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16. Abstract -- About 1510 A.s.t. on April 27, 1976, American Airlines, Inc., Flight 625 overran the departure end of runway 9 after landing at the Harry S Truman Airport, Charlotte Amalie, St. Thomas, Virgin Islands. The aircraft struck the instrument landing system localizer antenna, crashed through a chain link fence, and came to rest against a building located about 1,040 feet beyond the departure end of the runway. The aircraft was destroyed. Of the 88 persons aboard the aircraft, 35 passengers and 2 flight attendants were killed. Thirty-eight other persons received injuries which ranged from minor to serious. One person on the ground was injured seriously.

The National Transportation Safety Board determines that the probable cause of the accident was the captain's actions and his judgment in initiating a go-around maneuver with insufficient runway remaining after a long touchdown. The long touchdown is attributed to a deviation from precribed landing techniques and an encounter with an adverse wind condition, common at the airport.

The nonavailability of information about the aircraft's go-around performance capabilities may have been a factor in the captain's abortive attempt to go-around after a long landing.

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NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

AIRCRAFT ACCIDENT REPORT

Adopted: December 16, 1976

AMERICAN AIR LINES, INC.
BOEING 727-95, N1963
ST. THOMAS, VIRGIN ISLANDS
APRIL 27, 1976

SYNOPSIS

About 1510 A.s.t. on April 27, 1976, American Airlines, Inc., Flight 625 overran the departure end of runway 9 after landing at the Harry S Truman Airport, Charlotte Amalie, St. Thomas, Virgin Islands. The Aircraft struck the instrument landing system localizer antenna, crashed through a chain link fence, and came to rest against a building located about 1,040 feet beyond the departure end of the runway. The aircraft was destroyed. Of the 88 persons aboard the aircraft, 35 passengers and 2 flight attendants were killed. Thirty-eight other persons received injuries which ranged from minor to serious. One person on the ground was injured seriously.

The National Transportation Safety Board determines that the probable cause of the accident was the captain's actions and his judgment in initiating a go-around maneuver with insufficient runway remaining after a long touchdown. The long touchdown is attributed to a deviation from prescribed landing techniques and an encounter with an adverse wind condition, common at the airport.

The nonavailability of information about the aircraft's go-around performance capabilities may have been a factor in the captain's abortive attempt to go-around after a long landing.

1. FACTUAL INFORMATION

1.1 History of the Flight

On April 27, 1976, American Airlines, Inc., Flight 625, a Boeing 727-95, N1963, operated as a scheduled passenger flight from Providence, Rhode Island, to Harry S Truman Airport, Charlotte Amalie, St. Thomas, Virgin Islands, with an intermediate stop at John F. Kennedy International Airport, New York.

Flight 625 departed John F. Kennedy International Airport at 1200 1/ with 88 persons, including 7 crewmembers, aboard. It was cleared to the Harry S Truman Airport in accordance with an instrument flight rules (IFR) flight plan. The assigned en route flight level (FL) was 330. The flight was uneventful during takeoff, climb, cruise, and descent into the St. Thomas area. All required descent checklists were accomplished.

During the descent from FL 330 the flight engineer prepared a landing data card for the captain. This card showed an estimated landing weight of 125,000 lbs., a 30° flap reference speed (Vref) of 120 knots indicated airspeed (KIAS), a 40° flap Vref of 117 KIAS, and a missed approach engine pressure ratio (EPR) setting of 1.88, based on a temperature of 80° F.

The landing data card also included altitude computations based on an altimeter setting of 30.07 in. Hg. San Juan Center had given this altimeter setting for St. Thomas to the crew before the flight was cleared to contact the St. Thomas control tower. The actual altimeter setting for the airport was 30.00 in. Hg. The correct information was later given to the flightcrew by the control tower; however, the landing data card was not corrected.

At 1504:12 the flightcrew of Flight 625 cancelled their IFR flight plan with San Juan Center; the aircraft was about 15 to 20 nmi north of St. Thomas. Although the flight was cleared to proceed under visual flight rules (VFR), the captain elected to utilize the instrument landing system (ILS) for runway 9 to assist him in vertical guidance during the approach.

At 1505:37, the first officer contacted the St. Thomas control tower. The flight was told by the tower to "call Savanah 2/ at nine, ..., altimeter three triple zero."

1/ Unless otherwise indicated, all times herein are Atlantic standard, based on the 24-hour clock.

2/ An island about 5.5 nmi west of the approach end of runway 9 at St. Thomas which is used as a check point during a VFR approach to Harry S Truman Airport.

The ILS glide slope was intercepted about 1,500 feet m.s.l., with the flaps set at 15° and with an airspeed of about 160 KIAS. When the glide slope was intercepted, the flaps were lowered to 25°, the landing gear was extended, and the airspeed was slowed toward the desired V_{ref} speed. At 1,000 feet 3/ the flaps were extended to 30°.

During the flight from New York, the flightcrew had been told of the surface winds at St. Thomas. The winds were from 120° at 12 to 14 kn; no gusts were reported. During the final approach, St. Thomas tower gave the surface winds as 120° at 12 kn when queried by the flightcrew.

At 1509:37, the first officer advised, "A thousand feet, plus 20, sink 6." 4/ He continued his altitude calls as required--100-foot increments from 500 ft to 100 ft and 10-foot increments from 50 ft to 10 ft above the runway.

The captain said that the approach was started at V_{ref} plus 20 KIAS and that this speed was reduced until an airspeed of V_{ref} plus 10 to 15 KIAS was achieved. Both pilots stated that the aircraft was on the glide slope throughout the approach. The captain said that the aircraft was just a "shade below" the glide slope in the area of the runway threshold. The lowest airspeed the captain could remember seeing was V_{ref} plus 10 KIAS at or near the runway threshold. Neither pilot could recall seeing or noting the visual approach slope indicator (VASI) lights. The flight data recorder (FDR) showed that the altitudes and airspeeds during the approach were close to those recalled by the flightcrew.

The captain stated that, as the aircraft crossed the runway threshold at an estimated altitude of 30 to 40 ft, he retarded the throttles gradually, and then, when the landing was assured, retarded them against the idle stops. He said the aircraft was aligned with the runway, and he felt comfortable as he began the flare. Shortly thereafter turbulence was encountered.

The captain said that he did not anticipate turbulence "that far down the runway." He thought the turbulence was encountered about the 1,000-foot aiming point, and this turbulence caused the right wing to drop. He thought that the right flap or wingtip might strike the ground and he made a control correction to level the wings. After he leveled the wings the first officer told him that the aircraft was high. The captain said the turbulence seemed to buoy the aircraft; however, after the first officer's callout he "got it on the ground."

3/ Unless otherwise indicated, all altitudes are above field elevation.

4/ The statement meant an altitude of 1,000 feet, an airspeed of 20 kn above V_{ref}, and a descent rate of 600 feet/minute.

The first officer stated that after the aircraft was flared over the runway they encountered turbulence and the right wing dropped. The captain applied almost full control wheel deflection to level the wings. He noted that the aircraft was at "a zero sink," about 1,000 ft down the runway, when the turbulence was encountered. When the wings were leveled, the aircraft floated for a while and the first officer advised the captain that the aircraft was high. The first officer stated that a few seconds after his advisory, the captain "positively put the aircraft on the ground." He estimated that the aircraft landed about 2,200 to 2,300 ft down the runway. He said that he wasn't worried about the length of the landing.

The flight engineer said that the captain held an airspeed of V_{ref} plus 10 KIAS as the aircraft approached the threshold. He estimated that the aircraft was 25 ft to 50 ft above the ground when it crossed the runway threshold. He said that they went by a Boeing 727 waiting to takeoff, then ran into a patch of turbulence. They came out of the turbulence into smooth air, landed, and then the captain decided to go-around.

The captain said that, immediately before touchdown, he decided that the aircraft could not be stopped on the remaining runway; therefore, almost simultaneous with touchdown, he called for a go-around, moved the throttles forward to the "straight up" position (the 1.4 EPR position), and called for 25° of flaps.

The cockpit voice recorder (CVR) disclosed that when the captain called for the go-around, he did not order a change of flap setting. Shortly after the captain announced the go-around, the first officer asked the captain if he wanted 25° of flap. The captain responded, "Flaps fifteen." The first officer stated later that 25° was the correct flap setting for the go-around, and that rather than debate the point, he placed the flap handle in the 25° detent.

The flight engineer said that he had heard a 25° flap setting mentioned. He did not know whose voice it was, but it was said with a questioning inflection. He stated that he later saw the flap handle in the 25° detent and, to his knowledge, it was never moved from that setting.

The captain said that after he placed the throttles to the straight-up position he watched the EPR gauges. He did not see the EPR come up. He then moved the throttles as far forward as he could reach, and he thought that they had contacted the forward stops on the throttle race. He never saw the EPR pointers move beyond about the "5:00 to 5:30 position" on the EPR gauges (1.2 to 1.3 EPR). The captain said that there was no sensation either of power being applied or of aircraft acceleration. He saw they were not "going anywhere," so he closed the throttles and applied the wheel brakes. He did not recall extending the speed brakes; however, he believed that he "might have actuated the reversers in the very final stages."

The captain said the aircraft was landed in a nose-low, or possible three-point, attitude. He could not remember if he rotated the aircraft after he began the go-around.

The first officer said that after the go-around was ordered, the captain advanced the throttles to the upright position and, then, as far forward as possible. He stated that he did not hear power increase nor feel the aircraft accelerate. He saw the EPR pointers about the 1.4 position.

The first officer stated that the initial touchdown attitude of the aircraft was flat and that the nosewheel was not on the ground. He stated also, that the nosewheel never was lowered to the runway. He said the aircraft was then rotated to about 11° noseup during the attempted go-around. He said that the nose remained off the ground and was off the ground when the aircraft left the runway and the airport.

The flight engineer stated that, when the go-around was begun, the captain moved the throttles forward and he watched the EPR pointers move to the 1.4 position; however, he could not state if they were moved farther forward because he had turned his head to scan the flight engineer's instrument panel. When he returned his scan to the forward instrument panel, he noted that the engine instrument indications had not changed, and he thought that there had been an electrical failure. He, again, scanned his electrical panel and found the readings to be normal. He returned his attention to the forward instrument panel and reached forward to place his hand behind the throttles to assist the captain. Before he could reach them the captain pulled the throttles aft against the idle stops.

The flight engineer's recollection of the nose gear position and aircraft attitude during the landing roll, the attempted go-around, and the subsequent rejected go-around are similar to the first officer's.

The aircraft continued across the 500-foot overrun and struck the ILS localizer antenna and a portion of the airport's chain link perimeter fence. The right wingtip struck an embankment along the fence and the outboard portion of the wing was torn from the aircraft's structure. The aircraft crossed a road, which runs parallel to the perimeter fence, and destroyed several automobiles in its path. The aircraft came to rest in a gasoline station and against a rum warehouse. A passenger in an automobile, which was being serviced at the time the aircraft struck the service station, was injured seriously.

The three controllers on duty in the St. Thomas tower described Flight 625's final approach as "normal" until it reached the point on the runway where other Boeing 727's usually touchdown. They described the usual touchdown point as a point about 1,000 ft to 1,500 ft from the runway threshold. At that point, the aircraft appeared to float. The three controllers fixed the initial touchdown point either at or just before taxiway "C". Taxiway "C" is 3,000 ft from the threshold of runway 9.

Other witnesses, including an airport fireman on duty in the firehouse watch tower and two air taxi pilots, also described the approach as normal until the aircraft began to float. All of these witnesses fixed the initial touchdown point between 2,500 and 2,900 feet from the threshold of the runway.

Several witnesses stated that shortly after the aircraft touched down they heard several "bangs," which some associated with engine compressor stalls. However, during the questioning of the flightcrew members and the surviving flight attendants at the public hearing, these crewmembers stated that they did not at anytime hear unusual engine noises or "bangs" that could be associated with compressor stalls. The flightcrew also testified that there were no indications of engine compressor stalls on the engine instuments.

The accident occurred during daylight hours, about 1510, at latitude 18° 20' 28" N. and longitude 64° 57' 39" W. The elevation of the main wreckage area was 26 feet m.s.l.

1.2 Injuries to Persons

Injuries	Crew	Passengers	Others
Fatal	2	35	0
Serious	2	17	1
Minor/None	3	29	0

1.3 Damage to Aircraft

The aircraft was destroyed.

1.4 Other Damage

The ILS localizer antenna, a portion of the airport's chain link perimeter fence, eight automobiles, and several utility poles were destroyed.

The gasoline station's fuel-pump island and an automobile were destroyed. The rum warehouse and the gasoline station were extensively damaged by impact and fire.

1.5 Personnel Information

The seven crewmembers were properly certificated for the flight. (See Appendix B.)

1.6 Aircraft Information

The aircraft was cerificated, equipped, and maintained in accordance with Federal Aviation Administration (FAA) requirements. The gross weight and c.g. were within prescribed limits for both takeoff and landing. At the time of the accident, about 14,000 lbs of Jet A-1 fuel were onboard. (See Appendix C.)

1.7 Meteorological Information

N Surface weather observations at the Harry S Truman Airport are made by FAA tower personnel who are certificated by the National Weather Service (NWS).

At the time of the accident, the most current official weather observation, taken at 1445, was as follows: Scattered clouds at 2,500 ft, and at 12,000 ft, visibility--25 mi, temperature--84° F, dewpoint--73° F, wind--120° at 10 kn, altimeter setting--30.00 in Hg.

The wind measuring equipment which provides the control tower with surface wind information is located on the north side of runway 9, about 300 ft from its centerline and 1,900 ft from its threshold.

Terminal forecasts for Harry S Truman Airport are prepared by the NWS Forecast Office in San Juan, Puerto Rico. The terminal forecast valid when the flight departed New York was, in part, as follows:

<u>0900 April 27 to 0800 April 28</u> -- Wind--080° at 10 kn, Visibility--10 km or greater, 3/8 cumulus at 2,000 ft, 3/8 altocumulus at 8,000 ft, 3/8 cirrus at 30,000 ft, temporarily from 1100 to 1900, wind--080° at 10 to 20 kn visibility--same, 5/8 cumulus 1,800 ft....

While the flight was en route to St. Thomas, the next routine terminal forecast was issued and was, in part, as follows:

<u>1400 April 27 to 1400 April 28</u> -- Wind--100° at 10 kn, visibility--10 km or greater, 3/8 cumulus at 2,000 ft, 3/8 cirrus at 30,000 ft, temporarily from 1400 to 1900, wind--100° at 10 to 20 kn, visibility--same, 5/8 cumulus 1,800 ft....

1.8 N Aids to Navigation

Harry S Truman Airport's runway 9 is equipped with an ILS with an inbound course of 097°. Punta Intersection, the 8.5-nmi DME point on the approach, is the initial approach fix (IAF). The DME is collocated and frequency paired with the ILS. The crossing altitude at the IAF is 1,989 feet (2,000 feet m.s.l.). Bingo Intersection, the intersection of the localizer course and the 239° radial of the St. Thomas VOR (the 5.2-nmi DME point on the approach), is the final approach fix (FAF). The glide slope is intercepted just before crossing the FAF. The FAF crossing altitude is 1,447 feet (1,458 feet m.s.l.). Decision height for the approach is 389 feet (400 feet m.s.l.). The airport is also served by a VOR approach to runway 9.

There were no reported discrepancies to the navigational aids at the time of the accident, and no discrepancies were noted during a flight check of the facilities after the accident.

1.9 Communications

No air-to-ground communications difficulties were reported.

1.10 Aerodrome Information

Nl

Runway 9 at Harry S Truman Airport, a grooved asphalt-surfaced runway, is 4,658 feet long and 200 feet wide. There is a load bearing, grooved concrete and asphalt overrun, which is 500 ft long, on the east end of the runway which extends the usable runway length for landing to 5,158 feet. The field elevation is 11 feet m.s.l.

Although runway 9 does not have an approach lighting system, it is equipped with runway end identifier lights and a VASI which were illuminated at the time of the accident. The medium intensity runway edge lights were not illuminated at that time.

There are distance-to-go markers on the left side of runway 9, spaced at 1,000-foot intervals. Two white turbojet aiming marks, 150 feet long and 30 feet wide, are located 1,000 feet from the approach end of the runway -- one on each side of the runway centerline.

1.11 Flight Recorders

N1963 was equipped with a Sunstrand Model FA-542 flight data recorder (FDR), serial No. 1655, and a Fairchild Model A-100 cockpit voice recorder (CVR). The two recorders were located in the aft section of the fuselage. Both recorders sustained severe fire damage: however, the recording media were in good condition. All FDR traces and CVR channels were recorded clearly.

1.11.1 Flight Data Recorder

The final 10 minutes of the four analog parameters and the radio transmission binary were examined and the data plotted. The data showed that, after the flight had descended through 1,000 feet, a nearly constant descent rate of 650 f.p.m. was maintained at an indicated airspeed of 130 kn. All parameters were stable until about 35 seconds before the end of the recording. At that time, the recorder data traces indicated that the aircraft began to experience positive and negative vertical loads and corresponding airspeed oscillations as it descended below 135 feet. The airspeed increased to about 134 kn and then decreased to 127 kn between 30 seconds and 25 seconds to the recording's end. The altitude trace stabilized about 0 feet m.s.l., 24 seonds before the end of recording. There were two significant steps in the vertical acceleration trace -- one, of about 1.35g, 16 seconds before the end of the recording, and the other, of about 1.5g, 3 seconds before the end of the recorded data. The airspeed trace was disturbed somewhat between 24 and 21 seconds before the end of the trace. After that time, the airspeed decreased continually until it reached about 102 kn, 8 seconds before the end of the trace. A slight increase was then evident after which a sudden deceleration was recorded. The final airspeed recorded was 81 kn. (See Appendix D.)

1.11.2 Cockpit Voice Recorder

The quality of the CVR recording was excellent, and, in addition to the voices of the crew, it contains various sounds associated with cockpit activity and aircraft systems. The final 13 minutes of the tape was transcribed.

