
Ground collision between a Boeing 747-400, HL741 and Ilyushin IL-62 RA865, November 11, 1998

Micro-summary: This Boeing 747-400 collided with an Ilyushin IL-62 airplane on the ground.

Event Date: 1998-11-11 at 0133 AST

Investigative Body: National Transportation Safety Board (NTSB), USA

Investigative Body's Web Site: <http://www.nts.gov/>

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		NTSB ID: ANC99FA012A		Aircraft Registration Number: HL741	
		Occurrence Date: 11/11/1998		Most Critical Injury: Minor	
		Occurrence Type: Accident		Investigated By: NTSB	
Location/Time					
Nearest City/Place ANCHORAGE		State AK	Zip Code 99502	Local Time 0133	Time Zone AST
Airport Proximity: On Airport		Distance From Landing Facility:		Direction From Airport:	
Aircraft Information Summary					
Aircraft Manufacturer Boeing		Model/Series 747-400		Type of Aircraft Airplane	
Sightseeing Flight: No			Air Medical Transport Flight: No		
Narrative					
Brief narrative statement of facts, conditions and circumstances pertinent to the accident/incident:					
<p>HISTORY OF FLIGHT</p> <p>On November 11, 1998, at 0133 Alaska standard time, a Boeing 747-400 airplane, HL7414, operated as Flight 221 by Asiana Airlines of Seoul, Korea, sustained substantial damage when it collided with an Ilyushin IL-62 airplane. Both flights were being conducted under 14 CFR Part 129 as foreign flag carriers operating in the United States. The Asiana flight was taxiing to parking after landing at the Anchorage International Airport, Anchorage, Alaska. The 18 crewmembers and 220 passengers on board the Boeing were not injured. The Ilyushin was parked at gate N-2, and was being operated by Aeroflot Russian Airlines as Flight 853. It was scheduled to depart for San Francisco, California, at 0230. The crew of 11, and one contract cleaner, were on board preparing for departure; the passengers for this flight had not yet boarded. The crew of the Ilyushin were not injured; the cleaner on board reported a sprained wrist. The Asiana flight had departed John F. Kennedy International Airport, New York, New York, at 1828 Alaska standard time, and the destination was Anchorage.</p> <p>Continuous snow removal operations for the runways were in effect at the airport, and light snow was falling. At the time of the collision, witnesses stated that between one and two inches of dry snow had accumulated on the ground. When the NTSB investigator-in-charge (IIC) arrived about 0230, he observed a uniform layer of about 2 inches of loose snow on the north ramp, with dry pavement underneath.</p> <p>The ground marshaller for the Asiana airplane told the NTSB IIC that as the airplane reached N-6, he observed the nosewheels turn left, but the airplane continued straight ahead, with the nosewheels sliding sideways. The marshaller stated: "I gave the emergency stop sign (crossed wands). The aircraft slowed and then I heard an increase in engine power, then a reduction in power, and then a bigger increase in power. The aircraft disappeared in a cloud of snow..." He saw the airplane continue past gate N-4, and begin a right turn, away from the gate area. He then heard the collision.</p> <p>The left, outboard, engine (number 1) of the Boeing struck the left wingtip of the Ilyushin, and then the left wingtip struck the vertical stabilizer of the Ilyushin.</p> <p>Several other witnesses who were positioned either on the N-6 jetway, or on the ground, described the Boeing 747 taxiing in faster than normal, observing the nosewheels turn and slide sideways, hearing an increase in engine noise, and seeing a snow cloud behind the Boeing 747 (statements attached).</p> <p>The lead mechanic for another airline, who was sitting in a ground vehicle at gate N-8, provided a written statement which said, in part: "I was waiting for the Asiana 747-400 to clear the gate area, which I also had full view of.... As the Asiana flight approached, I observed it execute a</p>					
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right turn at N8. It was passing me when I saw, and heard, surprisingly, the unmistakable sound of thrust being applied to its engines. Within 2-3 seconds, I, and my vehicle was engulfed in a massive snow "whiteout". The 747-400 completely disappeared into the cloud of snow... I arrived on the scene exactly at the same time as the emergency people did... I do not remember if the Asiana airplane had any of its engines running when I arrived but I don't believe it did. I don't remember being in any sort of jet blast and there certainly would have been that given where I was standing. One thing I do know, is that the Asiana 747 applied power as it taxied by me."

The Asiana captain and first officer told the NTSB IIC during two separate interviews in the Asiana airport offices on November 11 (at 0300, and again at 1130), that when the captain turned the steering tiller to turn left into gate N-6, the airplane did not respond to tiller inputs, and that after passing gate N-4, they saw the Ilyushin in front of them at gate N-2. The captain stated that he applied right tiller, and right side brakes to turn to the right, away from the Ilyushin and the terminal, but was unable to miss striking the Ilyushin. The crew indicated they then shut down all four engines, and disembarked the passengers using a stair truck. During both interviews, and all subsequent interviews, an interpreter was provided by Asiana Airline.

