Runway overrun, Western Air Lines, Inc., Boeing 737-200, N4527W, Casper , Wyoming, March 31, 1975

Micro-summary: **Following a nonprecision approach, this Boeing 737 overran the runway.**

Event Date: **1975-03-31 at 0743 MDT**

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

Investigative Body's Web Site: **http://www.ntsb.gov/**

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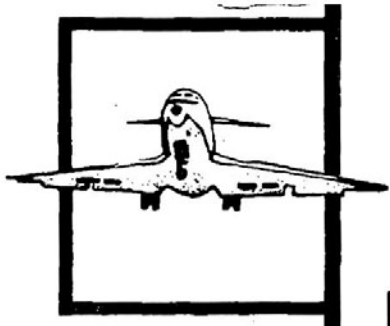

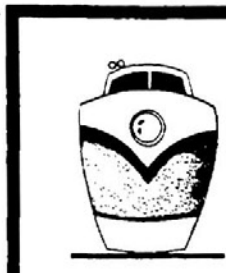

NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

AIRCRAFT ACCIDENT REPORT

WESTERN AIR LINES, INC.
BOEING 737-200, N4527W
CASPER, WYOMING
MARCH 31, 1975

REPORT NUMBER: NTSB-AAR-75-15

UNITED STATES GOVERNMENT

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File No. 1-1001

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D. C. 20594

AIRCRAFT ACCIDENT REPORT

Adopted: October 30, 1975

WESTERN AIR LINES, INC.
BOEING 737-200, N4527W
CASPER, WYOMING
MARCH 31, 1975

SYNOPSIS

At 0743 on March 31, 1975, Western Air Lines, Inc., Flight 470, overran the departure end of runway 25 at the Natrona County International Airport, Casper, Wyoming. The landing was made following a nonprecision approach on a snow-covered runway, with a following wind, and during reduced visibility. The aircraft was damaged substantially.

Of the 99 persons aboard the aircraft, 4 were injured. Of these four injuries, three occurred during the evacuation.

The National Transportation Safety Board determines that the probable cause of the accident was the failure of the pilot-in-command to exercise good judgment when he failed to execute a missed approach and continued a nonprecision approach to a landing without adequately assessing the aircraft's position relative to the runway threshold. Contributing to the accident were the excessive height and speed at which he crossed the approach end of the runway and the failure of other flight crewmembers to provide him with required callouts.

1. INVESTIGATION

1.1 History of the Flight

On March 31, 1975, Western Air Lines, Inc., Flight 470, a Boeing 737-200, N4527W, operated as a scheduled passenger flight from Denver, Colorado, to Minneapolis/St. Paul, Minnesota. The first en route stop was Casper, Wyoming.

Before Flight 470 departed Denver, the captain discussed the weather, visibility, and runway conditions at Casper with the company dispatcher in Los Angeles, California.

The flight departed Denver at 0703 1/ with 99 persons, including 6 crewmembers, aboard. It was cleared to Casper in accordance with a stored instrument flight rules (IFR) flight plan. The assigned en route

1/ All times herein are mountain daylight, based on the 24-hour clock.

flight level (FL) was 220. The flight was uneventful during takeoff, climb, and cruise.

Before the descent to Casper, the second officer prepared a landing data card which was based, in part on the 0700 Casper weather report. The card contained the following data:

> Ceiling--indefinite, 800 feet, sky obscured; visibility 1 mile, light snow; temperature--23°; dew point--19°; wind--050° at 12 kn; altimeter--29.68. The aircraft's gross weight--93,300 lbs.; the go-around engine pressure ratio--2.11; reference speed for approach--126 kn indicated airspeed (KIAS) at 40° flap setting, and 130 KIAS with 30° of flaps.
>
> A notation at the bottom of the card indicated "R/W 07 VR 7/8 Vl 2/ use 30 flaps for en route icing."