The cockpit conversation indicated that as the flight was descending from 8,000 feet m.s.l. to 2,700 feet m.s.l., the flight engineer was attempting to increase cabin pressure at a rate which would be comfortable to the passengers. During the descent, the aircraft reached an altitude at which ambient pressure became equal to cabin pressure. The flightcrew cancelled the IFR flight plan and slowed the descent to provide cabin comfort. The crew conducted the prelanding checklist; the captain called for 30° of flaps as the aircraft descended through 1,000 ft. The first officer began to call out altitudes at 100-foot intervals as the aircraft descended through 500 feet. Just before the 100 feet callout, the captain stated, "Right about here's where we hit that (stiff)." The first officer called out 100 feet, then 50, 40, 30, 20, and 10. Within 1 second of the 10 feet callout, there was an unidentified exclamation which denoted an unusual occurrence. Five seconds later the first officer stated "Still high, Art." One and a half seconds later, at 1511:12.2, there was a sound on the radio channel which was interpreted as a static discharge coincident with touchdown. Within 1 second there were some clicks recorded along with the sound of trim operation. At 1511:15.5, 3.3 seconds after touchdown, the captain stated, "Let's go around." This was followed immediately by the sound of three clicks and the momentary sound of the takeoff warning horn. At 1511:17.0, the first officer said, "flaps twenty five." Within the next 2 seconds, there was the sound of three or more sharp bangs and a click. At 1511:19.2, the captain stated, "flaps fifteen" and the takeoff warning horn sounded again. At 1511:24.0, an unidentified voice shouted, "Stop." Two seconds later there was a sound of an increasing roar, associated with engine noise, and, at 1511:28.4, the sound of initial impact. continued for 1.6 seconds until the end of recording.

1.11.3 Time-Distance Correlation

The flight data recorder information and cockpit voice recorder transcripts were used with other data to derive a time-distance correlation of events which could be used to analyze the circumstances of the accident.

The FDR airspeed values were corrected for density altitude to yield corresponding true airspeed values. The density altitude was based on a sea level barometric pressure at 30.00 in. Hg. and a surface temperature of 84° F. The corresponding groundspeed values were then determined by applying the component of the wind along the aircraft's flight track. The resultant groundspeeds were integrated to obtain a plot of distance versus time.

The distance versus time plot was compared to the CVR transcript to obtain a profile showing the relative positions of the aircraft with respect to altitude and distance traveled at the time of the recorded events or conversations. Several methods of obtaining this correlation were considered. One method was a direct comparison of the radio transmission times as indicated on the FDR to the times of air-to-ground communications on the CVR. Although this method theoretically should have produced a precise correlation, the actual accuracy of the respective time bases was not known. Another method was to assume a relationship between the significant vertical loads recorded on the acceleration trace of the FDR with particular sounds on the CVR such as sound of touchdown or sound of impact. Another assumption was that both recorders ceased to operate at precisely the same time. A comparison of the results of these methods showed a maximum difference of about 3 seconds in the timing correlation.

The final step in preparing the total correlation was to determine the position of the aircraft at a given time as a function of distance from a known ground reference point such as the runway threshold. As with the CVR-FDR correlation, the relationship between the FDR derived time versus distance plot and a ground reference point will depend upon the assumption used as the basis for the correlation. One logical assumption considered was that the vertical acceleration peak 3 seconds before the FDR ceased operation was the result of the aircraft's impact with an embankment 5,369 feet beyond the threshold of runway 9.

Using various assumptions for wind ranging from 120° at 12 knots to calm, and various assumptions for the CVR correlation and the ground reference correlation will produce a wide range of results. Depending upon the assumptions used the calculated touchdown point could be shown to be anywhere between 1,600 feet and 3,100 feet beyond the threshold. The corresponding height of the aircraft over the threshold would be 38 feet and 90 feet, respectively, and the airspeed between 128 and 132 kn.

The profile shown in Appendix D was prepared using assumptions which seemed to be most logical to the investigators. These assumptions are noted thereon. This profile shows that the aircraft crossed the threshold at an airspeed of 131 knots and an altitude of about 80 feet. The touchdown was calculated to be about 2,800 feet beyond the threshold. At touchdown, about 1,850 feet of runway and 500 feet of overrun were available on which to stop the aircraft. When the captain stated "Let's go around," the aircraft was about 3,450 feet beyond the threshold, or 1,200 feet of runway and 500 feet of overrun remained.

1.12 Wreckage and Impact Information

The first tire marks that could be identified as those from the accident aircraft were located 3,950 feet beyond the threshold of runway 9. These marks were made by the left and right main gear tires. These tire marks continued from the 3,950-foot point to the end of the runway, through a grass area, through the localizer antenna site, and ended at the top of an embankment which lead up to a road outside the airport's perimeter fence. (See Appendix E.)

The wreckage area began near the localizer antenna, about 150 feet east of the end of the paved overrun of runway 9. Almost simultaneously, the right wingtip hit the hillside just south of the localizer antenna and the main landing gear hit the localizer antenna, itself. The left wingtip and left, outboard trailing edge flaps hit the ground about 70 feet beyond the initial right wing contact. At this point, sections of the trailing edge aft flaps and flap fairings separated from the aircraft.

The path of the main landing gear could be followed up the embankment about 40 feet beyond the antenna. At the top of the embankment, three distinct tracks could be seen--two were made by the main landing gear and the third was of undetermined origin. Pieces from the wings' leading edge and trailing edge, as well as fuselage and underwing panels separated when the aircraft struck the embankment.

After it hit the embankment, the aircraft again became airborne. The second ground contact was on the opposite side of the perimeter road. On impact, the left and right underwing fairings, ram air inlets, ground air blowers, the main landing gear's wheel well fairing structure, and leading and trailing edge wing structures separated from the aircraft.

Destruction of the fuselage underwing keel beam and the main landing gear wheel well keel beam began when major parts of both keel beams separated from the aircraft and came to rest approximately 83 feet east of the perimeter road in the direction of the crash path.

The wreckage was scattered on the runway heading for about 375 feet, from the right wing contact point south of the localizer antenna to the rum warehouse. This point of contact was approximately 8 ft above the runway elevation of 11 ft. The main wreckage area was 16 ft above the runway elevation. (See Appendix F.)

There was no evidence of a failure of the aircraft's systems, structure, or powerplants before the aircraft landed or before it left runway overrun. The engine thrust reversers on the three engines were deployed partially.

The integrity of the flight and engine control systems could not be determined because of impact and fire damage. The wing leading edge devices were extended. Jackscrew measurements indicated that the trailing edge flaps were extended about 21°. The spoilers were stowed.

Although the cockpit area was damaged severely by postcrash fire, most switch and instrument positions were determined to be normal for the landing phase of flight. The three landing gears were down and locked.

1.13 Medical and Patholopical Information

Post-mortem examination of the 35 passengers and 2 crewmembers, revealed that they died of a combination of impact trauma, smoke inhalation, and third-degree burns.

All but three of the surviving occupants of the aircraft received various bodily injuries. Their injuries included abrasions, contusions, lacerations, fractures, and burns.

A review of the cockpit crew's medical records disclosed no evidence of pre-existing physical problems which could have affected their judgment or performance.

1.14 Fire

Fire erupted immediately after the right wing struck the embankment. The fire emanated from a rupture in the right wing near the fuselage and was fed by aircraft fuel. It spread rapidly through the center section and right wing areas of the aircraft, isolating the separated tail section from the remainder of the cabin area. The cabin area, the inboard sections of both wings, and the interior of the cockpit were eventually destroyed by fire.

The Virgin Islands Port Authority airport fire department responded to the accident before the aircraft had stopped. The fire vehicles proceeded down the runway onto the overrun. However, the driver of the lead fire vehicle determined visually that the trucks could not follow the path of the aircraft through the fence because of aircraft debris, "live" power lines, and dense smoke from the burning aircraft. The lead vehicle, with two others following, proceeded south along the perimeter fence and bypassed a closed knockdown gate that was blocked by parked automobiles. The three vehicles continued southwest and through an open gate. The vehicles then proceeded to the crash site, on the perimeter road. The first vehicle arrived on the scene about 2 minutes after the accident. The driver of the lead vehicle stated that the approach from the perimeter road placed him on the downwind side of the aircraft and that the dense smoke from the fire limited his visibility and firefighting capability. He also stated that aircraft debris, downed trees, and "live" powerlines prevented the truck from penetrating the accident area. No effort was made to move the vehicle through the impediments and approach the immediate vicinity of the aircraft wreckage. As a result, the lead vehicle was used to fight the fire from a distance of about 160 feet. In addition, only one proximity suit and no air packs were on the vehicle. Without an airpack, the fire could not have been fought in close proximity to the wreckage.

The second and third vehicle, because of the problems encountered by the lead vehicle, proceeded to the east side of the accident site. To do so, these vehicles had to proceed around a large hill directly south of the accident site--a distance of 1.9 miles. The first of the airport vehicles arrived in the new position about 11 minutes after the accident. A city firetruck was on the scene and fighting the fire when the airport trucks arrived. After the lead vehicle extinguished the fires in the tail section of the aircraft, which was the only section of the fuselage that could be reached from the west side of the accident site, it joined the other vehicles on the east side.

1.15 Survival Aspects

The accident was partially survivable. The structural integrity of the cabin area was compromised when it broke into three parts during the impact. Black, acrid smoke and intense fire penetrated the forward and center sections of the broken fuselage as the aircraft slid to a stop. The passengers and flight attendants who survived the accident escaped through breaks in the fuselage or through the overwing emergency exits on the left side of the fuselage within an estimated 1 to 1-1/2 minutes after the aircraft came to a stop. The three flight crewmembers escaped through the first officer's sliding window.

Several passenger seats broke loose from their mounts. Some were found outside of the immediate fuselage area. Because of the extensive fire damage, the security of all seats and seatbelts could not be determined.

The three flight crewmembers had their seatbelts and shoulder harnesses fastened. All of the fastened restraining devices functioned properly.

The two surviving flight attendants reported that their seats remained intact and their seatbelts and shoulder harnesses functioned properly.

1.16 Tests and Research

1.16.1 Engine Response and Flap Retraction Tests

A flight test program was developed to investigate engine response and acceleration times under conditions simulating those which existed at the time of the accident.

On May 4, 1976, an American Airlines Boeing 727, N1957, was used in a test at St. Croix, Virgin Islands. Several approaches and landings were made under conditions similar to those existing at the time of the accident. Engine acceleration times, flap retraction times, and thrust reverser actions were recorded.

During two go-arounds initiated after touchdown, engine acceleration from idle to 1.4 EPR was recorded as 6.6 seconds for engine No. 1 and No. 3 in both instances, and 4.6 and 4.3 seconds, respectively, for engine NO. 2. 5/

On two other go-arounds, when thrust was advanced to takeoff power with no delay at the thrust lever vertical position, the acceleration times from idle to 1.9 EPR were 7.9 seconds on engine No. 1 and No. 3 and 6.2 seconds on engine No. 2. .

Flap retraction time from 30° to 25° was found to be 3.7 seconds.

1.16.2 Analysis of B-727 Performance

The Boeing Company analyzed the theoretical performance of a B-727-95 for the conditions that existed at the time of the accident. The objective of the analysis was threefold. First, the analysis compared the performance of the aircraft in terms of longitudinal acceleration and vertical velocity for the 30° flap gear-down configuration and idle thrust with the rates of change of airspeed and altitude evident on the FDR measurements. The second objective of the analysis was to determine the ground distance required to stop the aircraft after touchdown using all available means of braking. The third objective was to determine the distance required to reconfigure the aircraft after touchdown, regain thrust and lift off for a go-around from the runway.

5/ During all these tests, engine bleed air was supplied by engines No. 1 and 3. The No. 2 engine bleed switches were "off." This is the normal configuration for landing in the Boeing 727-100 series aircraft with JT8D-1 engines.

(a) Comparison of airplane performance with FDR measurement.

The FDR measurements can be compared with the theoretical performance of the aircraft; however, the accuracy of such comparison is affected by external forces acting on the aircraft such as windshear or gusts. This is true because the FDR records speed that is relative to the air, while the analytical performance is described in terms of inertial acceleration. Direct comparisons are, therefore, only valid during constant wind conditions.

The FDR measurements from 31 seconds to 24 seconds before the end of recording showed that the indicated airspeed increased slightly and then decreased. During this 7 second period, the airspeed decreased from 128 kn to 122 kn--approximately 0.9 kn per second--and the aircraft descended from an indicated altitude of 100 feet to 0 altitude. The 0 altitude is probably consistent, within the accuracy and resolution of the measurement, with the level off altitude for the runway elevation. The aircraft performance was described as -0.9 kn/sec acceleration and 860 feet per minute descent. The Boeing Company's analysis shows that the aircraft, with 30° flaps, gear down, and idle thrust, can maintain an 860 ft/min descent rate while decelerating 1.4 kn/sec in free air, that is, before entering the influence of ground effect. As the aircraft nears the ground, the lift produced by the wing at a given angle of attack increases, or conversely, the same lift can be produced at a lower angle of attack with consequent reduction in aerodynamic drag. This causes an apparent increase in performance--for the same descent rate, the negative rate of airspeed change will decrease.

The FDR measurement from 24 sec to 21 sec before the end of the recording showed an airspeed disturbance with an overall increase from 122 kn to 127 kn. From 21 sec to 16 sec before the end of the recording, the airspeed decreased from 127 kn to approximately 122 kn The deceleration rate of 1 kn/sec is consistent with the calculated performance of the aircraft in the air, but close to the ground, with idle thrust.

The FDR shows that the airspeed decreased from 122 kn to 117 kn during the period from 16 sec to 12 sec before the end of the recording. This deceleration rate of 1.1 kn/sec is consistent with rollout drag with no braking force applied.

From 12 sec to 8 sec before the end of the recording, the FDR shows that the aircraft decelerated from 117 kn to 103 kn. Some braking force would have been required to achieve this 3.5 kn/sec deceleration rate. However, the FDR subsequently showed that the aircraft accelerated from 103 kn to 113 kn in the next second. This acceleration exceeds the aircraft's performance capability with maximum thrust. If FDR airspeed trace is correct, the decrease and increase in airspeed was the effect of a sudden wind change.

The Boeing analysis showed that the aircraft should accelerate from 100 kn at 1.4 kn/sec with 30° flaps, no braking force, and the thrust produced at an EPR of 1.4. The aircraft should accelerate at 4 kn/sec with 25° flaps and takeoff thrust. Therefore, the total change in airspeed from 12 sec to 6 sec--from 117 kn to 113 kn--is consistent with an unbraked roll with added thrust.

(b) Computed stopping distance.--The stopping distance required from touchdown is given in the following table. The distances are based on a dry runway, an aircraft weight of 125,000 pounds, an 84°F temperature, and no wind. Full braking and spoiler deployment is assumed 2 seconds after touchdown. Reverse thrust is assumed to be initiated 3 seconds after touchdown.

TABLE 1.--Stopping Distance Required from Touchdown

Flap	Vref	V_{app}	V_{td}	Ground Distance
30"	120 KIAS	122.7 KTAS (120 KIAS)	120.7 KTAS	1,532 ft
		133.0 KTAS (130 KIAS)	130.8 KTAS	1,730 ft
40°	116 KIAS	118.4 KTAS (116 KIAS)	114.1 KTAS	1.378 ft
		129.0 KTAS (126 KIAS)	124.4 KTAS	1.568 ft

A headwind of 5 kn will reduce the ground distance required to stop by about 100 feet.

(c) Distance required for touch-and-go.--The distance required for the B727-95 aircraft to execute a go-around after touchdown was calculated. It was assumed that the JT8D-1A engines were at minimum idle speed and that the aircraft was configured with 30° flaps when the action for go-around was taken. For the purpose of analysis, zero distance was assumed to be at the point at which the pilot set go-around thrust and selected 25° flaps. The aircraft was assumed to be rotated to the takeoff attitude at the higher speed of V_{ref} - 10 KIAS, or when full thrust was attained. The climb profile was predicated upon the selection for gear up 3 seconds after liftoff and the subsequent acceleration to a target climb speed of V_{ref} +20 KIAS.

Two assumptions were made for the time required for the engines to accelerate from idle thrust to go around thrust. The time of 6.32 sec was based on the engine acceleration times demonstrated during certification flight tests. An arbitrary time of 9 sec was considered to include the delay which might be attributed to a two step advancement of the thrust levers, i.e., a pause at 1.4 EPR.

The distance required, based upon zero wind and different initial airspeeds, is given in the following table.

TABLE 2.--Distance Required for Go-around after Touchdown

Time required for engine spinup from idle to go-around	Ground Distance from Initiation to Liftoff — Airspeed at initiation		
	100 KIAS	110 KIAS	120 KIAS 1/
(sec.)	(ft.)	(ft.)	(ft.)
6.32	2,247	1,912	1,917
9.00	2,652	2,387	2,448

1/ The longer distance shown for the 120 KIAS is the result of a delayed rotation, assuming that the pilot holds the aircraft on the runway until full thrust develops.

The distance between the point at which the aircraft lifts off and the point at which the aircraft reaches a height 35 feet above the runway is 800 feet. The distance between the point of liftoff and the point at which the airplane reaches 200 feet (with the landing gear retracted at a speed of Vref +20kn) is 2,650 feet.

1.17 Additional Information

1.17.1 American Airlines Boeing 727 Operations Manual

The following are excerpts from the NORMAL OPERATING PROCEDURES and the OPERATING TECHNIQUE section of the operating manual:

Section 3, page 57.--

ALL ENGINE GO-AROUND
IF ON RUNWAY

"POWER - Advance throttles initially to the vertical position approximately 1.4 EPR, and allow engines to stabilize.

FLAPS - order 'Flaps 25°.'

CHECK - Speed Brake Handle-----Full forward
Reverse Lights-----Out
Stabilizer Trim-----Adjust as Necessary
NOTE: If thrust reversers have been actuated, it is not recommended that a go-around be attempted.

POWER - Advance throttles to GO-AROUND EPR. Note that EPR and fuel flow are increasing symmetrically.

ROTATE- Rotate speed (approximate)-----REF-10 KTS
V_2 speed (approximate)-----REF+10 KTS

GEAR - Positive Rate of Climb-Gear Up." Maintain Minimum - Ref + 20K."