The captain told the NTSB IIC during the first interview on November 11, immediately after the accident that he did not use any reverse thrust, that he did not apply power, and that he kept the throttles at the idle position. He said he did not use differential power to turn. Both the captain and the first officer told the IIC that the captain was manipulating the controls, not the first officer. During the second interview on November 11, both the captain and first officer indicated that the taxi speed they read from the cockpit ground speed display was 6 or 7 knots. They said that for slippery/icy taxi operations, they are limited to 10 knots or less.

The captain wrote in his NTSB Pilot / Operator report that "ground speed was 5-6 knots. I add little power to gain momentum for the turn to N-6. However the a/c slipped to N-2 thru N-4. I tried to stop the a/c by applying brakes to no avail then the a/c continued skidding toward the parked IL-62M on N-2."

The Asiana crew said they did not believe there were any preimpact mechanical problems with the airplane.

The lead purser on the Boeing 747 stated to the NTSB IIC that when the airplane came to a stop, they did not know why. No one in the cabin felt the impact, no masks fell down, and they did not know there was an accident until the cabin occupants had deplaned. The persons in the cabin thought it was a regular stop, and expected to exit the Boeing by the normal jetway. The purser believed that it took about 20 minutes after they stopped to begin to deplane passengers via a stair truck.

The crew of the Ilyushin told the NTSB IIC, through an interpreter provided by Aeroflot, that they were in the main cabin at the time of the collision. They said that immediately after the collision, they turned off all power, and deplaned using air stairs on the right side of the airplane.

DAMAGE TO AIRCRAFT

The Boeing 747 sustained substantial damage to the left wingtip, and number 1 engine. The number 1 engine and nacelle assembly required removal and replacement. The outboard 10 feet of the left wingtip had to be cut off to separate the airplanes.

The Ilyushin was determined by the owner to be beyond economical repair.

OTHER DAMAGE

Gate N-2 at the international terminal sustained structural damage and was determined to be

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unusable by the airport authority. The left side of the parked Ilyushin impacted the jetway. The floor structure of the jetway was buckled.

A ground handling baggage cart which was positioned near the nose of the Ilyushin was blown over. This cart came to rest halfway between the Ilyushin and the terminal building, in a line directly aft of the exhaust section of the Boeing 747 number one engine. The baggage cart struck an unoccupied van.

Two lavatory servicing trucks parked between jetways N-2 and N-4 were blown into each other and sustained minor damage.

PERSONNEL INFORMATION

Boeing 747-400

The Boeing 747-400 had two flight crews assigned for the flight from New York to Anchorage. The accident crew assumed flight crew positions for the last 3.5 hours of the flight.

Both accident crewmen indicated they fly into Anchorage two or three times per month.

The Asiana captain was an ex-Korean Air Force pilot. At the time of the accident he had accrued 3,278 hours in the Boeing 747-400. He was hired by Asiana on January 1, 1990. The captain completed a Boeing 747-400 transition check on April 17, 1994. The captain told the NTSB IIC during the first interview on November 11, that he had been flying the Boeing 747(series) for seven years to Anchorage.

The captain held a Korean airline transport pilot certificate which was issued to him on September 27, 1975. He completed a type rating in the Boeing 747 on May 19, 1987. He added a rating on his pilot certificate for the Boeing 747-400 on June 11, 1994. The final two flights on the captain's 747-400 training records were shown to be conducted with Korean Ministry of Transport pilots. He also had ratings for the Boeing 737-400, and the Boeing 767-300.

The captain held a U.S. first class medical certificate issued on September 21, 1998, with the restriction that he "must have available glasses for near vision." He did not hold any U.S. pilot certificates.

A review of the captain's check flight / periodic training records revealed that taxi in / taxi out procedures were completed, with no negative comments.

The first officer was also an ex-Korean Air Force pilot. At the time of the accident he had accrued 1,744 hours in the Boeing 747-400. The first officer said he had been flying to Anchorage for three years. He was hired by Asiana on February 6, 1995. The first officer completed an initial check in the Boeing 747-400 on January 13, 1996, and a Korean endorsement for the Boeing 747-400 was added to his Korean pilot certificate on March 8, 1996. He flew as a copilot, with a Korean commercial pilot certificate for three years. He received his Korean airline transport pilot certificate on January 13, 1998, 2 1/2 years after receiving his U.S. airline transport pilot certificate.

The first officer held a Korean first class medical certificate issued September 28, 1998. No restrictions were noted on his medical certificate.

The first officer completed a U.S. private pilot flight examination in a multiengine airplane on April 28, 1995. He also completed a U.S. commercial pilot flight examination on the same day, April 28, 1995. He completed a U.S. airline transport pilot flight examination on May 1, 1995. According to the Designated Examiner's Report, FAA Form 8710-1, the ground and flight portions of these checks took 0.5 and 0.5 hours for the private; 3.0 and 1.4 hours for the commercial; and 2.0 and

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2.0 hours for the airline transport pilot checks, respectively.

