ran parallel to the fuel stain. The position of the fuel stain relative to the tire mark was consistent with the lateral spacing between the outboard tires and the engine centerline. See Figure 24.

Figure 24 - Fuel Spill and Landing Gear Tire Tracks

There were two additional fuel stain trails along the taxi route. The first stain trail was coincident with the tire scrub mark and consisted of a series of small, individual stains at a typical rate of several drops per foot. The second additional fuel stain trail was located between the continuous fuel stain and the tire scrub mark. The stain consisted of a series of small individual stains at a typical rate of several drops per foot.

The aircraft position at the time of the incident and evacuation was approximately 365 feet east of the ILS hold line at the east end of Taxiway Bravo. See Figure 25.

DYA405 boarded at Gate E9 prior to the accident. An examination of the gate area was made for fuel spill stains. A stain measuring approximately 3’ x 3’ was found 22’ left of the taxi centerline and 43’ from the 767-200 nose wheel stop line. Boeing indicated that, for the 767-200, the #1 engine centerline distance to the nose gear centerline is 25’ 10’’, which was inconsistent with the location of the stain. It was unknown where DYA405 was positioned relative to the Gate E9 taxi centerline and nose wheel stop line, so no determination was made of the source of the stain. The accident airplane operator indicated that DYA405 used Gate E9 (for departure) for the days prior to the accident, as had other aircraft types.

Figure 25 - Fuel Spill and Tire Tracks Leading to Final Airplane Position

Tom Jacky
Aerospace Engineer