Section 3A, page 13.--

"3. FLOATING BEFORE TOUCHDOWN 'eats up' runway rapidly. If speed is excessive, it's still better to set it onto the runway as near the 1,000 foot point as possible, rather than allowing it to float to bleed off speed. Deceleration on the runway is about 3 times greater than in the air. For example, with 10 knots excess speed, floating and touching down on speed will use up about 3 to 4 times as much additional runway as would be required if the aircraft was set down on the runway at the desired point and the speed bled off on the ground. Holding the airplane off for speed below reference before touch-down similarly increases landing distance."

Section 3A, page 15.--"During approach consider the use of 40° flaps. When landing on runways that are of minimum required length, or where less than normal braking action is reported or anticipated, or when other adverse conditions dictate, 40° flaps should be used - increased flap settings will reduce stopping distance."

1.17.2 American Airlines Operations Bulletin FM2C7.

December 12, 1972

Operations Bulletin FM2 C-7 was to be placed in the Flight Manual Part 2 (the individual approach charts) in front of the chart for St. Thomas. The text of the bulletin was as follows:

"(1) An exception is made to Flight Manual Part One in that DAY VFR approaches are authorized at STT provided....THE STT WEATHER CLOUD BASE IS REPORTED AT 3,000 FEET OR MORE AND THE VISIBILITY IS 3 MILES OR MORE AND THE FLIGHT HAS RECEIVED APPROVAL TO MAKE A VFR APPROACH. When approaching STT, from DUTCH or CULEBRA, and having received authorization for a VFR approach -- the course shall be altered to pass over

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Savanah Island, thence turning left for a straight-in approach to Runway 9. This exception to Part One is not to be construed as endorsing unwise or imprudent operating practices.

(2) B-727/100 are the only aircraft authorized to serve STT.

(3) Landings will be made on Runway 9 only.

(4) All landings and take-offs at Truman Airport will be made by the Captain.

(5) Flap Usage: As a standard practice, 40 degrees flap landings will be made. However, with strong or gusty winds, it is the Captain's option to use 30 or 40 degree flaps for landing.

With a wind component of 20 knots or more, landing with 30 degree flaps is recommended.

(6) Tailwind Components for Landing: A tailwind component of four knots wet and six knots dry is authorized and requires the use of 40 degree flaps."

1.17.3 Takeoff Warning Horn

According to company practice, the takeoff warning horn switch is set at 25°(±2°) off the idle stop of the throttle race. The 25° setting is about the vertical position of the thrust levers. The takeoff warning horn on N1963 would have sounded whenever the power levers were advanced past the prescribed race position if the nosewheel strut was compressed about 1 inch from its fully extended position and any one of the following four conditions were present: (1) The stabilizer trim outside the prescribed setting for takeoff, (2) the flaps are extended less than 5° or more than 27.5°, (3) the auxiliary power unit switch is not in the "off" position, or (4) the speed brake lever is out of the zero detent.

1.17.4 Aircraft Certification Requirements for Performance Demonstration.

The Boeing 727-100 series aircraft was certificated in 1963 after its performance was demonstrated in accordance with the requirements of Civil Air Regulations Part 4b and Special Civil Air Regulation No. SR 422.

These regulations specified that the following performance parameters be demonstrated throughout a range of weight, aircraft configurations, altitude, wind and temperature conditions within the operational limits of the aircraft as established by the applicant.

(a) Accelerate-stop distance.--The accelerate-stop distance is the distance required to accelerate the aircraft from a standing start to a critical engine failure speed and then bring it to a full stop. The critical engine failure speed (V_1) is a speed selected by the applicant as the minimum speed at which controllability is adequate with only aerodynamic control to safely continue the takeoff. Spoilers and maximum wheel braking are used; however, reverse thrust is not used in the determination of stopping distance. Testimony from an FAA Engineering test pilot disclosed that about a 7-second delay is included for the pilot to transfer his actions from acceleration to stop in order to approximate pilot response during line operation.

(b) Takeoff path.--The takeoff path is the altitude versus distance profile of the aircraft as it takes off from a standing start and climbs to 1,500 feet above the takeoff surface or the altitude at which it is configured for enroute flight, whichever is greater, after having experienced a failure of the critical engine at V_1. The takeoff path is demonstrated using a prescribed configuration change and acceleration schedule.

(c) Takeoff distance and takeoff run.--The takeoff distance is the horizontal distance that it takes the aircraft to accelerate from a standing start to reach a height of 35 feet above the takeoff surface assuming a failure of the critical engine at V_1, or 115 percent of the horizontal distance that it takes the aircraft to reach the 35-foot height with all engines operating, whichever is greater.

The takeoff run is the horizontal distance to a point equidistant between the liftoff point and the 35-foot height, as determined for takeoff distance.

(d) Takeoff Flightpath.--The takeoff flightpath is that portion of the takeoff path which begins at 35 feet height above the takeoff surface.

The net takeoff flightpath is the aircraft's actual demonstrated takeoff flightpath reduced at each point by a,gradient of 0.9 percent (for three-engine aircraft).

(e) Landing distance.--The landing distance is the horizontal distance required to land the aircraft and bring it to a full stop from an initial position 50 feet above the runway surface and an initial speed 30 percent above stall speed. Reverse thrust is not used during the determination of landing distance. The B727-100 landing distances for optimum conditions are:

40° Flaps

0 Wind	4,300 ft
10 kn. headwind component	4,050 ft

30" Flaps

0 Wind	4,600 ft
10 kn. headwind component	4,350 ft

The FAA Engineering test pilot stated during the public hearing that an approximate 2-second delay is included in the demonstration procedure to allow pilot transition to braking the aircraft after touchdown.

(f) All-engines-operating landing climb.--The all-engines-operating landing climb is the steady gradient of climb that the aircraft can achieve when configured for landing with the power that is available 8 seconds after the thrust levers are moved from the idle to the takeoff power position and when the aircraft is maintaining a speed 30 percent above stall. The gradient may not be less than 3.2 percent. This gradient for the B727-100 at sea level and a temperature of 84°F is 8 percent for 30" flaps and 5.9 percent for 25" flaps.

1.17.5 Approval of American Airlines B-727 Operations at Harry S Truman Airport.

A certificated air carrier must request FAA approval to operate a particular type of aircraft into a particular airport. The criteria used by the FAA in granting approval for such a request are essentially those defined in the Federal Air Regulations. First, the airport must be one which has been certificated in accordance with the requirements of 14 CFR 139. Secondly, the carrier must demonstrate that the aircraft's performance is compatible with the airport facility in accordance with the requirements of 14 CFR 121. Thirdly, the carrier must submit acceptable training programs to insure flightcrew proficiency and familiarization with the operation. These requirements are also specified in 14 CFR 121.

After requesting FAA approval for a given operation, the air carrier will normally conduct an analysis wherein the aircraft's performance, as determined during the type certification tests and described in the FAA-approved flight manual, is compared with the runway length and the terrain under the departure flight path. The object of the analysis is to determine that the aircraft can take off with the margins specified in 14 CFR 121.189 and land with the margins specified in 14 CFR 121.195. These requirements are paraphrased as follows:

(a) Takeoff requirements. -- In order to take off from any airport, it must be shown that the aircraft's accelerate-stop distance does not exceed the length of the runway plus the length of any stopway; that the takeoff distance does not exceed the length of the runway plus the length of any clearway; that the takeoff run does not exceed the length of the runway; and that the net takeoff flight path of the aircraft clears all obstacles either by a height of 35 feet vertically or by at least 200 feet horizontally within the airport boundaries and by at least 300 feet horizontally after passing the airport boundaries. For the latter purpose, it can be assumed that the aircraft can be turned using a maximum bank angle of 15° after reaching a height 50 feet above the runway.

An analysis to show compliance with the takeoff requirements consists of a comparison of the performance of the aircraft for the limits of its operational conditions with a profile view of the airport and surrounding topography.

(b) Landing requirements.--In order to land at the airport, it must be shown that the aircraft is capable of making a full stop. landing using the landing distance demonstrated during the certification tests, within 60 percent of the effective length of the runway. For a wet or slippery runway an additional margin is required. Essentially, the runway must be 15 percent 'longer than the runway required if dry, or, the dry stopping distance established for the aircraft must not exceed about 52 percent of the effective length of the runway.

There are no additional criteria specified for assurance of a missed approach or go around for FAA landing approval for visual landings. However, FAA personnel stated at the Safety Board's public hearing that an analysis of the terrain clearance during a missed approach executed from a point 50 feet above the runway threshold is based upon the demonstrated landing climb gradient for the aircraft and is considered during approval of a particular operation.

The aircraft's performance--accelerate stop distance, takeoff distance, takeoff run, net takeoff flight path, landing distance, and landing climb gradient--is a function of several variables. These include the aircraft's gross weight, existing longitudinal wind component, and the temperature. Thus, the airport analysis reduces to the determination of the maximum gross weight at which the aircraft can meet the criteria for either takeoff or landing for various wind conditions. Currently, temperature is considered only for takeoff performance. The air carrier then prepares the data in the form of takeoff and landing charts which are entered into their operations manuals. This information will tell the flightcrew the particular conditions at which the aircraft can land or take off at the airport. The operations manual is then accepted by the FAA before issuance of an operating certificate which authorizes the particular operation.

Jet aircraft first operated into Harry S Truman Airport in 1965. American Airlines did not begin their operation until March 1971, after the acquisition of Trans Caribbean Airways, Inc., who had already been operating B-727 into the airport.:. American Airlines conducted an airport analysis and prepared other documents describing the pilot familiarization requirements and pertinent operations materials. This documentation was the basis for FAA approval.

American Airlines, in accordance with the flight manual provisions of 14 CFR 121.135 prepared landing weight charts for both 30- and 40-degree flaps. These charts are maintained in the company's Airport Analysis Manual which must be carried on every flight by the first officer. The 30-degree flaps landing weight chart for Truman Airport disclosed that a minimum headwind component of 20 kns is required for landing in that configuration. (See Appendix G.)

American Airlines procedures require that a captain must make at least three landings at St. Thomas with a superintendent flying/check airman before qualifying for the route. (See Appendix H - 1971 memorandum from the Company to all Caribbean flightcrews.)

1.17.6 Corrective Action by American Airlines

As a result of evidence and performance data developed during the accident investigation and at the public hearing, American Airlines initiated actions and instituted policies designed to clarify and strengthen their approach and landing procedures. These actions concerned procedures. for all of their aircraft and all of their operations including the B-727 operations into St. Thomas. They included a memorandum and two bulletins to flightcrews concerning performance data and approach criteria. They also established a requirement for the demonstration of the approach criteria by flightcrews in the visual flight simulators. (See Appendixes I through K.)

1.18 New Investigation Techniques

None

2. ANALYSIS

2.1 General

The aircraft was certificated, equipped, and maintained according to applicable regulations. The gross weight and c.g. were within prescribed limits. The aircraft's airframe, systems, powerplants, and components were not factors in this accident.

Although some witnesses heard what they considered to be engine compressor stalls, none of these sounds were reported by the flightcrew or by the two surviving flight attendants, one of whom was seated on her jumpseat located between engines No. 1 and 3 and just forward of engine No. 2. No evidence of engine stalls was observed during the post-accident powerplant examination. The "bangs" recorded on the CVR tape from Flight 625 were compared by spectrum analysis with CVR tapes with known compressor stall noises from other B-727 aircraft. This analysis gave no positive evidence of compressor stalls on Flight 625. Additionally, investigative findings indicated that even had a few low magnitude compressor stalls occurred at the time the "bangs" were heard, the effect on engine performance would have been negligible.

The flightcrew was properly certificated and each crewmember had received the training and off-duty time prescribed by applicable regulations. There was no evidence of medical or physiological problems that might have affected their performances. The airport was properly certificated in accordance with 14 CFR 139 and there were no exemptions in effect on the day of the accident.

2.2 Approach and Landing

Witness observations, crew statements, FDR information, and CVR information all indicate that the aircraft approached the runway in a normal profile which would result in a touchdown 1,000 feet or slightly more beyond the threshold. Instead of touching down, however, the aircraft floated 5 to 10 feet above the runway's surface. The FDR data indicate that the aircraft floated between 7 and 8 seconds, during which time it would have traveled about 1,500 feet. This correlated with witness observations which placed the touchdown between 2,500 and 2,900 feet beyond the threshold. After touchdown, the captain, who was concerned that he would not be able to stop the aircraft on the remaining runway, decided to execute a go-around maneuver. He announced his intention to go around about 3 seconds after touchdown.

After the accident, the captain stated that he moved the thrust levers to a vertical position and hesitated in order to allow the engines to attain a stabilized thrust, about 1.4 EPR, before going to takeoff power. This procedure is prescribed in the American Airlines operating manual for go-around from the runway. When the captain thought that the engines were not accelerating at an expected rate, he moved the thrust levers to the forward stop. Then, when it appeared to him that the engines were again not accelerating at a rate which would result in a successful go-around, he brought the thrust levers back to idle and attempted to slow the aircraft by using maximum wheel braking. He did not at this time, employ any other braking devices.

The activation of the takeoff warning horn disclosed that the captain moved the thrust levers to the vertical position at the same time that he announced his intention to go-around--within 3 seconds of the time of touchdown. The aircraft was traveling about 200 fpm. If the aircraft touched down as early as the 2,500-foot position, there would have been less than 1,600 feet of runway remaining, excluding the 500-foot overrun. The rubber deposits on the runway surface began about 3,950 feet from the threshold, or about 700 feet from the departure end. The Safety Board believes that the hard braking which produced the rubber deposits began simultaneously with the power reduction. This would indicate that the aircraft traveled only about 900 feet when the thrust levers were forward. The integration of airspeed measured by the FDR shows that the 900 feet was traversed in about 5 seconds.

The time required for the JT8D-1A engine to accelerate from idle to takeoff thrust was determined to be about 6.3 seconds during the B-727 certification flight tests. This time was confirmed during tests conducted after the accident. Other tests were conducted to determine the effect of the two-step procedure for thrust addition. The results showed that it took 5 seconds or more for the indicated EPR to reach 1.4. Boeing engineers stated that the two-step procedure would extend the total time for the engines to reach go-around thrust by 2 or 3 seconds.

The Safety Board, therefore, concludes that the flightcrew's observations of a maximum EPR of 1.4 before the retardation of power after about 5 seconds, was consistent with the normal acceleration of the engines and that powerplant anomalies were not a factor in this accident. However, the effect of the normal engine acceleration schedule on the total performance of the aircraft must be discussed.

After the aircraft has landed, and particularly after a significant period of time with the thrust levers in idle, the engines are likely to be turning at minimum rotational speed. When the decision is made to go around, it will take about 6 to 7 seconds before the engines will accelerate to takeoff power. During at least part of this time, the aircraft will continue to decelerate while traveling down the runway at a high speed. As thrust develops, the aircraft must be accelerated back to liftoff speed. The Boeing Company's analysis of this situation showed that a go-around initiated at 110 KIAS will require at least 1,912 feet of runway to achieve a liftoff with takeoff thrust. This distance increases to 2,387 feet if the pilot hesitates with the thrust levers at the vertical position.

An inherent danger in the go-around maneuver is that the pilot will rotate the aircraft to the takeoff attitude before sufficient thrust has developed to counter deceleration. This procedure is likely to increase the distance required to lift off even more than that determined by the analysis.

The Safety Board, thus, concludes that a successful go-around could not have been executed when the captain attempted to do so. However, the analysis of the aircraft's braking performance indicated that, using maximum braking and spoilers, the aircraft could have been stopped in less distance than required for go-around. In fact, after this landing, the captain should have been able to stop the aircraft on the runway and certainly within the confines of the runway overrun.

Therefore, to complete the analysis of this accident, there are several areas which must be discussed. These are the factors and circumstances leading to the long touchdown, the decision making process of the captain before and after the landing, the factors which could have influenced this decision making process, and the adequacy of the margins of safety in the FAA's airport and aircraft certification criteria.

In order to evaluate the factors and circumstances which led to the long touchdown, the extent and comprehensiveness of the company's operational guidelines must be examined. Additionally, the extent to which the approach conformed to the specific training and operating instructions given to American Airlines pilots must be reviewed.

Company guidelines were set forth in a 1971 memorandum issued to all pilots who were flying American's Caribbean routes. The memorandum contained company policy concerning flap usage, aiming point, touchdown point, and go-arounds. It pointed out the possibilities of encountering downdrafts on the approach, and emphasized the necessity of being in the "slot", the importance of the 1,000-ft aiming point, and the possible existence of a wind shear which could produce a float if the aircraft is landed long beyond the 1,000-ft point. The memorandum also pointed out the necessity of executing a go-around if the approach is not in the slot, if the landing will be "appreciably" beyond the 1,000-ft point, or if a bounce occurs on initial touchdown. The memorandum stated that "the use of 40° of flap is the standard practice;" however, there was an option to use either 30° or 40° flaps "with strong, gusty winds." It recommended the use of 30° flap with a wind component of 20 kn or more.

A 1972 Operations Bulletin FM2 C-7, with one change, reiterated the guidelines on flap usage contained in the 1971 memorandum. In restating the policy regarding the option to use 30° or 40° flaps, the winds were described as "with strong or gusty winds." The word "or" is underlined in the bulletin. The contents of this bulletin are, according to company management personnel, regulatory.

In 1975 the company issued another memorandum concerning flap usage. It sets forth the FAR landing distances for both the 30° and 40° flap settings. It notes that a 40° flap setting saves 250 ft of runway and that this was "the reason for requiring 40° of flaps when landing at St. Thomas in headwinds of 20 knots or less."

The testimony of company management personnel, the 30° flap landing weight chart for St. Thomas, and the contents of the cited memoranda leave no doubt that the intent of the company was to require the use of 40° of flap for all landings at St. Thomas in headwinds below 20 kn. Unfortunately, the wording of bulletin FM2 C-7 does not fully relay that intent. The insertion of the underlined word "or" between the adjectives "strong" and "gusty" had the effect of extending the option to use 30° flap for landing to the crew if the winds were gusty, and added an area of ambiguity which, if considered out of context with the other operational guidelines provided by the company before and after the issuance of FM2 C-7, was misleading.