All three tests were performed by Mr. Clifford Hodges, FAA Designated Examiner number WP-15-02. The recommending instructor for these tests was Mr. Kevin Conley, flight instructor certificate number 562834310.

A review of the first officer's check flight / periodic training records revealed that taxi in / taxi out procedures were completed, with no negative comments.

Ilyushin IL-62M

The flight engineer and navigator were in the cockpit at the time of the collision, preparing the airplane for departure. The two captains and the copilot were in the first class area of the cabin, waiting for the systems on the airplane to warm up. None of the crew reported seeing the Boeing 747 prior to the collision.

AIRCRAFT INFORMATION

Boeing 747-400

The Boeing 747-400 was operated by a two man cockpit crew. The 747-400 has a fuselage length of 231 feet, and a wingspan of 213 feet.

The steering systems employed on this airplane consisted of hydraulically driven nose wheel steering, body gear steering, and wheel brakes. The nose wheel steering receives limited authority input from the cockpit rudder pedals, and full authority input from hand-operated tillers located at both the captain's and first officer's positions. This system is always active, whether the airplane is on the ground or airborne. Body gear steering also is available and is always active. This system consists of hydraulically turning the main landing gear trucks in the opposite direction of the tiller to aid the airplane in turning in a smooth arc. The main landing gear brake system may be used for turning.

Additionally, the use of differential thrust on the four wing-mounted engines is available to assist the pilot in ground turning performance.

Inspection of the tires of the Boeing 747 revealed that 17 of the 18 tires had deep tread grooves visible. The number eight tire, located on the left main body truck, appeared worn with no visible tread. The 16 main tires pressures ranged from 170 psi to 191 psi. The nose tires pressures were 160 psi, and 175 psi. The outside air temperature at the time of measurement was 20 degrees Fahrenheit.

The Asiana Airlines B747 Flight Handbook dated August 01, 1995, page 05-04-02, states, in part: "5. Max taxiing speed (recommended) on idle thrust (1) Turning ... 10 kts or below (5 kts if wet or slippery) (2) On ramp ... 10 kts or below..."

On page 05-04-03, the Flight Handbook states, in part: "12. During winter time taxiing...(2) If taxiing on slippery taxiways, ... avoid using large amount of tiller to prevent slipping sideways."

Ilyushin IL-62M

The IL-62M was a four engine, low wing, airplane manufactured by the Ilyushin Group, Moscow, Russia. The cockpit crewmembers of the Ilyushin consisted of two captains, a copilot, an engineer, a radio operator, and a navigator. The airplane measured 174 feet in length, and had a wingspan of 141 feet.

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Fuel cells were located in both wings, extending to the tips. In addition, a fuel cell was located in the vertical stabilizer. The vertical stabilizer fuel cell was empty at the time of the collision. The auxiliary power unit (APU) gas turbine was located in the fuselage, underneath the vertical stabilizer. The APU was operating, and was turned off by the crew immediately after the collision.

METEOROLOGICAL INFORMATION

Weather Observations

The Anchorage International Airport special weather observation taken at 0118 was, in part: winds from 070 at 4 knots; visibility 1 1/2 miles with light snow and fog; broken clouds at 400 feet and 1,100 feet, overcast clouds at 3,300 feet. The special weather observation taken at 0139, immediately after the accident, was, in part: winds from 060 at 3 knots; visibility 2 miles in light snow and fog; broken clouds at 400 feet and 2,500 feet, overcast clouds at 3,300 feet.

Pavement Surface Condition sensor records, taken and maintained by the Anchorage International Airport Operations Department, indicate that surface contamination began to occur between 1355 and 1535 on November 10. At 2320, the Anchorage International Airport Operations log recorded a forecast of "no more than 2 inches expected."

Notices to Airmen (NOTAMS)

Local (L) NOTAM number 98-248, issued by the Anchorage Airport at 1550 on November 10, stated: "all rwys altnly closed snow removal."

Local (L) NOTAM number 98-249, issued by the Anchorage Airport at 1745 on November 10, stated: "caution icy conditions all ramps." NOTAM 98-249 was sent electronically to all tenant air carriers at the Anchorage International Airport, the Anchorage Air Traffic Control Tower, and the Kenai Flight Service Station. This was issued one hour four minutes prior to takeoff, but after the flight crew had received their weather in New York. The airplane was not equipped with an in-flight data link system for receiving updated information from the company while in flight. The Asiana company representative in Anchorage told the NTSB IIC that no additional NOTAM information was passed to Flight 221 via company radio once the airplane was within radio communication range of Anchorage. Anchorage tower Automated Transcribed Information System (ATIS) "Tango" did not include any ramp condition information.

Local (L) NOTAM number 981111034001 issued at 1840 Alaska standard time on November 10, stated: "TWYS PTCHY LSR SANDED." This was issued after Asiana Flight 221 departed from New York.