With regard to speed control, the company's Aircraft Operations Manual states that the use of reference speed to reference speed +10 kn throughout the final approach to touchdown will normally provide the "most stable flight and desired airspeeds." The manual does not contain a requirement to bleed off the addition to reference speed before or after crossing the runway threshold. The testimony at the hearing further confirmed this lack of a requirement. These speed control procedures vary from those contained in the company's 1971 memorandum which discussed the wind and gust additives to reference speeds and then states, "maintain bug speed until arresting the rate of descent, then start reducing the thrust levers to idle just prior to touchdown. Touchdown may occur as low as 5 knots below bug speed." The 1971 memorandum also advised that, "The airplane must be flown onto the ground. Do not hold it off!"

The Safety Board believes that adherence to reference speed is most significant to a successful precision touchdown at St. Thomas. Although the Board believes that the language in 1971 memorandum is more specific than the procedures included in the aircraft operations manual, it concludes that the company provided its flightcrews with adequate speed control guidance in the manual to operate safely into Harry S Truman Airport.

The captain said that he knew that any southeast wind at St. Thomas would be gusty and, therefore, he decided to use 30° of flaps. He stated that the aircraft at 30° flap is more controllable, is easier to manage, and that, "you have a greater margin for what is ahead." His decision to deviate from company operational guidelines warrants further examination. The reported wind values did not include any gust velocities, nor were there any pilot reports denoting gusty conditions. Once the decision to use the nonstandard flap setting was made, there was no evidence that any crewmember checked the company landing analysis chart to see if landing was permissible. Indeed, had this been done it is possible that the flightcrew might have been reminded of the fact that a 20 kn headwind component was required by the company for a 30° flap landing. However, the Board realizes that the aircraft's landing weight was within the limits set forth in the "FAR Landing Field length - 30° Flaps" chart contained in the company's Airport Analysis Manual.

The decision to use 30° rather than 40° flaps exposed the aircraft to a performance penalty; required landing distance was increased 250 feet. More importantly, the reduced drag associated with the 30° flap confirguration made the aircraft more vulnerable to the effects of increased airspeed as the aircraft would decelerate at a lesser rate, and any wind shear or gusts encountered during the landing maneuver would be more apt to produce a float.

In the actual approach, the captain stated, and FDR data confirms, that he maintained a 10 kn margin above reference speed as the aircraft passed over the threshold. Analysis of the FDR information indicates that the aircraft was slightly above the precision approach profile as it passed over the threshold; however, the crew's and witnesses' observations placed the aircraft on or near to a normal approach path. The Board believes that, when the captain attempted to flare the aircraft and arrest its descent rate, the excess speed above reference was a factor in overflying his aiming point. The FDR-distance correlation shows that the airplane was slightly beyond the 1,000-foot marker when the FDR airspeed trace shows two aberrations which were probably caused by a gust of wind from the northeast. The airspeed increased about 5 kn as a result of an increase in the headwind component and the crew stated that the aircraft rolled to the right. When the captain corrected the lateral motion, the aircraft ended up slightly high. Thus, the Board concludes that the encounter with the gust added to the lift produced by the rotation of the aircraft and caused a prolonged float. The FDR data indicates that the aircraft floated about 4 seconds after the airspeed stabilized. The performance analysis shows that the deceleration during this period was normal for a 30° flap, idle thrust configuration.

A review of the major events influencing the approach and landing is necessary to bring matters into perspective. The approach to the threshold was flown within normal variations of speed and altitude control and the aircraft was stabilized in the landing configuration. When the aircraft was over the threshold, the power levers were retarded according to procedures to arrive at the touchdown point with an idle power setting. FDR data and witness statements indicate that the aircraft's wheels were about 10 feet above the runway at the 1,000-foot touchdown point. Thus, touchdown appeared to be imminent and there was no reason for the captain to suspect that a go-around might be necessary. In fact, since the captain testified that he was "programmed to land," his thought processes were probably oriented toward the next phase of the flight which was control of the aircraft on the ground and the necessary control inputs such as the power reversing process, braking, and steering of the aircraft. Thus, the captain's perceptions of the approach and imminent touchdown reinforced his expectation of another normal landing.

The next major event that occurred in this accident sequence was the encounter with the turbulence which caused a lateral upset of the aircraft of sufficient magnitude to cause either the captain or the first officer to utter an exclamation of surprise. The effect of the turbulence was substantiated by the FDR and the aircraft's reaction to it was observed by a qualified witness. The captain was now faced with the predicament of being unable to land the aircraft before taking the necessary action to correct the lateral upset. The captain was also confronted with a more critical situation. The aircraft was still about 10 feet above the runway and well beyond the normal touchdown point. Thus, he was faced with an immediate decision to land the aircraft or to initiate a go-around. He probably had less than 5 seconds to evaluate the situation and take action as the aircraft was fast approaching the point along the runway from which a go-around would have been a dangerous, if not an impossible maneuver but from where the aircraft still could have been landed and stopped successfully.

These decisions which faced the captain represent the third major event in this accident sequence. His decision to positively put the aircraft on the runway came shortly after the first officer issued his "still high, Art" warning. The pilot pushed over the nose of the aircraft and forced it onto the runway. Although he knew he was past the normal touchdown point, the captain's testimony indicated that his awareness of the extent of his progress down the runway only became evident after touchdown when he integrated the runway and airport environment into his visual field. The pilot stated that his visual appraisal of the runway environment and his experience and training caused him to change his mind about his initial landing decision. The response to this decision came about 3 seconds after touchdown.

The process of decisionmaking involves the perception of sensory inputs, integration of these inputs with past experience, choosing between alternatives, and reacting accordingly. From a behavioral standpoint, the process of "deciding" involves the interaction of the sensory variables (such as viewing of the operating environment, the sense of acceleration and deceleration, etc.) with past experience and with subjective confidence about the situation. On the basis of this interaction, expectancies are formed, which form the basis for the motor reaction in implementing the decision. In this instance, the pilot's decision to initiate a go-around may well have been based on his previous experience with takeoffs at St. Thomas and his training in touch-and-go landings.

The captain had extensive operating experience (154 previous landings) into the St. Thomas airport. Normal takeoffs are made from a standing start and the aircraft will normally rotate about 3,500 feet after the roll begins. In this case, the aircraft was about 500 feet from the point at which it was normally rotated for takeoff when the captain decided to go around and his airspeed was at or within 3 or 4 kn of rotation speed for the go-around maneuver (V_{ref} -10 kns, or **110** kns). Thus, his experience would lead him to believe that a go-around was a viable course of action. However, the aircraft was in a diminishing speed regime and the engines were spooled-down which altered the situation significantly.

The limited training for touch-and-go landings received by most airline captains during their early transition training is conducted under ideal conditions. Airspeed is maintained to the maximum extent possible as are engine RPMs. Thus, engine acceleration time and ground roll are reduced considerably. Furthermore, these maneuvers are conducted on runways of sufficient length so that maximum aircraft performance is not a consideration. Moreover, most pilots are taught that bad approaches or landings which may result in accidents can be avoided by the execution of a go-around. However, it was demonstrated in this case, and the Safety Board believes it may be prevalent throughout the industry, that air carrier pilots have little knowledge of the distance required to execute a go-around under varying conditions of temperature, elevation, velocity, gross weights, and engine spool-down.

An analysis of the Boeing 727-100 performance data showed that the aircraft's ground roll from initial throttle action to liftoff during the touch-and-go maneuver, requires more than **1,900** feet of runway, while another **800** feet will be traversed before the aircraft reaches an obstruction clearance height of **35** feet above the ground. This situation was aggravated by American Airlines' standard procedure for "go-around from the runway" which called for a two-step advance of the power levers to allow the engines to stabilize at a thrust level of 1.4 EPR. Tests have shown that this procedure may lengthen the takeoff roll by as much as **500** feet. These figures compare with a stopping distance of about **1,700** feet using maximum braking and other available braking devices.

The captain stated that he believed that the aircraft could be stopped within about 2,000 feet; this estimate was within 270 to 470 feet of the manufacturer's computations of the stopping distances that would have been required at St. Thomas. He testified that he did not become aware that he would not be able to stop the aircraft until after touchdown. Calculations indicate, however, that although the remaining runway length was, indeed, marginal, the aircraft could have been stopped. Had the captain looked at the distance remaining markers on the left side of the runway, he may have realized that sufficient runway remained to effectively stop the aircraft. Undoubtedly, the proximity of the buildings near the airport perimeter and the hills beyond the departure end of the runway created the appearance that the remaining distance was inadequate. Thus, the captain's ability to make the correct decision was impaired by his lack of knowledge of the aircraft's performance capability.

The fourth and final event in this sequence occurred when the captain realized that the rate of aircraft and engine acceleration would not allow the aircraft to become airborne safely in the remaining runway length available to him. While the captain testified that he closed the throttles because he did not notice the engine response which he would have expected on the EPR gauges, he had allowed only about 5 seconds for engine acceleration. Although 5 seconds was insufficient for full engine response, it allowed the aircraft to travel an additional 1,000 feet. Certainly, the proximity of the runway's end was an additional factor in the captain's decision to abort. He, therefore, closed the throttles and applied full wheel brakes. Evidence of tire marks, indicative of braking, were visible about 700 feet from the runway's end and 1,200 feet from the end of the overrun area. However, for a time--and at least until the aircraft left the overrun surface--the captain did nothing further to bring the aircraft to a quicker stop. He did not lower the nose wheel to the ground, extend the spoilers, or use reverse thrust. As a result, the aircraft did not decelerate at its full capability. The failure to lower the nose wheel probably had a significant effect on the aircraft's rate of deceleration, since the lift which was being developed affected directly the stopping force which was transmitted between the runway surface and the aircraft tires. Although reverse thrust apparently was selected, it was not applied until just before final impact.

The captain stated that he did not know why he did not use all available deceleration means. It has been found that, when danger appears imminent, man may undergo certain behavioral changes [6/] intended to extract him rapidly and impulsively from such a situation without having to go through the slower reasoning process. The cited literature indicates that this so-called emergency mechanism may be detrimental in situations where deliberate responses are necessary because it cancels the reasoning function. Thus, when a well-learned response (such as a go-around), which training and experience has taught the pilot to believe is effective, to the contrary makes the situation more dangerous, the emergency mechanism may set in within seconds. When the emergency mechanism is triggered, the sense of danger will increase and decisions requiring deliberate reasoning are less likely to be made.

In this case, the emergency mechanism was triggered when the captain realized that a go-around was impossible and that an accident was inevitable. The captain probably reacted impulsively and instinctively to the dangerous situation by applying full wheel brakes but he did not remember the more deliberate means of lowering the aircraft nose, deploying the spoilers, and applying maximum reverse engine thrust to attempt to stop the aircraft. Had the pilot used these deceleration means when he commenced braking at the 700 feet remaining mark, the aircraft might have been brought to a stop within the confines of the airport perimeter. At the very least, a much lower velocity impact would have occurred.

6/ Davis, "Human Errors and Transport Accidents," Ergonomics, 2.24 (1958) Department of Medicine, University of Cambridge.

The Board believes that intensive training is the most effective means to combat the effects of this emergency mechanism. Had the captain been exposed during training to critical go-around situations and to the maximum performance stopping capabilities of the aircraft by means of flight simulation and lectures, he may have reacted appropriately in this situation.

In summary, it is evident that the captain could have extracted himself twice from a dangerous situation and could have avoided this accident. His first opportunity was during the turbulence encounter just after passing the 1,000-foot touchdown area; he should have followed company procedures and should have initiated a go-around as soon as he regained control of his aircraft.

His second opportunity to avoid the accident came when he decided to land the aircraft,;he should have applied maximum performance stopping procedures to bring the aircraft to a stop within the remaining runway length. Furthermore, when an accident was inevitable, the captain had an opportunity to lessen the damage to the aircraft and to diminish the impact velocity; at this time, he should have applied maximum performance stopping procedures.

Thus, while the Safety Board believes that the causal area of this accident involves the captain's actions before and after the touchdown, his lack of substantive information about the aircraft's stop or go-around performance capabilities seriously affected his ability to make a proper decision in this situation. The Board is aware that American Airlines' training procedures have been revised to include these performance factors. An Operations Bulletin (FM2 C-13) was issued on August 16, 1976, and placed in the Flight Manual. The bulletin states that any decision to go-around at St. Thomas should be made and initiated no later than the 1,000-foot touchdown markers. This bulletin continues with the following company policy:

> "Go-around shall not be attempted after the aircraft has touched down on the runway, and the landing should be continued to a stop -- recognizing the full stopping capabilities of the 727 with spoilers, main and nose gear brakes."

Thus, American Airlines recognizes that in their operations at St. Thomas, pilot knowledge of the go-around and stopping capabilities of the Boeing 727 are vital to a safe operation. The Board is concerned, however, that there may be other airports exhibiting similar operational and environmental conditions which are served by turbine-powered aircraft and by other air carriers. Therefore, to prevent a similar accident, these areas of concern have been addressed in a recommendation letter to the Federal Aviation Administration.

2.3 Airport Certification

Finally, the Safety Board considered the adequacy of FAA aircraft and airport certification criteria for the Harry S Truman Airport.

The requirements of 14 CFR 139 are confined exclusively to the airport proper. It does not impose any requirements on the airport manager outside of the airport property except to light and mark objects identified as obstructions in 14 CFR 77, and which are within the airport operators authority. The on-airport requirements include crash/fire/rescue capabilities, emergency planning, pavement, safety areas, lighting and marking of pavement, hazardous materials, wind and traffic indicators, ground vehicles, self-inspection programs, public protection, security and others. Based on a review of the three certification inspections and on physical inspections of the airport, the Safety Board determined that the airport met all requirements of 14 CFR 139.

At the Safety Board's public hearing witnesses from the FAA's Flight Standards Service stated that the B-727 operations into the Harry S Truman Airport were approved and are within the criteria of 14 CFR 121. There is no question that the aircraft can take off and land on runway 9 within the safety margins prescribed by the FAA. For instance, the aircraft, at its maximum operating weight for St. Thomas, can lose a critical engine on take off and still clear the terrain beyond the departure end safely. The company has demonstrated that the aircraft can stop, without the use of reverse thrust, within 60 percent of the length of the runway after crossing the threshold 50 feet high at reference speed as required by 14 CFR 121.195. These criteria as applied at St. Thomas are the same as those required at any other airport. They are predicated, however, upon the pilot's use of prescribed and approved techniques--the aircraft must be flown at the proper speed and the pilot must respond to required actions in a prescribed and a predictable manner.

Although 14 CFR 121 does not specifically require that an aircraft certified for landing be capable of clearing terrain on a go-around maneuver, the FAA witnesses stated that this factor is considered. Since the landing climb gradient exceeds the climb gradient attained with one engine inoperative on takeoff, the go-around maneuver, if executed over the runway threshold, is inherently safe insofar as departure terrain clearance is concerned.

The Safety Board believes that the existing regulations for the certification of a given air carrier operation are adequate. The regulations do not specifically consider factors particular to the airport. At the Harry S Truman Airport for example, there are known to be unique wind conditions which can cause an adverse deviation in an aircraft's performance. There are also visual factors related to runway dimensions and surrounding terrain. However, the regulations do include a provision whereby any carrier, pilot group or individual pilot can halt operation into any airport and report to the proper authority any known specific hazard condition. The FAA witnesses testified that they were unaware of any such reports before this accident.

Furthermore, in evaluating the adequacy of the airport for jet aircraft operations, one must review the accidents which have occurred. Since the beginning of commercial jet operations at Harry S Truman Airport in 1965, there had been two accidents, before this accident, involving air carrier jet aircraft, one of which included fatalities. These accidents involved a DC-9 in 1969 and a B-727 in 1970. The probable cause of the first accident was determined to be a loss of effective braking action caused by dynamic hydroplaning. There were several improvements to the airport following that accident, including the grooving of the runway. These improvements were designed to help prevent hydroplaning accidents.

The probable cause of the second accident, in which two persons died, was determined to be the captain's use of improper techniques in recovering from a high bounce after a poorly executed approach and touchdown. The airport handles more than 7,000 jet aircraft operations annually. Based on this evidence the safety Board concludes that the airport, although less than ideal, is safe with regard to B-727-100 operations, provided that these operations are conducted within prescribed procedures.

2.4 Crash/Fire/Rescue

A key factor in evaluating crash/fire/rescue response to an accident is how quickly was such a response required in order to save lives. Testimony by witnesses and surviving passengers indicate that the fires began when the right wing struck the embankment at the end of the runway. Even as the aircraft slid to a halt, the smoke had become dense in and around the fuselage. The flight attendant on the galley jumpseat stated that she saw the first-class cabin being torn apart in the impact sequence. The flight attendant in the rear of the aircraft indicated that when the aircraft came to a halt, the tail section in which she was sitting had broken off. Both flight attendants stated that as soon as the impact sequence stopped, and before they could leave their seats, they saw fire within 4 feet away. They stated that the flames were moving rapidly toward them. In addition, they saw dense black smoke immediately, which made breathing difficult. One flight attendant stated the fire was consuming the oxygen so rapidly she began to "quickly suffocate."

Two survivors stated that smoke in the cabin was immediate and affected their ability to breathe almost before they could get out of their seats. One woman reported that she felt faint from the smoke as she moved up the aisle to an exit.

The Virgin Islands Port Authority (VIPA) firemen responded to the crash site within 2 to 2-1/2 minutes of the first impact. The Insular Fire Department (IFD) had a vehicle on site within 5 minutes. The firemen reported that by the time they arrived they did not believe anyone could be alive in the wreckage because of the extent and intensity of the fire and smoke. The Safety Board believes that in order for rescue efforts to have been effective, the initial response would have had to occur in less than 1 minute. Since the fuselage broke into at least three sections on impact and since the fires began before the aircraft stopped, the Safety Board believes that the fire spread very rapidly throughout the wreckage. The volume of smoke and heat which was reported to have spread immediately further reduced the chance that survivors could live for more than 1 minute in the wreckage. The presence of a black substance in the mouths and throats of surviving passengers indicates that smoke inhalation was a problem even to those who did escape. Finally, interviews of persons who lived near the crash site and responded within seconds after the accident, indicated that the smoke and heat around the aircraft reached a high intensity in such a short time that survivor assistance was very difficult.

The Safety Board is concerned with the lack of equipment onboard the fire vehicles for close-in firefighting. If the airpacks, which are necessary equipment for use in conjunction with the proximity suits and which were available at the firehouse, had been on each vehicle, the firemen could possibly have used handlines to proceed nearer the fire for more effective firefighting.

The Safety Board concludes that the airport emergency plan and supporting mutual aid agreement was sufficiently detailed to provide procedures which governed the rescue efforts at this emergency. This conclusion is based on the manner in which the plan actually functioned in this accident. Furthermore, the VIPA and the Department of Public Safety stated in the public hearing that improvements are being made which will strengthen the existing procedures.

3. CONCLUSIONS

3.1 Findings

1. The aircraft was certificated and maintained according to approved procedures.

2. All crewmembers were certificated and qualified for the flight.

3. The airport was properly certificated under 14 CFR 139 and was without exemptions.

4. Harry S Truman Airport is capable of B727-100 operations under requirements of *14* **CFR** 121.

5. The certification of B727-100 aircraft into the airport was accomplished properly.

6. The additional restrictions imposed by the company augmented the required **FAA** safety margins.

7. The captain did not follow the company procedures in landing at St. Thomas. The company's intent was to require a 40° flap landing configuration for all landings at St. Thomas whenever the headwind component did not exceed 20 kn and no gusty wind conditions were present.

8. The use of 30° flap instead of 40° flap increased the landing roll, provided lower drag, lessened the decelerative capability **of** the aircraft, and made the aircraft more susceptible to atmospheric or aerodynamic factors which could produce a float.

9. The float probably resulted from either an updraft encounter, or, from an increase in lift resulting from the rotation of the aircraft, or an increase in airspeed as a result of a rapid change of headwind; or a combination of any two or all of these factors.

10. A successful go-around was possible immediately upon the onset of the float, after the wing dropped, and most probably after the wings were leveled. This capability became more and more marginal as the float and engine spool-down continued.

11. The aircraft touched down about 2,500 to **3,000** ft beyond the runway threshold. Based on these distances, it could have been stopped within the confines of the remaining runway, but a safe go-around could not be made.

12. Although the captain realized the remaining runway was critical with regard to stopping the aircraft, he did not know that the remaining runway was even more critical with regard to the execution of a go-around.

13. With adequate training as to the aircraft's performance capability and with training environment exposure to similar situations, the captain may have reacted immediately to stop the aircraft instead of attempting a go-around.

14. The first airport rescue vehicle began to apply extinguishing agent on the aircraft from the west side within 2 to 2-1/2 minutes after the accident.

15. Wind reporting at St. Thomas is often inaccurate because of the topography surrounding the airport.

3.2 Probable Cause

The National Transportation Safety Board determines that the probable cause of this accident was the captain's actions and his judgment in initiating a go-around maneuver with insufficient runway remaining, after a long touchdown. The long touchdown is attributed to a deviation from prescribed landing techniques and an encounter with an adverse wind condition, common at the airport.

The nonavailability of information about the aircraft's go-around performance capabilities may have been a factor in the captain's abortive attempt to go-around after a long landing.

4. SAFETY RECOMMENDATIONS

As a result of this accident, on December 9, 1976, the National .Transportation Safety Board recommended that the Federal Aviation Administration:

"Insure that procedures in the operations manuals of airports certificated under 14 CFR 139 are current and applicable to the airport. (Class II, Priority Followup.) (A-76-138)

"Institute, through the regional offices of the Office of Airport Programs, a program to emphasize to airport management the importance of a continual, critical review and update of airport operations manuals. (Class III, Longer Term Followup.) (A-76-139)

"Require that the Virgin Islands Port Authority revise its operating procedures at Harry S Truman Airport to insure that:

(a) All necessary CFR equipment, especially air packs and proximity suits, is brought to an accident site on the responding CFR vehicles;

(b) the direct emergency line is reinstalled to provide immediate communications between the airport and Insular Fire Department;

(c) the Insular Fire Department be included on the Virgin Islands Port Authority radio frequency for accident notification and control purposes; and

(d) procedures for proper continuity of airport command during emergencies be included in the Harry S Truman Airport operations manual. (Class 11, Priority Followup.) (A-76-140)"

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ WEBSTER B. TODD, JR.
Chairman

/s/ KAY BAILN
Vice Chairman

/s/ FRANCIS H. McADAMS
Member

/s/ PHILIP A. HOGUE
Member

/s/ WILLIAM R. HALEY
Member

December 12, 1976

5. APPENDICES

APPENDIX A

INVESTIGATION AND HEARING

1. Investigation

The Safety Board was notified of the accident about 1520 on April 27, 1976. The investigation team went immediately to the scene. Working groups were established for operations, air traffic control, witnesses, human factors, structures, maintenance records, powerplants, systems, airport, flight data recorder, and cockpit voice recorder.

Participants in the on-scene investigation included representatives of the Federal Aviation Administration, the Boeing Company, American Airlines, Inc., the Allied Pilots Association, the Virgin Islands Port Authority, the Professional Air Traffic Controllers Organization, the Transport Workers Union, the Flight Engineer's International Association, and the Pratt & Whitney Aircraft Division of United Technologies Corporation.

2. Public Hearing

A 3-day public hearing at St. Thomas began on July 13, 1976. Parties represented at the hearing were: The Federal Aviation Administration, American Airlines, Inc., the Allied Pilots Association, the Virgin Islands Port Authority, the National Weather Service, the Flight Engineer's International Association, the Transport Workers Union, and the Boeing Company.

APPENDIX B

PERSONNEL INFORMATION

Captain Arthur J. Bujnowski

Captain Authur J. Bujnowski, 54, was hired by American Airlines, August 14, 1941. He entered the U.S. Navy in April 1944, and returned to the company October 1949. The captain holds Airline: Transport Pilot Certificate No. 718760 with type ratings in Convair 240, Douglas DC-6 and -7, Lockheed Electra, and Boeing 727 aircraft. He has a First Class Medical Certificate dated March 18, 1976, with no waivers.

Captain Bujnowski passed proficiency checks on December 28, 1975, and June 23, 1975. His last line check was completed December 1, 1975. His last recurrent and emergency ground training was received December 27, 1975. The captain upgraded to the Boeing 727 June 8, 1965. He had accumulated 22,225 total flight-hours, about 10,000 hours of which were in Boeing 727 aircraft. His flying time during the last 90 days, 30 days, and 24 hours were 197 hours, 75 hours, and 3 hours 10 minutes respectively. He had been off duty 24 hours before reporting for this flight. At the time of the accident, he had been on duty about 4 hours 25 minutes of which 3 hours 10 minutes were flying time.

Before the accident, Captain Bujnowski had made 154 landings at St. Thomas. Of these landings, 27 were made in the 90 days before the accident and 10 were made in the 30 days before the accident.

First Officer Edward R. Offchiss

First Officer Edward R. Offchiss, 36, was hired by American Airlines on May 30, 1966. He held Commercial Pilots License No. 1450329, and a First Class Medical Certificate dated November 19, 1975, with a waiver for color vision. His last 2 proficiency checks were taken on February 7, 1976, and February 18, 1975. His last recurrent ground and emergency training was received February 6, 1976.

First Officer Offchiss was upgraded to the B-727 on June 7, 1969. He had accumulated about 8,000 total flight-hours, of which about 2,500 hours were in the Boeing 727 aircraft. His flying time during the last 90 days, 30 days, and 24 hours, was 133 hours, 67 hours, and 3 hours 10 minutes, respectively. He had been off duty 96 hours before reporting for this flight. At the time of the accident, he had been on duty about 4 hours 25 minutes, of which 3 hours 10 minutes were flying time.

First Officer Offchiss had made 38 previous landings at St. Thomas. Of these landings, 6 had been made in the 30 days before the accident.

APPENDIX B

Flight Engineer Donald C. Mestler

Flight Engineer Donald C. Mestler, 45, was hired by American Airlines on June 7, 1951. He held Flight Engineer Certificate No. 1437320, and a Second Class Medical Certificate dated March 22, 1976, with no waivers. His last 2 proficiency checks were received November 20, 1975, and October 10, 1974. His last line check was received May 6, 1974; he received recurrent ground and emergency training November 18, 1975.

Flight Engineer Mestler was upgraded to the Boeing 727, March 11, 1965. He had about 9,500 flight-hours, of which about 8,000 hours were in the Boeing 727. His flying time during the last 90 days, 30 days, and 24 hours was 165 hours, 75 hours, and 3 hours 10 minutes respectively. He had been off duty for 24 hours before reporting for this flight. At the time of the accident, he had been on duty about 4 hours 25 minutes, of which 3 hours 10 minutes were flying time.

Flight Engineer Mestler had 125 landings at St. Thomas. Of these landings, 22 were in the 90 days before the accident and 10 were in the 30 days before the accident.

Flight Attendants

The four flight attendants were current and qualified to perform their prescribed duties.

APPENDIX C

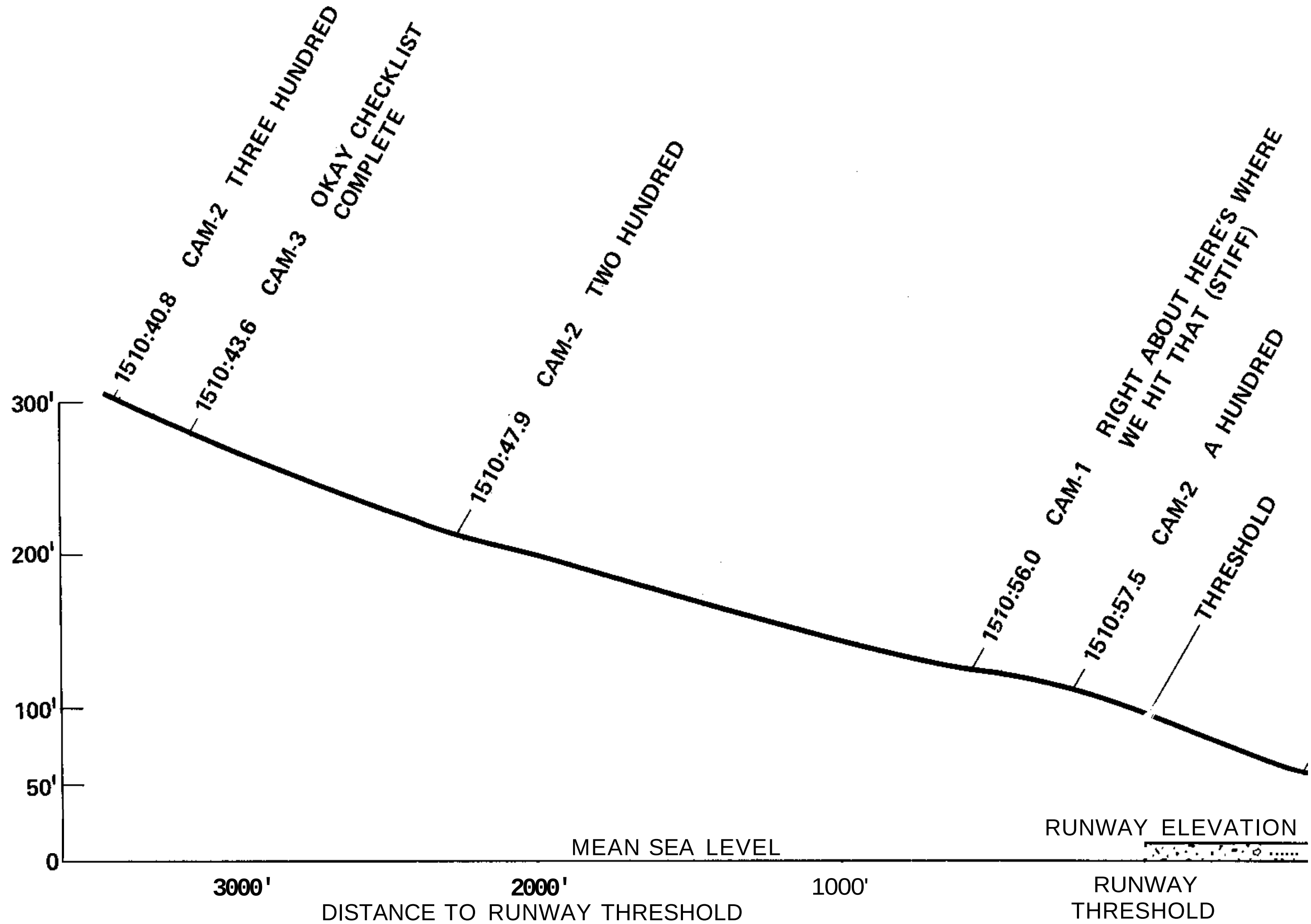
AIRCRAFT INFORMATION

Boeing 727-95, serial No. 19837, N1963 was delivered to American Airlines, Inc., on December 20, 1967. It was certificated and maintained according to procedures approved by the FAA. At the time of the accident, the aircraft had accumulated 21,926 flight-hours; 148 hours had been flown since the last major phase check.

Engines: Three Pratt & Whitney JT8D-1A

	Serial No.	Date of Installation	Total Time	Hours Since Last Overhaul
No. 1	649268	12/19/75	26,043	1,054
No. 2	649416	9/5/75	23,373	1,835
No. 3	649222	1/25/76	24,498	760

At the time of the landing at St. Thomas on April 27, 1976, the aircraft was within the c.g. limits established for the aircraft and the landing weight was about 125,000 lbs.



DERIVATION OF EXHIBIT

1. THE DISTANCE PLOT WAS DEVELOPED FROM THE F.D.R. AIRSPEED MEASUREMENT CORRECTED FOR DENSITY ALTITUDE AND WIND. THE FOLLOWING ASSUMPTIONS WERE USED
   - –SEA LEVEL BAROMETRIC PRESSURE – **30.00** IN. HG.
   - –SEA LEVEL TEMPERATURE – 84° F.
   - –WIND – CONSTANT – 120° TRUE/10 KNOTS

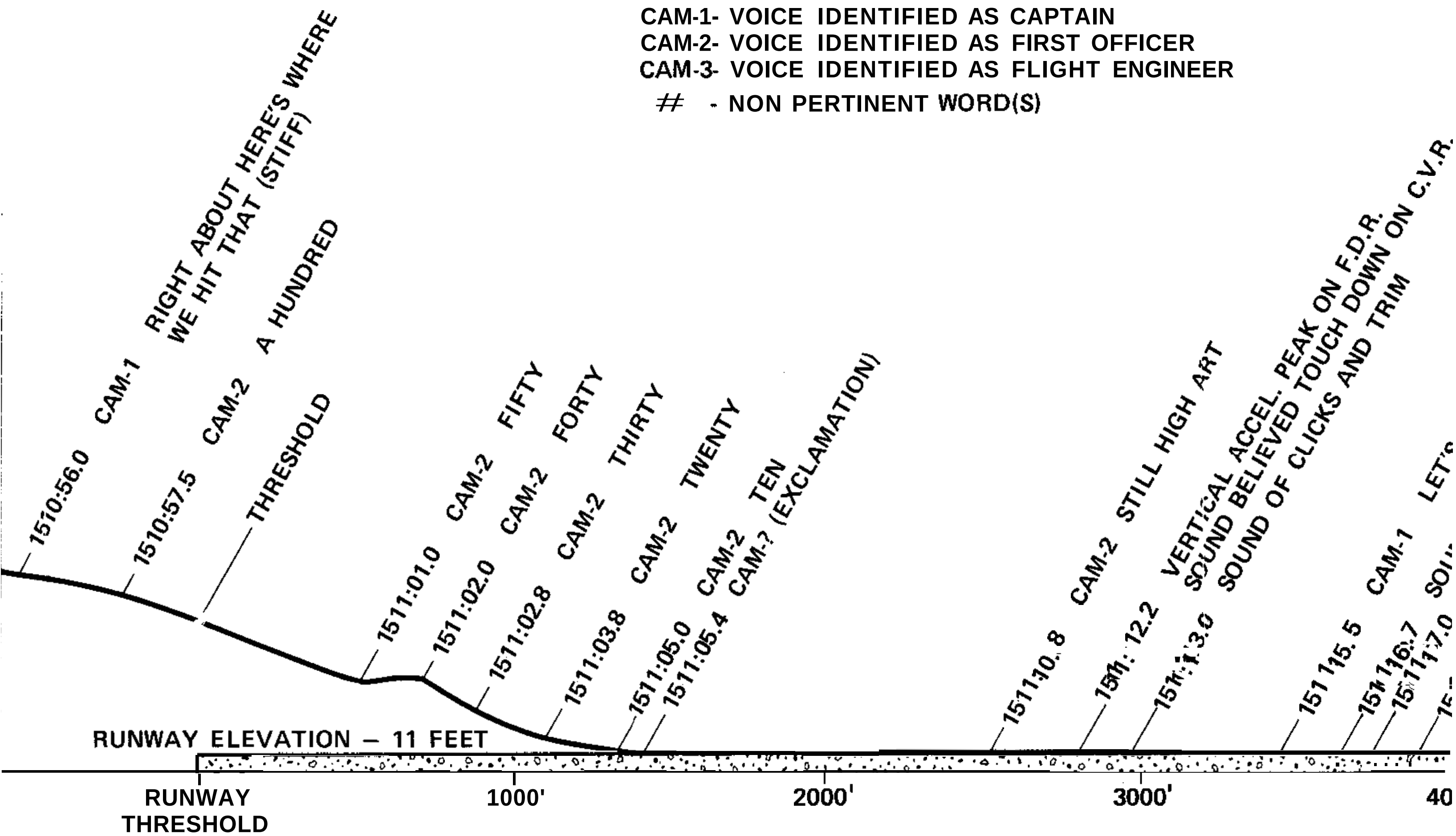
2. THE TIME CORRELATION BETWEEN THE FLIGHT RECORDER DATA AND THE C.V.R. TRANSCRIPT **IS** BASED UPON THE ASSUMPTION THAT A VERTICAL ACCELERATION PEAK THREE SECONDS BEFORE THE END ***OF*** THE F.D.R. TRACE CORRESPONDS WITH A SOUND OF THE INCREASING ROAR RECORDED ON THE C.V.R.