The Tapley "decel meter" reading, an indicator of friction, taken on the north ramp immediately after the accident was 0.25 (no units). The Ground Vehicle Friction Correlation Chart (appended) equates a "decel meter" reading between 0.17 and 0.36 to an aircraft "Braking Action Level" of "poor."

FAA Advisory Circular (AC) 150/5200-30A, Airport Winter Safety and Operations, states, in part:

"Snow, ice, and slush on aircraft movement surfaces can degrade the coefficient of friction and reduce aircraft braking and directional control. ... c. Parking Ramp Operations. Snow, ice, and slush accumulations on ramps and parking or holding areas create safety hazards. Three effects of such accumulations are: (1) Slick Surfaces. Equipment and personnel operating on a slick or icy pavement surface may not have sufficient traction to start, stop, or even remain in place... . Maintaining directional control under these conditions is also a very real problem."

FAA AC 150/5200-30A further states: "...the most critical areas should be attended to

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first...Airport operators should identify and prioritize all areas...based on safety requirements, flight schedules, emergency roads or firefighters access routes, and NAVAIDS for the active instrument runways. Priority 2 areas generally include secondary runways and taxiways...and ramp areas not otherwise classified...Operation of snow removal equipment and support vehicles must be conducted to prevent interference and conflict with aircraft operations."

COMMUNICATIONS

At 1849 Alaska standard time, Asiana Flight 221 was cleared for takeoff from John F. Kennedy International Airport, New York, New York. At 0112, Asiana Flight 221 transmitted "Anchorage approach, Asiana 221 passing one-two thousand for eleven thousand, we have (ATIS) Tango." At 0126 Asiana Flight 221 landed at Anchorage International Airport. At 0129 Asiana Flight 221 reported to the Anchorage Tower that the braking action was normal at the touchdown zone and poor at the middle. At 0133, controllers in the Anchorage Tower observed the collision and told Asiana Flight 221 that assistance was coming.

AERODROME INFORMATION

Anchorage International Airport is comprised of three runways; runway 06L is 10,601 feet long, runway 06R is 10,897 feet long, and runway 32 is 10,584 feet long. Passenger concourses A, B, and C serve domestic flights, and are surrounded by the "south ramp."

The International Terminal (also referred to as the "North Terminal") is situated on the north ramp. It is a straight line shape, with the axis oriented 046/226 degrees magnetic. The terminal has eight gates, four on the north side, and four on the south side. The south side gates are numbered, from west to east; N-8, N-6, N-4, and N-2.

Access to the north ramp is from the west, from taxiway "E." The lead-in taxi lines to this ramp are oriented 046/226 degrees magnetic. The parking lines at the gates are oriented 90 degrees to the left of the lead-in taxi lines, on a heading of 316 degrees magnetic.

The ramp area is generally level, with a very slight downhill grade away from the terminal building toward low point drains in the ramp. As the Boeing 747 approached gate N-6, on its inbound heading of 035 degrees magnetic, the grade between N-6 and N-4 was slightly uphill.

Snow removal operations at the airport are generally the responsibility of the State of Alaska, Department of Transportation, Anchorage International Airport, Airport Maintenance Department. In addition to the Airport Maintenance Department, air carrier contractors also are responsible for clearing the ramp areas in the immediate vicinity of their gates. Snow removal operations at the time of the accident were being conducted as outlined in the "Snow Removal Plan" dated September 24, 1997. This plan was redated "98/99 Winter Season", and incorporated no changes from the previous year.

The "Snow Removal Plan" defines priorities for snow and ice removal. Priorities are divided into categories I, Ia, II, III, and IV. Priority I is for instrument runways, taxiways with direct access to instrument runways, and emergency response avenues.

Ramp cleaning of the nose and taxi lines to the international terminal, and the domestic terminal, are considered Priority Ia. Cleaning of access ways for small aircraft taxiing to Charlie and Alpha concourse gates are also priority Ia. Runway 14/32 is listed as priority II, unless winds/visibility dictate, or the ILS 06R is out of service. Runway 06L/24R is Priority III.

The Snow Removal Plan, Section II. D. states: "Snow removal operations will begin immediately at the onset of a snowfall and will continue until snow is completely removed from all areas of responsibility. Snow removal will begin on those areas listed as PRIORITY I and Ia, and will

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continue until snowfall has ended and those areas are free of snow. Snow removal operations may also be conducted simultaneously in Priority II, III, and IV areas dependent upon prevailing conditions, manpower and equipment availability. In any event, Priority I areas will be maintained in a safe and snow free condition prior to commitment of resources to lower priority areas."

The plan states that snow removal on the ramps will be performed with "T-Dozers" to clean the nose and taxi lines to the parking gates, and then sand will be applied "to improve braking and turning capabilities of aircraft."

The NTSB Airports Group Chairman investigator (report attached) asked the Anchorage Airport Operations Manager if snow removal actions taken prior to the accident reflected any change in priorities, and what significance, if any, existed because snow was being removed from runway 14/32, prior to any apparent retreatment of the North Terminal ramp taxi lines. The Operations Manager's written reply said, in part: "The Snow Plan specifically states that supervisors may divert snow removal personnel and equipment from one assignment to another in order to effectively combat inclement weather conditions. ...The priority system is in effect a guidance standard of functional priorities and when necessary a "step down" process to close runways and other areas to keep the higher priority runways essential areas open-it is not a checklist nor a mandated sequential or legalistic process. ...the swing shift foreman indicated on his daily report that snow removal was started on swing shift (1530-2330). ... Reports and statements support that a heavy equipment operator was called in on overtime four hours early to assist with this snow removal activity... In summary, snow removal was occurring in the order as laid out within the Airport Snow Plan."

The Snow Removal Plan, Section II.H. states: "With the exception of emergencies, prior to the closure of Runway 6R, Runway 14/32 must be cleaned, sanded, and made ready for the landing of aircraft.

The continuous snow removal operations which were in progress during the swing and mid shifts prior to the accident were concentrated on runway 06L, runway 06R, runway 32, and the ramp and taxiways to the main terminal.

There were no field maintenance reports indicating that the north ramp had been plowed since the airport maintenance swing shift had started work at 1600 on November 10. The equipment used on these ramps was listed on the field maintenance reports as "none." Vehicle records, and a statement provided by one truck operator, indicated that at 2000 on November 10 (5 hours 33 minutes prior to the accident), the operator was instructed to sand the north ramp. His statement indicated he sanded all lead-in taxi lines to the North (International) Terminal.

At 2115, the same operator who was directed at 2000 to sand the north ramp was instructed to "fill the truck with urea and follow the plows." The accident airplane was the first airplane of the evening to utilize the north ramp or terminal. At 0230, the NTSB IIC did not observe any indication that the ramp had been plowed.

According to the Airport Operations Manager, at 2330, one vehicle operator working overtime was assigned to plow the ramp areas. He inspected the North and South Terminals, and determined that the South Terminal and commuter areas needed to be plowed first. He concentrated on the South Terminal area from 2330 until 0330.

The vehicle log for 2330 on November 10 to 0800 on November 11 indicated truck number two placed urea on the north ramp. It does not specify when during this time period the application occurred.

Interviews by the NTSB IIC with deicing personnel revealed that no airplanes were deiced on the ramp area in front of gates N-4, N-6, or N-8 during the 12 hours prior to the accident. The NTSB IIC walked along the lead-in taxi line from taxiway "E" in the tire tracks of the Boeing 747,

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periodically kicking the snow aside to reach dry pavement. He observed no indication of ice or frozen deicing fluid under the dry snow.

During the time period 2300 to 2400 on November 10, there were 14 aircraft operations (defined as a takeoff or landing) handled by the Anchorage International Airport control tower. During the period 0000 to 0100 on November 11, there were 14 operations. The average number of operations for these time periods for the previous one year were 15.6 and 15.1, respectively.

FLIGHT RECORDERS

Three recorders were recovered from the Boeing 747-400. The Digital Flight Data Recorder (DFDR), the Cockpit Voice Recorder (CVR), and a Data Access Recorder (DAR) which is used by maintenance personnel. The universal time channels of these three were not exactly synchronized. The collision itself could be determined by noise on the CVR (at 0132:53), and lateral accelerations on the DFDR (at 0132:23) and DAR (at 0132:31).

Cockpit Voice Recorder

A Cockpit Voice Recorder Group was convened at the NTSB laboratory in Washington, DC. This group was comprised of a chairman from the NTSB Office of Research and Engineering, a Korean speaking radar specialist from NTSB headquarters, and a 747-400 rated captain from Asiana Airlines. During transcription of the CVR a third crewman's voice was occasionally heard. This voice was that of one of the off duty crewmen. The CVR revealed that the cockpit crew listened to Anchorage International Airport ATIS information "Tango" and completed the approach checklist during the descent for landing.

After the Boeing 747 landed, the tower controller asked Asiana Flight 221 for a braking action report. The copilot transmitted to the tower that "the touchdown zone area is ah normal braking action ah mid is a poor." The captain then stated to the copilot "the braking action at touchdown was okay. ... but when we turn off from the runway. ... because it snows a lot. Wow."