3. THE CORRELATION OF THE PLOT TO THE RUNWAY THRESHOLD **IS** BASED UPON THE ASSUMPTION THAT THE PREVIOUSLY MENTIONED ACCELERATION PEAK AND SOUND **OF** ROAR OCCURRED WHEN THE AIRCRAFT STRUCK AN EMBANKMENT **5369** FEET BEYOND THE RUNWAY THRESHOLD.

ACCURACY: THE EXHIBIT **IS** DEPENDENT UPON F.D.R. MEASUREMENTS AND THE ABOVE ASSUMPTIONS. THEREFORE F.D.R. TOLERANCES AND THE ACCURACY OF ASSUMPTIONS WILL AFFECT THE ACCURACY OF THE EXHIBIT. THE INFORMATION SHOWN **IS** NOT TO **BE** CONSTRUED AS AN EXACT FACTUAL

LEGEND

CAM- COCKPIT AREA MICROPHONE
CAM-1- VOICE IDENTIFIED AS CAPTAIN
CAM-2- VOICE IDENTIFIED AS FIRST OFFICER
CAM-3- VOICE IDENTIFIED AS FLIGHT ENGINEER
\# - NON PERTINENT WORD(S)



MENT CORRECTED
JSED:

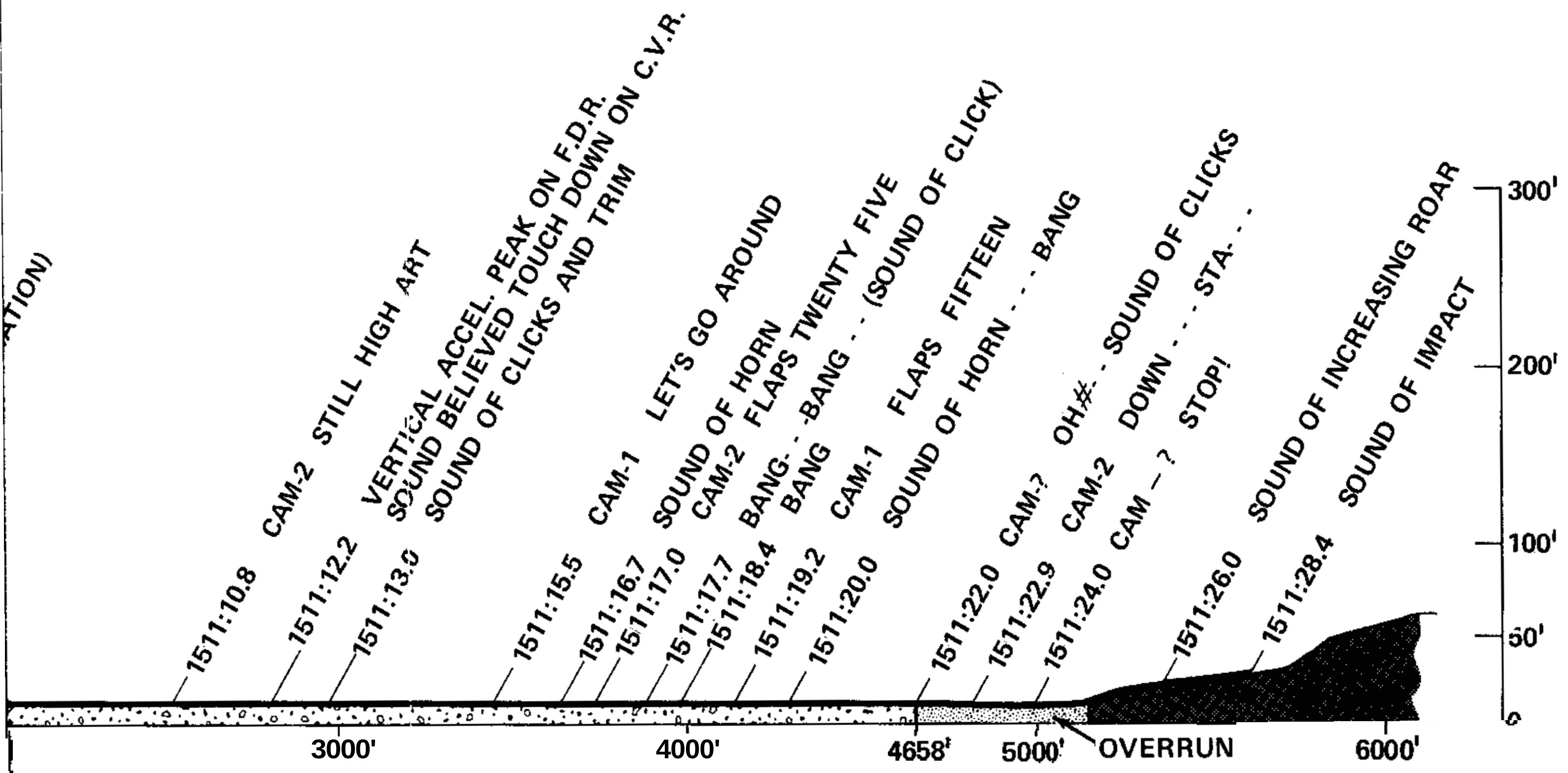
C.V.R. TRANSCRIPT IS
REE SECONDS
'HE INCREASING

PON THE ASSUMPTION
ROAR OCCURRED
JNWAY THRESHOLD.

E ABOVE
JMPTIONS WILL
TO BE CONSTRUED

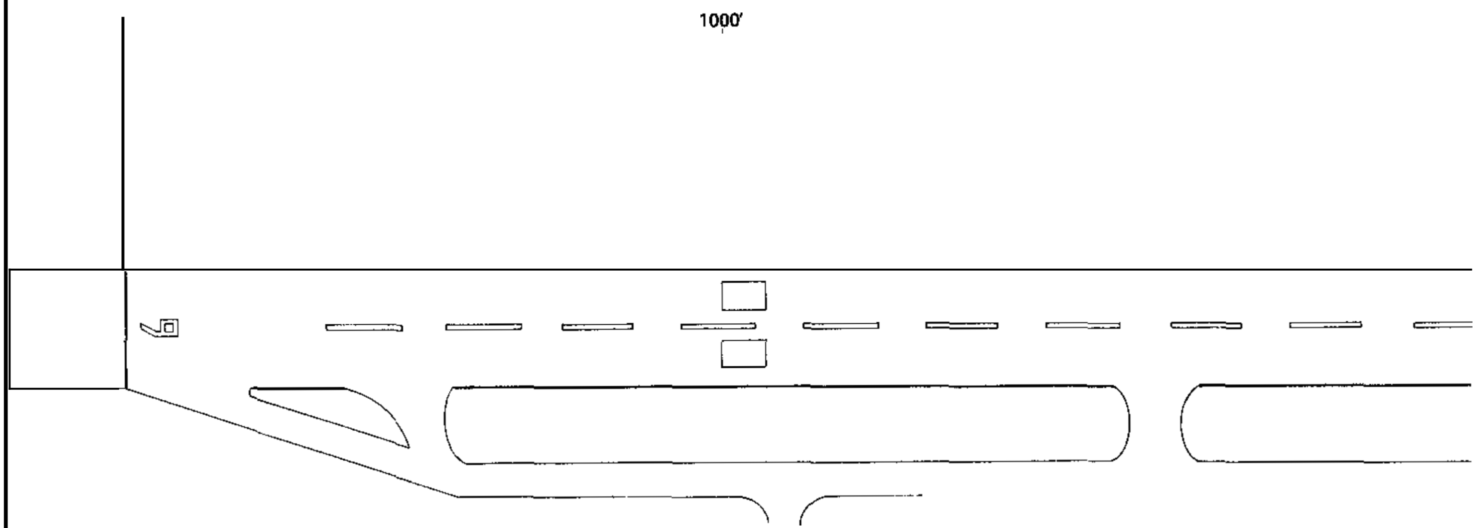
LEGEND

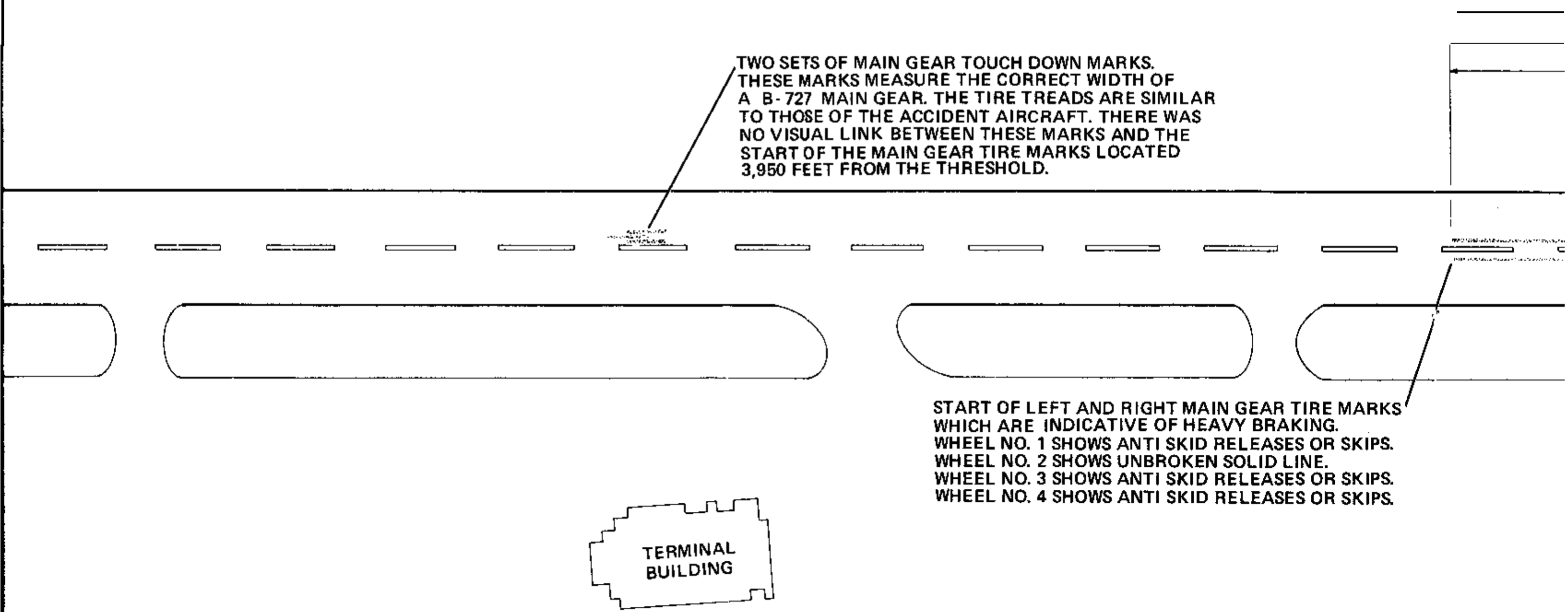
AREA MICROPHONE
DENTIFIED AS CAPTAIN
DENTIFIED AS FIRST OFFICER
DENTIFIED AS FLIGHT ENGINEER
TINENT WORD(S)

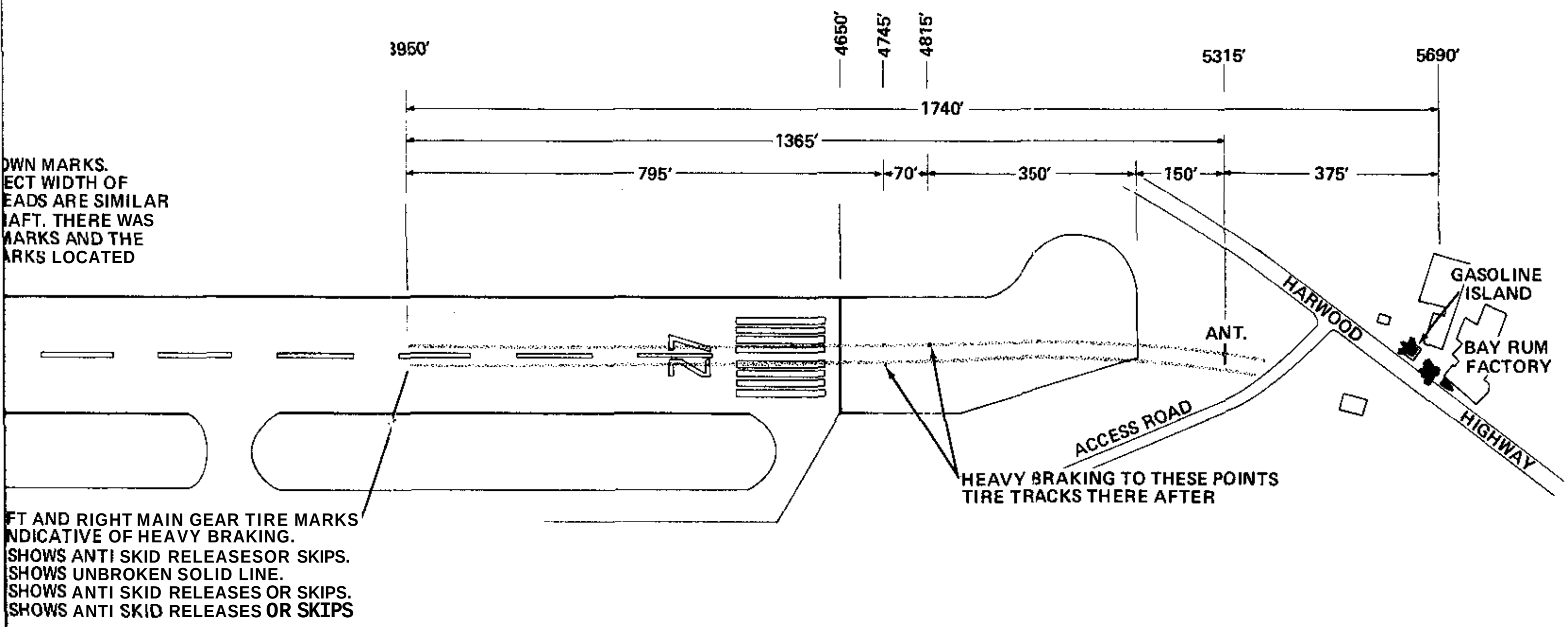


NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON,D.C.

APPROACH PROFILE
AMERICAN AIRLINES, BOEING 727-95 N1963
HARRY S TRUMAN AIRPORT, ST. THOMAS, VIRGIN ISLANDS
APRIL 27,1976

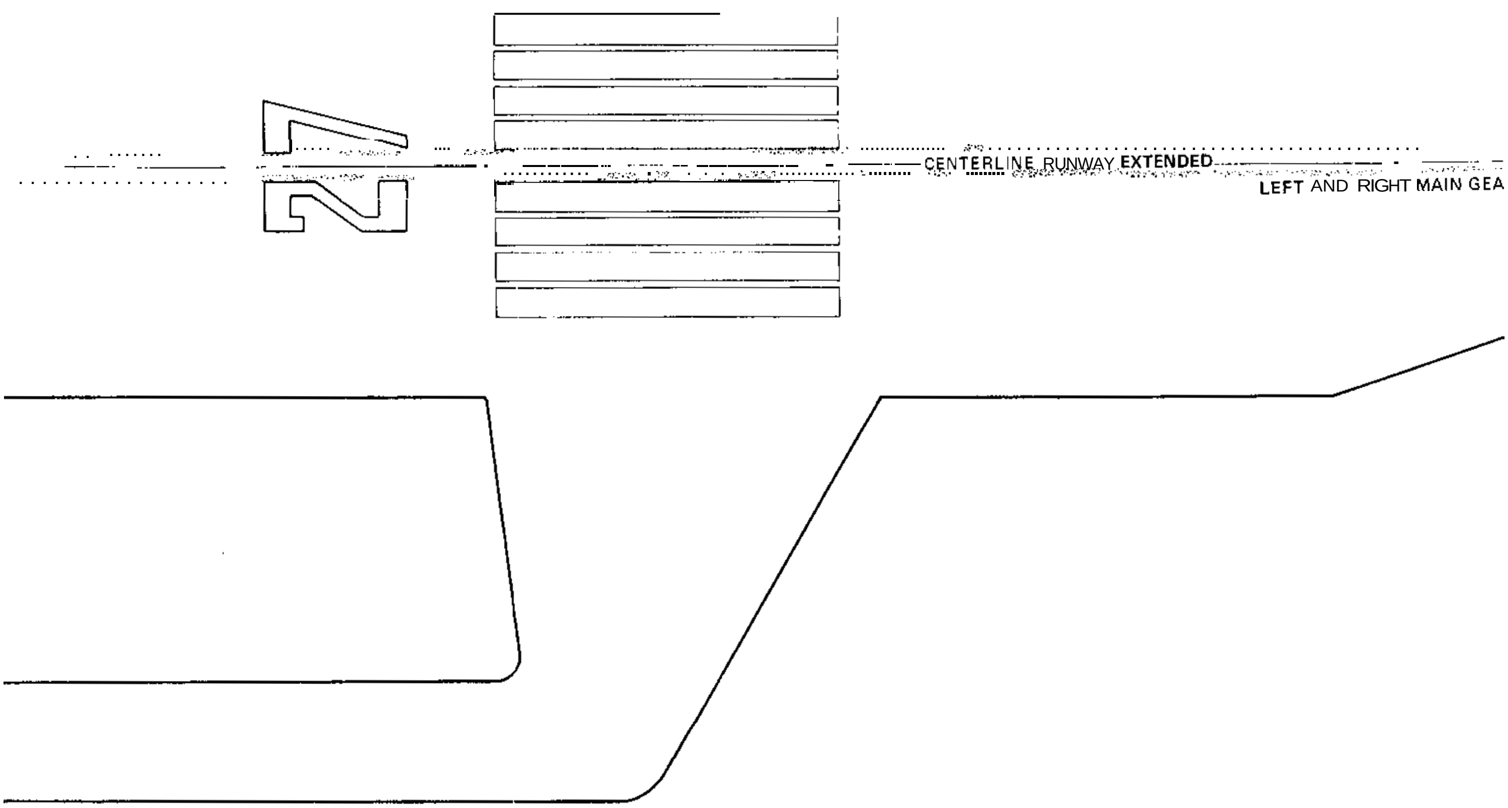

1000′


TWO SETS OF MAIN GEAR TOUCH DOWN MARKS. THESE MARKS MEASURE THE CORRECT WIDTH OF A B-727 MAIN GEAR. THE TIRE TREADS ARE SIMILAR TO THOSE OF THE ACCIDENT AIRCRAFT. THERE WAS NO VISUAL LINK BETWEEN THESE MARKS AND THE START OF THE MAIN GEAR TIRE MARKS LOCATED 3,950 FEET FROM THE THRESHOLD.
START OF LEFT AND RIGHT MAIN GEAR TIRE MARKS WHICH ARE INDICATIVE OF HEAVY BRAKING.
WHEEL NO. 1 SHOWS ANTI SKID RELEASES OR SKIPS.
WHEEL NO. 2 SHOWS UNBROKEN SOLID LINE.
WHEEL NO. 3 SHOWS ANTI SKID RELEASES OR SKIPS.
WHEEL NO. 4 SHOWS ANTI SKID RELEASES OR SKIPS.
TERMINAL BUILDING



NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

RUNWAY EXAMINATION CHART
AMERICAN AIRLINES, BOEING 727-95, N1963
HARRY S TRUMAN AIRPORT
CHAROLETTE AMALIE, ST. THOMAS, VIRGIN ISLANDS
APRIL 27. 1976



LEGEND:

1. PIECES OF RIGHT WING TIP NAV. LIGHT PLEXIGLAS BLUE AND CLEAR – FIRST POINT OF FUSELAGE IMPACT APPROX. 8 FEET ABOVE OVERRUN ELEVATION
2. IMPACT WITH CHAIN LINK FENCE
3. PIECE OF LEFT TRAILING EDGE FLAP
4. LEFT MAIN LANDING GEAR DOOR AND SIDE STRUT
5. RIGHT TRAILING EDGE FLAP TRACK FAIRING – LEADING EDGE DEVICE WITH FENCE – PIECES OF AFT OUTBOARD TRAILING EDGE FLAP
6. MAIN GEAR DOOR
7. PACK FAN MOTOR
8. TAG FROM NOSE GEAR STEERING UNIT
9. PIECE OF NO. 6 LEADING EDGE DEVICE
10. HEAT EXCHANGER
11. NOSE GEAR ASSEMBLY
12. PORTION OF KEEL BEAM . AFT DRAIN MAST – PARTS OF LEFT HYDRAULIC SERVICE PANEL
13. TAIL ASSEMBLY INCLUDING THREE ENGINES
14. FUSELAGE CENTER SECTION AND WING SPAR AREA
15. GALLEY AREA
16. COCKPIT SECTION
17. IMPACT WITH LOCALIZER SYSTEM – MAIN GEAR IMPACT MARKS
18. SECTION OF RIGHT WING TIP WITH TRAILING EDGE FLAP AND LEADING EDGE DEVICE ATTACHED
19. LEFT MAIN GEAR
20. LEFT WING TIP PANEL
21. RIGHT MAIN GEAR ASSEMBLY
22. RIGHT FORWARD NOSE GEAR DOOR
23. UPPER DRAGLINK BOLT
24. SPOILER LOCKOUT LARGE IDLER SUPPORT CLAMP
25. FORWARD DRAIN MAST
26. HEAVY GOUGES AND SCRAPE MARKS ON STREET IN LINE WITH AIRCRAFT DIRECTION OF TRAVEL
27. TREE BROKEN APPROX. 8 FEET ABOVE GROUND
28. HONYCOMB FOUND IN LOCALIZER ANTENNA SUPPORT STRUCTURE
29. PIECES OF LEADING EDGE SLAT TRACK
30. LEFT MAIN LANDING GEAR AFT TRUNION BEARING SLEEVE
31. 18 INCH PIECE OF KEEL BEAM STRINGER (WHEEL WELL AREA)
32. FUEL LINE ACCESS COVER – WHEEL WELL STUB FRAME
33. PIECE OF LEFT WING TO BODY FAIRING
34. THRUST REVERSER DOOR – NOs. 2 AND 3 LEADING EDGE SLATS

SYMBOL KEY:

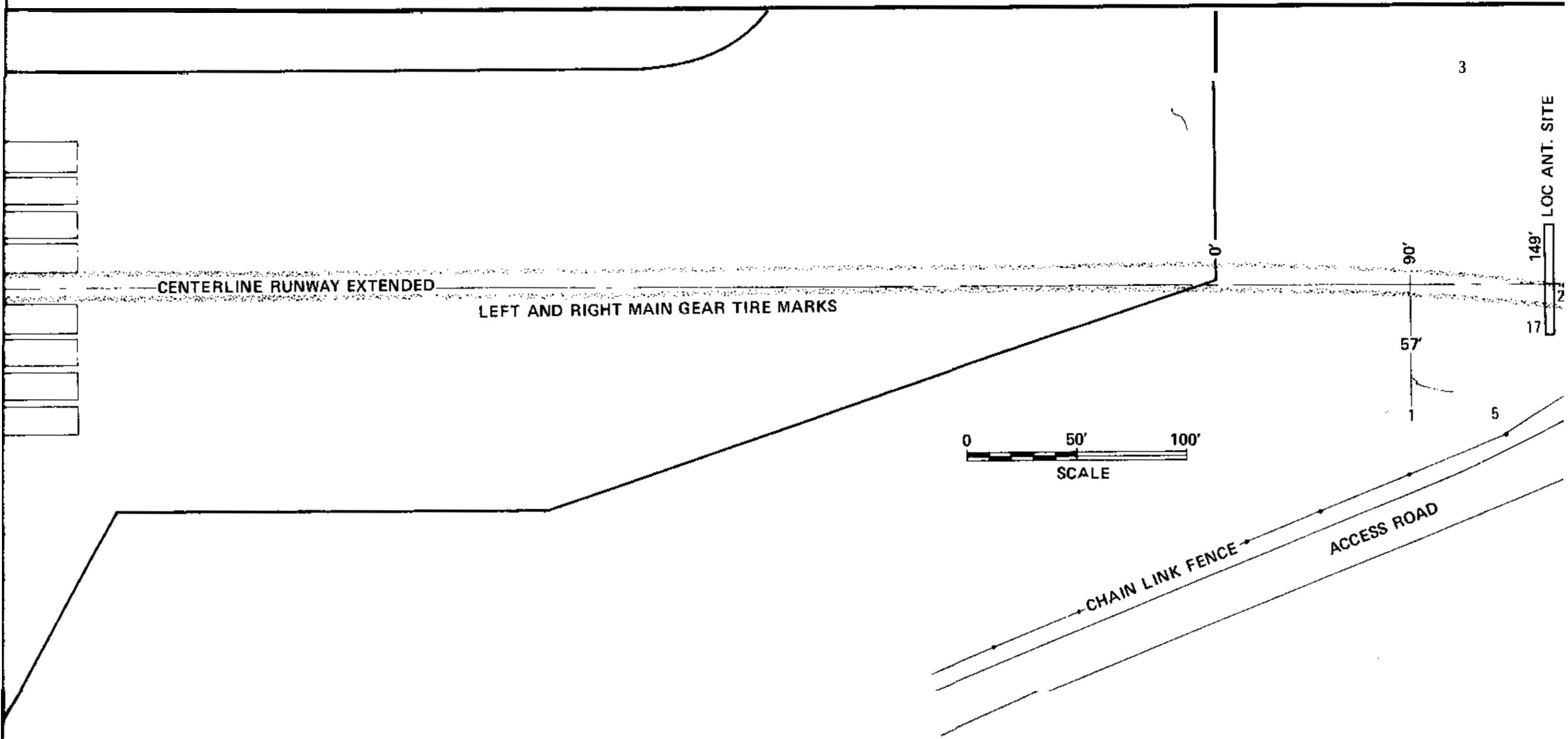
A AUTOMOBILE

T TRUCK

1 FIRST INDICATION OF FIRE LOCALIZE

2 AREA OF FIRE DAMAGE (INCLUDES 4

FIRE AREA



POINT OF

NCE – PIECES

VICE PANEL

EVICE ATTACHED

CTION OF TRAVEL

SYMBOL KEY:

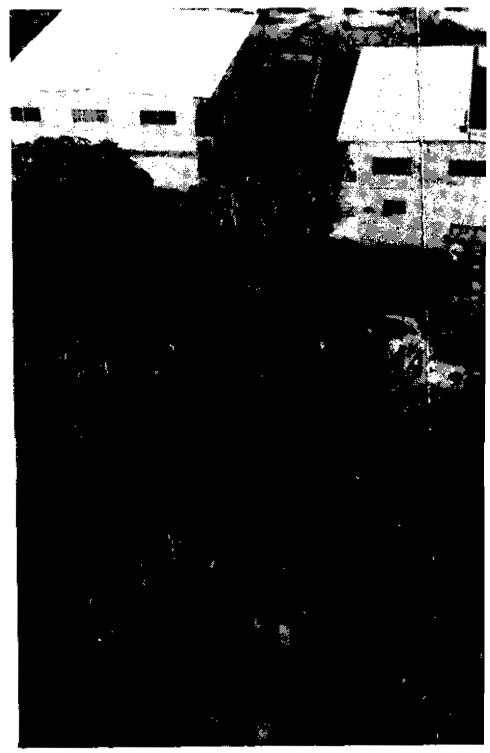
Ⓐ AUTOMOBILE

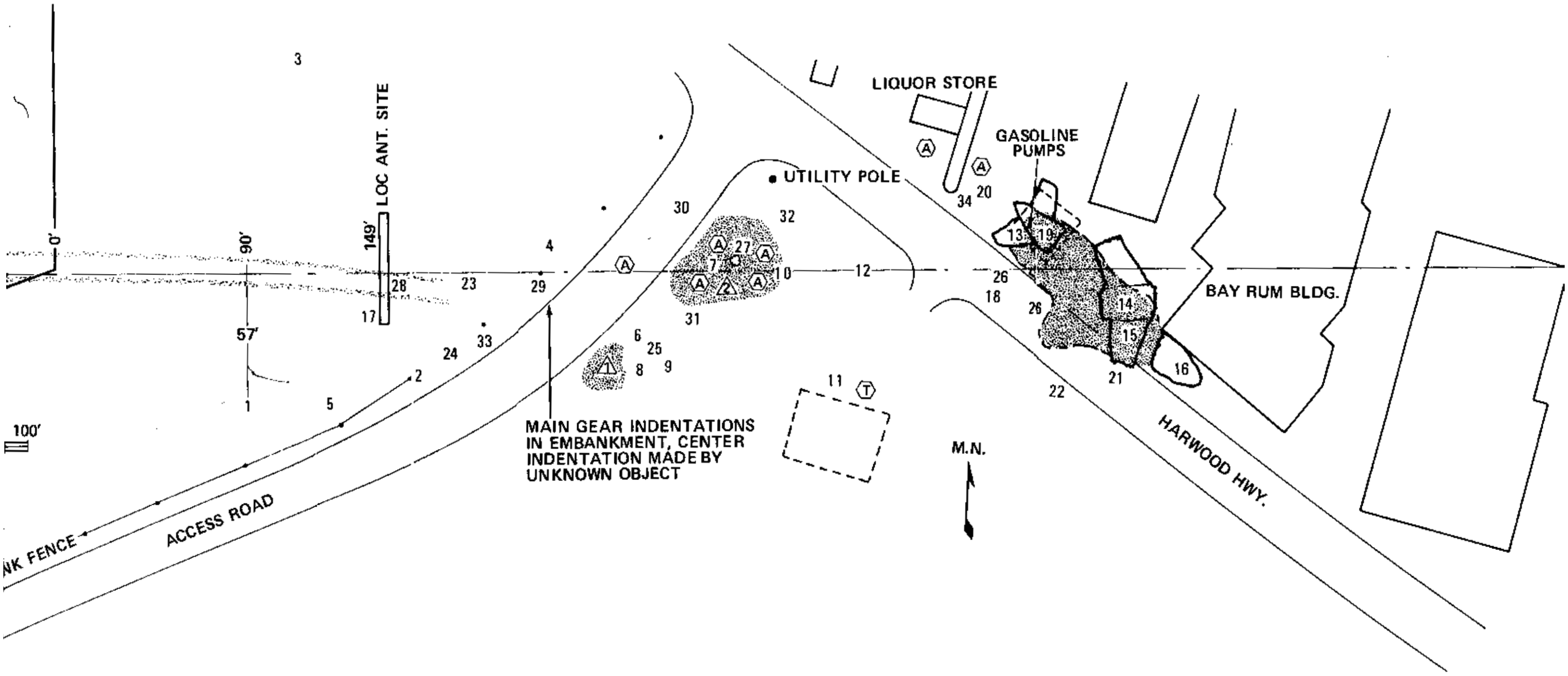
Ⓣ TRUCK

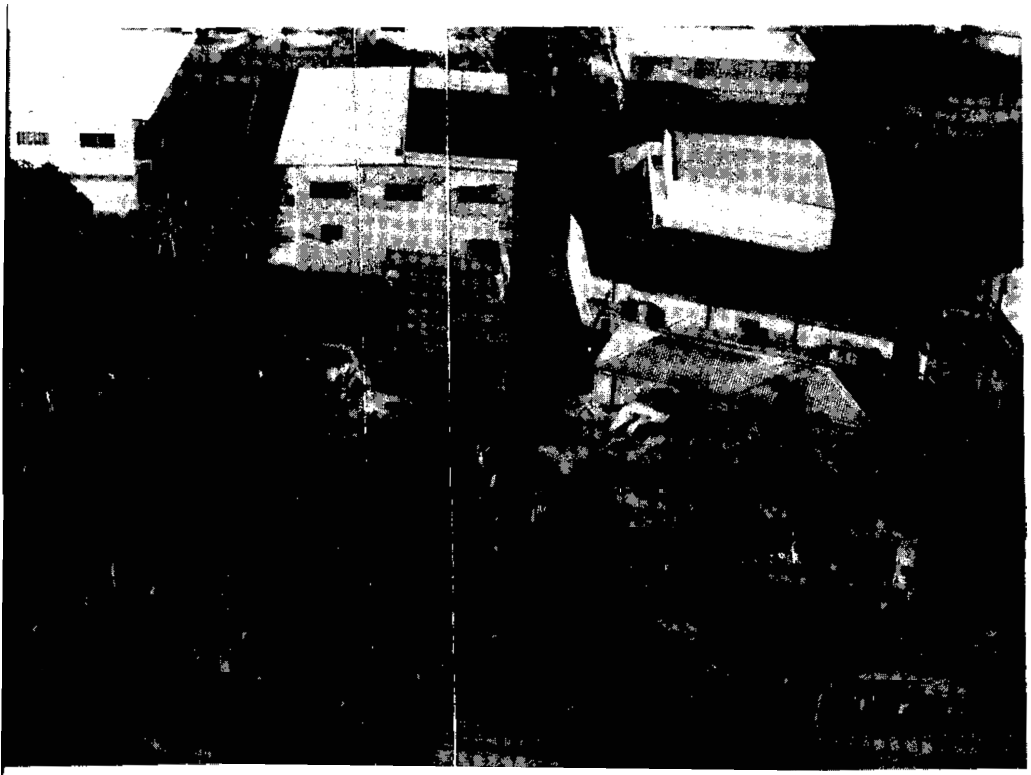
⚠1 FIRST INDICATION OF FIRE LOCALIZED

⚠2 AREA OF FIRE DAMAGE (INCLUDES 4 AUTOMOBILES AND 1 TREE)

FIRE AREA







NATIONAL TRANSPORTATION SAFETY BOAR
WASHINGTON, D.C.

WRECKAGE DISTRIBUTION CHART
AMERICAN AIRLINES, BOEING 727-N196:
HARRY S TRUMAN AIRPORT
CHARLOTTE AMALIE, ST. THOMAS, VIRGIN ISLANDS
APRIL 27, 1976

APPENDIX G

AIRPORT ANALYSIS

BOEING 727-100

30° FLAPS

LANDING WEIGHTS

Caribbean
Page 3
Aug 18-75

STATION	CODE	RUNWAY NO.	RNWY COND	EFFECT LNDG LENGTH FT.	ZERO WIND WEIGHT LBS.	MINIMUM HEADWIND	ADD LB/KT HDWND	CRIT TAIL WIND	SUBT LB/KT ABOVE CRIT TLWND	** ARPT CRIT TEMP °F
ST,. THOMAS ELEV. 11'	STT	9	WET	4650	122700W	20	780	NJA	NIA	120
		9	DRY	4650	135000	20	0	NIA	AIA	/120
		21	N/A	N/A	NJA	N/A	N/A	N/A	N/A	

LANDING NOT AUTHORIZED WITH NOSE WHEEL BRAKES, ANTI-SKID OR THRUST REVERSERS INOPERATIVE.

W INCREASE THIS WEIGHT BY AMOUNT SHOWN FOR EACH KNOT OF HEADWIND I9 EXCESS OF 20 KTS. DO NOT EXCEED 135000 LBS. AFTER APPLYING ALL CORRECTIONS.

40° FLAPS

STATION	CODE	RUNWAY NO.	RNWY COND	EFFECT LNDG LENGTH FT.	ZERO WIND WEIGHT LBS.	MINIMUM HEADWIND	ADD LB/KT HDWND	CRIT TAIL WIND	SUBT LB/KT ABOVE CRIT TLWND	** ARPT CRIT TEMP °F
ST. THOMAS ELEV. 11'	STT	9	WET	4650	127000#	0	825	0	3000 1)	120
		9	DRY	4650	136000#	0	0	0	2800 2)	120
		27	NA	NA	NA	NA	NA	NA	NA	NA

\# DO NOT EXCEED 135000 LBS AFTER ALL CORRECTIONS APPLIED.

LANDING NOT AUTHORIZED WITH NOSE WHEEL BRAKES, ANTI-SKID OR THRUST REVERSERS INOPERATIVE.

1) LANDING AUTHORIZED WITH UP TO 4 KTS TAILWIND COMPONENT AFTER APPROPRIATE WEIGHT ADJUSTMENT.

2) LANDING AUTHORIZED WITH UP TO 6 KTS TAILWIND COMPONENT AFTER APPROPRIATE WEIGHT ADJUSTMENT.