The following chronology appears on the CVR:

0131:37 the first officer tells the captain "right side clear" as they prepare to turn off of taxiway "E." 0131:51 the captain says "we are skidding." Then three seconds later he says "turning right." 0132:25 the captain states "we have to make a guess, what can we do. Got to keep going." 0132:28 the first officer says "oh, what's going on, the aircraft is not turning." 0132:30 the captain replies "what, not turning?" 0132:32 the first officer says "yes, aircraft is not turning, the aircraft is skidding." 0132:33 the captain says "is that right?" 0132:35 there is a momentary increase in engine noise. 0132:39 the sound of the takeoff warning horn is heard (This horn activates when the N1 value from engines number 2 or 3 reaches 71.0%, and the flaps are not configured for takeoff). 0132:40 the first officer says "yes, uh oh it's not control," followed by "brake off, brake off." 0132:45 the captain says "this way, turn this way," followed by the first officer saying "yes, I'm pushing it fully. We are going to collide." An off duty crewmember then is heard to say "looks like we are going to collide." 0132:50 the first officer asks "is it going to be okay?" The captain replies "it will be okay, let's keep turning." The first officer again asks "is it going to be okay?" The captain replies "yes" followed three seconds later by the sound of collision. The first officer then says "what is it? It seems we are locked? Stop, stop, stop." 0133:08 the captain says "we are collided."

0134:55, 1 minute and 55 seconds after the collision, a ground crewman on the ground interphone states "cockpit ground...shut the engines first," to which the captain replies "yes." 0135:02 the ground crewman again says "shut the engines first."

0135:40 the ground crewman asks "what happened?" to which the captain responds "we were skidded."

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While we were taxiing to spot six we just kept skidding. Then we started turning to the right to avoid collision but left wing collided with Russian aircraft." The ground crewman asked "why did you use so much power to ramp in?" The captain replied "no, the power was at idle." The ground crewman then stated "no, the power was not idle. It looks like you turned the aircraft with increased power."

Digital Flight Data Recorder (DFDR)

A Digital Flight Data Recorder Group (report attached) was convened at the NTSB laboratory in Washington, DC. This Group consisted of a chairman from the NTSB Office of Research and Engineering.

A review of the DFDR data showed:

0131:52 (31 seconds prior to the collision), while on a magnetic heading about 030 degrees, all four engines N1 values begin to increase from 13%, to a peak of 38% at 0132:02 (21 seconds prior to the collision). The N1 values then reduce to 25% until four seconds after the collision, when they begin to reduce to 13%. 0132:00 (23 seconds prior to the collision) the rudder pedals deflect about 11 degrees to the right, and both the top and bottom rudders are deflected 15 degrees to the right, where they stay until the collision. 0132:04 (19 seconds prior to the collision) the master warning illuminates (and is accompanied by the takeoff configuration warning horn). 0132:10 (13 seconds prior to the collision) the magnetic heading begins to turn to the right, and stops about 125 degrees. 0132:23 a lateral acceleration (impact) is noted, concurrent with a thrust reverser deployed indication on the number 1 engine. 0132:26 a second acceleration is noted concurrent with the magnetic heading ceasing change to the right. Thirteen seconds after the collision the engine N1 values reduce to their minimum values of 13%.

A Data Access Recorder (DAR) located on board the Boeing 747 recorded the following parameters:

01:31:16, the magnetic heading of the airplane begins to turn from north to 045 degrees, the groundspeed varies between 9.8 and 13.0 knots, the N1 values of all four engines read between 24.6% and 25.1%, and the Thrust Lever Angles (TLA) read between 17.2 and 17.4 degrees (idle position). The groundspeed recorded after the right turn to about 040 degrees, and prior to the next right turn immediately before the collision, varies between 8.8 knots and 13.3 knots.

01:31:56, the TLAs increase. Groundspeed begins to increase. 01:32:00, the TLAs peak at 30 degrees, then return to 17.0 degrees. 01:32:03, the N1 values peak between 74.0% and 78.6%. 01:32:08, the TLAs for engines number 1, 2, and 3 again increase to between 23.7 degrees and 24.7 degrees. The N1 values for engines numbers 1, 2, and 3 remain at 57%, 55%, and 52% respectively. 01:32:20, the groundspeed peaks at 16.0 knots. Magnetic heading passes through 064 degrees, while turning right. 01:32:29 all engine TLAs return to 17 degrees and the N1 values on engines numbers 2, 3, and 4 show a decrease. 01:32:31, the N1 values for engine number 1 cease.

WRECKAGE AND IMPACT INFORMATION

The NTSB IIC arrived on scene about 0230. At that time the passengers had deplaned from the Boeing 747, and the crew was still on board. No lights were visible inside either airplane, and no electrical power appeared on. The left wing of the Ilyushin was draining fuel from the damaged left wingtip.

Tracks of the Boeing 747 main landing gear wheels were visible in the unplowed snow immediately after the accident. Snow depth was a uniform two inches across the north ramp. The tracks from the nose wheels were not discernable from those of the main wheels. The tracks were initially oriented on a magnetic heading of 030 degrees, from the point where the Boeing 747 entered the north ramp from taxiway "E." The tire tracks made a right turning arc commencing abeam gate N-4, and terminated at the Boeing 747.

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Narrative (Continued)

The most northern tracks (those corresponding to the left main landing gear trucks), measured 310 feet from a point immediately abeam gate N-6. The centerline of the tracks abeam gate N-6 were on the centerline of the lead-in taxi line to the north terminal. The same tracks measured 156 feet from a point abeam gate N-4. The centerline of the tracks were about 150 feet north of the centerline of the lead-in line abeam gate N-4 (see attached diagrams).