NOTES:

** Subtract 475 lbs for each degree F above Crit. Temp.

APPENDIX H

AMERICAN AIRLINES, INC.
Flight Office
New York

May 21, 1971

TO: B-727 International Pilots - Caribbean

FROM: Manager, Flight - New York

SUBJECT: St. Thomas and St. Croix Flights

Harry S. Truman Airport (MIST/STT) at Charlotte Amalie, St. Thomas Island, U.S. Virgin Islands, is located at 18" 20.3' N., 64° 58.1' W, sixty-two NM East of San Juan International Airport.

The total length of runway 09-27, and overrun is 5150 feet. The full width runway is 200 feet wide and 4650 feet long, with a 100 feet wide, 500 feet long overrun on the east end. This overrun is only half the runway width and extends on the north side.

The approach plate for St. Thomas indicates that runway 09-27 is grooved. Actually, the first 1000 feet of runway 09 is not grooved but the remainder is grooved in the center 140 feet, although the runway is 200 feet wide.

The runway is located on the Southwest side of the island, in a pocket of hills. This location gives St. Thomas its own peculiar wind conditions. With other nearby airports reporting winds from the East or North of East, St. Thomas can have winds from the Southeast. The normally gentle trade-winds increase in velocity and change direction, locally, as the winds curl around and over the island's hills.

A mini-mountain wave exists on the approach to and over the airport when the winds exceed 15 knots from a Northeasterly direction. Turbulence increases as the winds increase above the 15 knot level. The cause for the mountain wave is a WNW-ESE oriented ridge that rises to 1709 feet approximately two miles Northeast from the runway. Turbulence from rotors is present below 1000 feet and a downdraft exists between approximately 1000 feet and the hilltop elevation over the airport and to the East when wind direction and speed are at or above values that establish a wave.

An exception has been made to Flight Manual Part One (FM2 C-1, March **14,** 1971), "in that DAY VFR approaches are authorized at STT provided....... THE STT WEATHER CLOUD BASE IS REPORTED AT **3000** FEET ***OR*** MORE **AND** THE VISIBILITY IS 3 MILES OR MORE **AND** THE FLIGHT **HAS** RECEIVED APPROVAL TO MAKE A VFR APPROACH. When approaching STT, from DUTCH or CULEBRA, and having received authorization for a VFR approach -- the course shall be altered ***so*** as to pass over Savana Island, thence turning left for a straight-in approach to runway **9.** This exception to Part One is not to be construed as endorsing unwise or imprudent operating practices."

All St. Thomas take-offs and landings will be made by the Captain.

For landing at St. Thomas, the use of *40* degrees flaps is the standard practice. With strong, gusty winds, use **of** *40* degrees, or **30** degrees flaps for landing, is at the Captain's option. With a wind component of 20 knots or more, landing with **30** degrees flaps is recommended. When the airport analysis permits a tailwind landing, use of *40* degrees flaps is required. Refer to the airport analysis for flap usage and authorized wind components.

It **is** required that pilots make *40* degree flap landings at other **air-**ports, prior to a St. Thomas entry, to become more familiar with the different characteristics of the aircraft between **30** degrees **and** 40 degrees flap landing.

Jet landings are permitted only to the East on runway **09.** Landings are PROHIBITED on runway 27.

The St. Thomas VASI system consists **of** two single box displays on either side of runway **09** and are located at 550 feet and 1050 feet from the approach end.

Approaching the airport, **on** the VASI, be alert to the possibility of **a** "sinker" at approximately 500 feet and another at approximately 100 feet on the glide slope.

The VASI slope (2.5 degrees) intersects runway **09** at **800** feet from the approach end.

Your aiming point should be **1000** feet down the runway and an immediate decision to go-around must be made if the touchdown will be appreciably beyond this point. If a bounce occurs on the initial touchdown, a go-around should be initiated. There is **NOT** enough room for a go-around following a second touchdown.

If the airplane is landed long (beyond the 1000 feet point), the airplane will tend to float, as the winds pass through the "venturi effect" of the hill where the control tower is located, and the hill to the North of the runway.

The target touchdown aim point is **1000** feet, ± zero, for all approachee. The ever present "sinker" could cause an early touchdown from a low approach. There is no apron to the runway, the end of the runway is the water.

The aircraft must be landed on target, **on** airspeed. If you are not in the "slot", execute a go-around.

During the Caribbean Airport Qualification Film for St. Thomas, the VOR missed approach procedure **is** narrated immediately after a visual approach **is** made to runway ***09***. This procedure is for the VOR and should **not** be confused with the normal go-around procedure if the landing is rejected. Refer to your approach plate and Operating Manual for further clarification.

Using the recommended procedure of adding to Reference speed, one-half the steady wind component, and all the gust factor, up to a maximum of **20** knots, the V_{ref} at St. Thomas **will** be 116-120 knots. (Refer to B-727 Operating Manual, Section **3A**, Page **13.)**

With a target IAS on the approach of 120-125 knots, the aircraft is passing up runway at the rate of 200 feet per second. The airplane must be flown onto the ground. Do not hold it off!

Maintain Bug speed until arresting the rate of descent, then start reducing the thrust levers to idle just prior to touchdown. Touchdown may occur as low ***as*** **5** knots below Bug speed.

The following modified technique for reversing should be used. It will effectively shorten landing distances and the amount of braking required **(AAL** Bulletin 132-71).

After the main gear is firmly on the ground, the speed brakes should be raised as the nose wheel is being lowered to the runway. **Also**, prior to nose wheel contact, reverse levers should be brought to the reverse IDLE position. After positive nose wheel contact (to assure nose wheel steering), reverse power should be increased immediately as required. Under no circumstances should power be applied above IDLE, until the nose gear is firmly on the ground.

> NOTE: Both reverse thrust and speed brakes pitch the airplane up. It is important, therefore, that the nose is started down prior to speed brake application. This also insures that the airplane is not pulled off the ground inadvertently prior to speed brake extension.

Reverse thrust has its greatest effect at higher speeds ***so*** that full reverse should be used as soon as possible after touchdown.

Brakes should be applied almost simultaneously with speed brakes and reverse thrust application.

Take-offs are permitted in either direction, on runway 09 or runway 27.

When take-offs are made on runway 27, DO NOT apply maximum take-off power while on any portion of the 500 feet overrun. The take-off roll may commence on the overrun, but maximum power is not to be applied until reaching the actual beginning of runway 27. This is very important to avoid blast problems to buildings across the road from the East end of the airport.

When take-offs are made on runway 09, we will use the Red Hook Standard Instrument Departure. For noise abatement, climb as rapidly as possible to 2500 feet. Upon passing the end of runway 09, a 15 degree banked right turn to a heading of 120 degrees is required for obstacle clearance. (The First Officer will call out passing the end of the full length runway.)

The Red Hook SID and the STT 120 radial is the noise abatement climb-out route, but for your information, for noise abatement, pilots are to remain on the 120 heading until Southeast of Water Island. No aircraft may pass directly over the City of Charlotte Amalie, or Water Island below 2500 feet, unless otherwise directed by ATC. American Airlines will avoid flying directly over the City of Charlotte Amalie or Water Island.

Fuel is available if needed, but we do not normally fuel at St. Thomas.. The fuel that is available from PAA is obtained by defueling inbound PAA aircraft. When inbound to St. Thomas consider your fuel requirements. Too much fuel on board could reduce your departure pay load and, of course, you know the pitfalls of insufficient fuel, one runway airports, strong winds, rain showers, disabled aircraft on the runway, etc.

For short segment operations (i.e., St. Thomas - St. Croix, St. Thomas - San Juan), the minimum fuel required for take-off may be reduced to 10,000 pounds. This in no way negates the requirement for prudent planning that considers all factors involved, with safety being the paramount feature (AAL Bulletin 132-71).

For routings airway information, frequencies, position reports, etc., refer to current Jepco charts, the AAL Flight Planning Manual, the International Flight Information Manual and International NOTAMS.

It is most important that you read all of the notes on the charts, approach plates, etc. (airspace restricted areas, airway directional altitudes, transition levels, transition altitudes, etc.).

Know your route, INS, Loran inoperative, HF out routings and emergency airports.

Flight Assistance Service. New York radio operates an Air/ground radio service on 6568 KHz along with other stations, coordinating the relay of weather and position reports, air traffic control information and offering flight assistance to pilots in flight by radio contacts. A PIREP reporting service concerning weather conditions encountered in flight is offered to enroute pilots as an aid to navigation in areas of severe weather.

JFK to MIST Routing

Loran check should read **3190** on Station **3H5** at the **AAL** JFK gates.

New York to St. Thomas flights will normally fly the JFK Porpoise SID to Tuna (XTU), then **A-20** to Kraft, Direct STT.

APPENDIX I

May 6, 1976

J. A. Brown

H. C. Milton

<u>RE-EMPHASIS ON SLOT APPROACH</u>
<u>REQUIREMENTS AND LANDING TECHNIQUES DURING SIMU-</u>
<u>LATOR TRAINING & LINE CHECKING</u>

We need to re-emphasize the Slot Approach, Landing Techniques and Go-Around procedures during initial, recurrent training and line checks on all equipment in accordance with Operating Manual procedures. (Pertinent B-727 procedures attached.)

During this exercise, the following points should be stressed:

1. Stabilized Approach....in the Slot or <u>Go-Around</u>. (Section 3A, Page 12)

2. Touchdown to be made on or near the 1000' point....with firm corrective action to be taken by the Supervisory Pilot Instructor if any tendency to hold the aircraft off the ground is noted. We can tolerate only a 1° to 2° increase in deck angle to reduce (but not stop) the rate of sink. (Section 3A, Page 13....floating before touchdown and its effect on landing distance, including increased engine thrust response time.)

3. A Go-Around should never be attempted - particularly on a <u>minimum</u> length runway - unless more than adequate runway remaining is known to exist. Preliminary calculations for the B-727 show that you will use up more runway to Go-Around from idle RPM than it would require to stop without reverse thrust. This should be demonstrated in the simulator, using full flaps to simulate minimum performance condition. (Section 3, Page 57)

4. Emphasize the <u>minimum</u> length required to go-around - including engine acceleration times - following a touchdown on all our aircraft. Operational Engineering is calculating the Go-Around versus stopping distances required for all aircraft using a two-second delay in the throttle advance following touchdown and I will forward the results when received.

APPENDIX I

Acceleration times for engines leaving test cell - idle to T/O thrust are approximately:

JT-8 --------	8 seconds
JT-3 --------	8 seconds
CF-6 --------	4.5 seconds
JT-9 --------	5 seconds

There is some deterioration with length of time in service.

5. Emphasize:

   a. If a Go-Around must be made -- Go-Around Techniques, including thrust application, throttle position with varying temperatures, etc.

   b. That a Go-Around following initiation of reverse actuation is <u>NOT RECOMMENDED</u>!

If the inclusion of these demonstrations require eliminating some other maneuver, would suggest pitchup.

Please advise.

H. B. Benninghoff

cc - D. E. Ehmann
A. M. Reeser

Attachments:

APPENDIX J

M. W. EASTBURN
DIR. SAFETY

American
Airlines

LA GUARDIA FIELD

BULLETIN

TO: Pilots 6 Flight Engineers Number 223-76

FROM: Vice President Flight May 10, 1976

SUBJECT: MANAGING THE APPROACH/LANDING

I'm sure all of you have read and heard a great deal about our tragic accident at St. Thomas.

A great amount of investigative work has been done, but much remains to be done. The ultimate finding as to cause of the accident is of course a decision for the NTSB to render. We therefore do not presume to pre-empt the Board and make a prejudgment in the matter.

However, our daily operations must continue and I would therefore like to take the opportunity to review certain elements of all approaches and landings with you.

We have in our Operating Manuals a graphic depiction (in Section 3A) of what we call the "slot," the beginning of which is the normal decision point with regard to whether to proceed with the landing or to pull up. The target touch-down point, also graphically depicted, is 1000'. Granting that adverse atmospheric conditions may extend this point somewhat, we should virtually always have the airplane on the runway by at least the 1500' point. It's far better to "put it on" the runway, even if it will be a firm landing, than to allow it to float or to hold it off, striving for a smooth landing. Floating "eats up" runway very rapidly. In the case of the 727, deceleration on the runway is about three times greater than in the air.

While the normal decision point, as just stated, is at the beginning of the slot (approximately the middle marker), any necessary go-around should virtually always be initiated no later than the target touch-down area.

In addition to your position down the runway, another important consideration in the go-around decision is the state of the engines at initiation of the go-around. If they are spun down to idle rpm,

APPENDIX J

Bulletin 223-76
Page 2

remember to count on about eight seconds to obtain go-around power on the 727 and 707 (four to five seconds on the DC-10 and 747). Waiting for this power recovery will rapidly use up runway. Any obstacle beyond the end of the runway will therefore require an earlier decision and initiation of the go-around. Never attempt to salvage a landing from a bad final approach.

Finally, let's all review our standard procedures and practices, and the guidance material in the Operating Technique section of our manuals - all of which represent a lot of thought and inputs from a lot of sources. And let us move forward in the establishment again of a safety record that dispels the notion of the inevitability of an eventual accident in a large operation such as ours. Instead, let's embrace the notion that accidents do not have to happen in our business.

Captain D. E. Ehmann

Distribution
Lists 12
13
14A & B

APPENDIX K

FLYING OPERATIONS

BULLETIN

Subject: Truman Airport Operations	No: FM2 C-13 Date Aug 16-76

FILE Flight Manual Part Two-Caribbean Coverage in front of STT Approach Chart 11-1. Remove FM2 C-7 and C-12.

1. An exception is made to Flight Manual Part One in that DAY VFR approaches are authorized at STT provided ..... THE STT WEATHER CLOUD BASE IS REPORTED AT 3000 FEET OR MORE AND THE VISIBILITY IS THREE MILES OR MORE AND THE FLIGHT HAS RECEIVED APPROVAL TO MAKE A VFR APPROACH. When approaching STT, from DRINK or CULEBRA and having received authorization for a VFR approach, the course shall be altered so as to pass over Savana Island, thence turning left for a straight-in approach to Runway 9. This exception to Part One is not to be construed as endorsing unwise or imprudent operating practices.

2. B-727/100 are the only aircraft authorized to serve STT.

3. Landings will be made on Runway 9 only.

4. All landings and take-offs at Truman Airport will be made by the Captain.

5. The point during the approach and landing where the decision is made to land and stop or execute a go-around is most important to a safe operation at this airport. The following guidelines must be adhered to:

-Any decision to go-around should normally be made and initiated at the threshold and definitely no later than at the 1000' touchdown markers if still airborne.

APPENDIX K

Page -2-

-Go-around shall not be attempted after the aircraft has touched down on the runway, and the landing should be continued to a stop -- recognizing the full stopping capabilities of the 727 with spoilers, main and nose gear brakes. Stopping distances from touchdown for all brakes with and without reversing at 125,000 lbs follow:

	40°	30°
SPOILERS & ALL BRAKES	Wet 2040' Dry 1725'	Wet 2235' Dry 1843'
SPOILERS, ALL BRAKES AND REVERSERS	Wet 1670' Dry 1575'	Wet 1795' Dry 1675'

6. Flap Usage
The standard landing flap setting is 40 degrees. With 40 degree flaps the minimum target airspeed on approach is V_{REF} plus 10 knots with a maximum (including wind and gust additives) of V_{REF} plus 20 kts. With a steady state headwind component of 15 knots or more, 30 degree flap landings may be made at the Captain's option, on a dry runway at a weight depicted in the Airport Analysis. Thirty degree flap landing weights that meet FAR field length for less than 15 knots headwind component are shown on an additional table in the Airport Analysis. Thirty degree flap landings with less than 15 knots headwind component require the use of the Captain's emergency authority and submission of an OF-27.

7. If the steady state wind is reported greater than 25 knots or gusts of this value are reported with such frequency as to make probable the exposure to these gusts during the landing, the flight should proceed to an alternate.

8. Tailwind landings on a wet runway are not authorized. Tailwind landings are authorized only with 40 degree flaps on a dry runway with a maximum of four knots in accordance with Airport Analysis.

APPENDIX K

Page -3-

9. Landings and take-offs are not authorized during precipitation and/or with standing water on the runway.

10. Landing on Runway 9 when wet requires a 10 knot headwind component with 40 degree flaps to provide a cushion of 300 feet of runway.

11. The maximum take-off gross weight limitation for Runway 9 will be based on a zero headwind component when the wind direction is between 110° and 160° and the velocity is 15 knots or greater.

12. Night take-offs from Runway 9 are not authorized if obstruction lights, including Sara Hill, are inoperative.

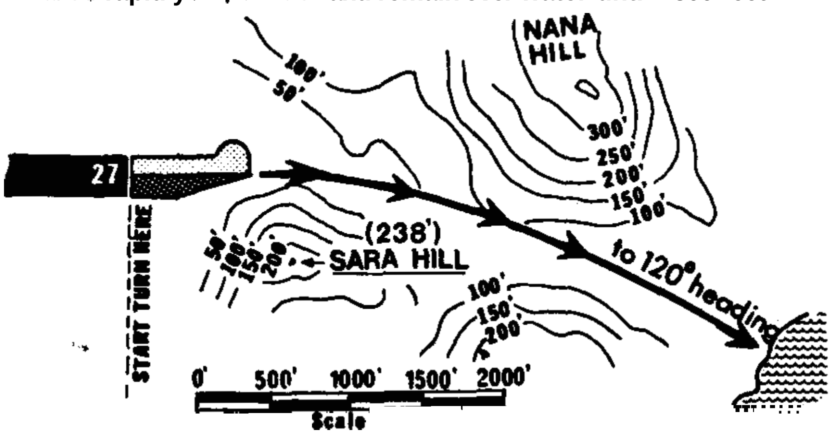
13. For take-off on Runway 9, a right turn (15° bank) to 120° will be initiated at the end of the runway.

14. For take-off on Runway 27, the 500 foot over-run may be utilized provided a left counter clockwise turn is made into position and maximum take-off power is not applied until the aircraft is on the full width runway.

RUNWAY 9 TAKEOFF FLIGHT PATH PROFILE

Start turn to 120° at the end of the full width runway.

Climb as rapidly as possible and remain over water until 2500 feet.



Capt. D. A. Wetherbee
Manager Flight - NYC

Capt. A. M. Reeser
Director Flying Procedures

List: 620