The number one engine of the Boeing had a hole torn in the left (outboard) side extending from two inches aft of the intake duct to the aft end of the core exhaust. The outboard leading edge of the number one engine intake duct had paint transfer and scratches which were the same height above the ground as the left wingtip of the Ilyushin.

The left wingtip and winglet of the Boeing 747 was imbedded in the vertical stabilizer of the Ilyushin, about half the distance to the rudder. The leading edge fairing of the vertical stabilizer from the Ilyushin was located at the base of the terminal building, in front of the Ilyushin, and in a line directly aft of the Boeing 747 number 1 engine.

The outboard tip of the Ilyushin's left aileron was located at the base of the jetway to gate N-4. Various small pieces of sheet metal debris were located between gates N-2 and N-4.

Skid marks in the snow surrounding the tires of the Ilyushin extended three feet to the left side of each set of tires.

TESTS AND RESEARCH

A functional ground test of the nosewheel steering, anti-skid, body-gear steering, and braking systems on the Boeing 747-400 was performed on November 18, 1998 by NTSB, FAA, and Asiana employees. These systems operated in accordance with the B-747-400 Aircraft Maintenance Manual (AMM) 32-41-00, AMM 32-42-00, and AMM-32-51-00.

According to the aircraft load sheet provided by Asiana, the landing weight of the Boeing 747 was 512,621 pounds, at a center of gravity of 22.04% mean aerodynamic chord. The Boeing Commercial Aircraft Group flight safety representative told the IIC that this loading results in a weight on the nosewheel assembly of 64,244 pounds, and a weight on the main wheels of 448,377 pounds, and that the rolling coefficient of friction (μ) of the main wheels is 0.018 (no units). The idle thrust of each engine was 2,162 pounds at the existing conditions. While sliding forward, the estimated coefficient of friction of the nosewheel across the surface was 0.009.

ADDITIONAL INFORMATION

Air traffic controllers in the Anchorage control tower observed the collision, and immediately notified Airport Rescue and Fire Fighting (ARFF) personnel. The fire station is located immediately north of the international terminal. ARFF trucks and personnel were on scene in approximately two minutes.

A maintenance contractor ground handler told the NTSB IIC that about 0135 he spoke to the pilot on the ground interphone and requested he shut down the engines. The ground handler said that about 0200, airport security police asked him why the number one engine was still running. The ground handler said the number one engine was not running, but the number one Air Driven Pump (ADP) was on, providing ground power to the Boeing 747. He then spoke with the pilot via ground interphone and asked that the number one ADP be shut down at the request of airport security.

Both crewmen told the NTSB IIC during both interviews on November 11, that they shut down all four engines immediately after the accident, but left the Auxiliary Power Unit (APU) running to keep lights on in the cabin. The APU was turned on during the taxi in from the runway. The number one

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Narrative (Continued)

Air Driven Pump (ADP) located in the number one engine nacelle was on to provide hydraulics and electrical power to the airplane.

The crew of the Ilyushin said that when they deplaned their airplane about five minutes after the collision, they did not hear the engines of the Boeing 747 operating.

A statement received from the airport police incident commander indicated that when he arrived on scene, a stair truck was requested to evacuate the passengers "in an orderly manner as the situation did not appear to warrant the use of the aircraft evacuation slides." He further stated that "the crew didn't want to deplane their passengers as there were a few spots of snow on the stairs and they were apparently concerned that one of their passengers may slip and fall. The only time I detected any sense of urgency from the Asiana crew regarding deplaning their passengers, was after I demanded that they do so immediately.... The time elapsed between when the stair truck was called for and when the last passengers were deplaned was 47 minutes as noted by dispatch."

The captain and first officer of the Boeing 747 said in a written statement that "after the engines were shut down, the captain determined that the accident was not an emergency situation where lives would be put in danger. The sole reason for not using the emergency exit was due to the captain's judgement." In the same statement, the crew said that it took 25 minutes after the collision to start removing the passengers. The ground staff was preparing a step car...."

		NTSB ID: ANC99FA012A			
		Occurrence Date: 11/11/1998			
		Occurrence Type: Accident			
Landing Facility/Approach Information					
Airport Name	Airport ID:	Airport Elevation	Runway Used	Runway Length	Runway Width
ANCHORAGE INTERNATIONAL	ANC	144 Ft. MSL	6R	10897	150
Runway Surface Type: Asphalt					
Runway Surface Condition: Snow--dry					
Type Instrument Approach: ILS-localizer Only					
VFR Approach/Landing:					
Aircraft Information					
Aircraft Manufacturer		Model/Series		Serial Number	
Boeing		747-400		25452	
Airworthiness Certificate(s): Transport					
Landing Gear Type: Retractable - Tricycle					
Homebuilt Aircraft? No	Number of Seats: 274	Certified Max Gross Wt.	870000 LBS	Number of Engines: 4	
Engine Type:	Engine Manufacturer:	Model/Series:	Rated Power:		
Turbo Fan	GE	CF6-80C2	57180 LBS		
- Aircraft Inspection Information					
Type of Last Inspection	Date of Last Inspection	Time Since Last Inspection	Airframe Total Time		
Continuous Airworthiness		Hours	Hours		
- Emergency Locator Transmitter (ELT) Information					
ELT Installed? Yes	ELT Operated? No	ELT Aided in Locating Accident Site?			
Owner/Operator Information					
Registered Aircraft Owner		Street Address			
		TOWN KANGSEO PO BOX 98 #47			
ASIANA AIRLINES		City	State	Zip Code	
		SEOUL, KOREA			
Operator of Aircraft		Street Address			
		PO BOX 190351			
ASIANA AIRLINES		City	State	Zip Code	
		ANCHORAGE	AK	99519	
Operator Does Business As: ASIANA			Operator Designator Code: AAR		
- Type of U.S. Certificate(s) Held: None					
Air Carrier Operating Certificate(s):					
Operating Certificate:			Operator Certificate:		
Regulation Flight Conducted Under: Part 129: Foreign					
Type of Flight Operation Conducted: Scheduled; International; Passenger Only					
FACTUAL REPORT - AVIATION					

 <p>National Transportation Safety Board FACTUAL REPORT AVIATION</p>	NTSB ID: ANC99FA012A
	Occurrence Date: 11/11/1998
	Occurrence Type: Accident

First Pilot Information

Name On File	City On File	State On File	Date of Birth On File	Age 56
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Sex: M	Seat Occupied: Left	Principal Profession: Civilian Pilot	Certificate Number: On File
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Certificate(s): Airline Transport

Airplane Rating(s): Multi-engine Land

Rotorcraft/Glider/LTA: None

Instrument Rating(s): Airplane

Instructor Rating(s): None

Type Rating/Endorsement for Accident/Incident Aircraft? Yes	Current Biennial Flight Review?
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Medical Cert.: Class 1	Medical Cert. Status: Valid Medical--w/ waivers/lim.	Date of Last Medical Exam: 09/1998
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- Flight Time Matrix	All A/C	This Make and Model	Airplane Single Engine	Airplane Multi-Engine	Night	Instrument		Rotorcraft	Glider	Lighter Than Air
						Actual	Simulated			
Total Time	11982	3278			3431	2299				
Pilot In Command(PIC)										
Instructor										
Last 90 Days										
Last 30 Days										
Last 24 Hours	3	3		3	3					

Seatbelt Used? Yes	Shoulder Harness Used? No	Toxicology Performed? No	Second Pilot? Yes
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Flight Plan/Itinerary

Type of Flight Plan Filed: IFR

Departure Point NEW YORK	State NY	Airport Identifier JFK	Departure Time 1828	Time Zone AST
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Destination Same as Accident/Incident Location	State	Airport Identifier ANC	
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Type of Clearance: IFR

Type of Airspace: Class D

Weather Information

Source of Briefing:
Company

Method of Briefing:

 <p>National Transportation Safety Board FACTUAL REPORT AVIATION</p>	NTSB ID: ANC99FA012A
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Weather Information

WOF ID	Observation Time	Time Zone	WOF Elevation	WOF Distance From Accident Site	Direction From Accident Site
ANC	0139	AST	144 Ft. MSL	0 NM	0 Deg. Mag.

Sky/Lowest Cloud Condition: Unknown 0 Ft. AGL Condition of Light: Night/Bright

Lowest Ceiling: Broken 400 Ft. AGL Visibility: 2 SM Altimeter: 29.00 "Hg

Temperature: 27 °C Dew Point: 25 °C Wind Direction: 60 Density Altitude: Ft.

Wind Speed: 3 Gusts: Weather Conditions at Accident Site: Instrument Conditions

Visibility (RVR): 0 Ft. Visibility (RVV) 0 SM Intensity of Precipitation: Light

Restrictions to Visibility: Blowing Snow; Fog

Type of Precipitation: Snow; Snow Shower

Accident Information

Aircraft Damage: Substantial Aircraft Fire: None Aircraft Explosion: None

Classification: Foreign Registered/U.S. Soil

- Injury Summary Matrix	Fatal	Serious	Minor	None	TOTAL
First Pilot				1	1
Second Pilot				1	1
Student Pilot					
Flight Instructor					
Check Pilot					
Flight Engineer					
Cabin Attendants				14	14
Other Crew				2	2
Passengers				220	220
- TOTAL ABOARD -				238	238
Other Ground	0	0	0		0
- GRAND TOTAL -	0	0	0	238	238

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	Occurrence Type: Accident

Administrative Information

Investigator-In-Charge (IIC)
MATTHEW L. THOMAS

Additional Persons Participating in This Accident/Incident Investigation:

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