Flight 470 was about 40 nmi from the Casper VOR 3/ when Denver Center terminated radar service. At 0736, following a descent to 12,000 feet, 4/ the flightcrew contacted Casper approach control and advised that the flight was about 12 nmi south of the Evansville Intersection. 5/ At that time, the controller cleared the flight to use the localizer back course approach for runway 25, to circle to runway 3, or to land straight in. The Casper weather was given as an "indefinite ceiling, 800, sky obscured, visibility 1, variable with light snow, visibility 3/4 variable, 1 1/2. Visibility does appear lower west than east; it appears right on one east and we have a strong one west." The wind was given as "040° at 9." One minute later, the approach controller advised that "runway 7/25 has been plowed. There's about a 1/4-inch of powder snow on it. Braking action reported, Convair 580, as poor. Runway 3/21 is being plowed at this time."

Incoming Frontier Flight 80 was also on the approach control frequency. At 0740, the controller gave Frontier 80 the local weather conditions and indicated that the wind was 50° at 10 kn.

At 0751, Flight 470 reported at the Henning Intersection 6/ and was cleared to contact the Casper Tower. The tower controller cleared the flight to land on runway 25 and gave the wind as 030° at 8 kn. The

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2/ Runway 07 visibility range - 7/8 mile variable to 1 mile.
3/ Very High Frequency Omnidirectional Range.
4/ All altitudes herein are mean sea level unless otherwise indicated.
5/ The intersection of the Natrona County International Airport ILS back course localizer and the 156° radial of the Casper VOR.
6/ The intersection of the back course localizer to runway 25 and the 184° radial of the Casper VOR.

flight was also advised by the controller that a disabled snow blower was "just west of the intersection runway 21, left side runway 25, on the edge...." The flightcrew acknowledged the transmission but asked which runway was cleared. Following the controller's statement at 0742 that "Runway 25 is cleared for landing," the flight asked for the wind report and was told again that the wind was 030° at 8 kn.

During postaccident interviews, the captain stated that the aircraft and its systems operated normally and that he was flying the aircraft throughout the flight. He recalled that the aircraft crossed the Evansville Intersection at 7,600 feet and the clearance to make a back course localizer approach was received about that time. He said that he accepted this approach because prevailing conditions met approach criteria; however, he stated that he had mentioned to the other crewmembers the possibility of executing a runway 25 missed approach. If he did make a missed approach, he would proceed over the field and begin a front course ILS approach to runway 07. He said later that he had considered the wind and braking reports and the reports were acceptable. The first officer stated also that beginning a back course approach presented no problems to him and that it was routine for the tower to clear aircraft for straight-in approaches and landings when winds were less than 10 kn.

Both pilots stated that the aircraft was in the approach configuration, flaps 25°, landing gear down, airspeed 150 KIAS, and altitude 6,800 feet. At Henning, both pilots began to time the distance from the final approach fix to the missed approach point (MAP). At 0741:09, the captain stated that the elapsed time would be 1 minute 38 seconds; however, the first officer said later that he had estimated the time to be 1 minute 20 seconds after he applied a wind factor. The Jeppesen approach plate, which both pilots were using, lists a time interval of 1 minute 26 seconds and a descent rate of 1,040 feet per minute at a ground speed of 140 KIAS. The distance between the two points is 3.8 nmi and the altitude difference is 1,140 feet.

At 0741:42, the first officer called out "thousand to go to the field." 7/ Then, at the captain's direction, the first officer set the 201° radial of the Casper VOR in the window of his course deviation indicator. At 0742:09, the first officer called "approaching minimums," and 12 seconds later, he called "just about at minimums." The cockpit voice recorder (CVR) recorded increasing engine noises at this time.

Both pilots stated that the aircraft flew level for a few moments at the minimum descent altitude (MDA). Four seconds later, or at 0742:25, the first officer called the runway in sight directly below the aircraft. Both pilots recalled that the airspeed was 150 kn., with the trailing edge flaps set at 25°. The first officer estimated the aircraft's distance to the runway threshold to be 1/4 mile when he first sighted the runway. When the first officer indicated that he had the runway in

7/ Field elevation is 5,348 feet.

sight, the captain, who was flying by instrument reference, glanced out and estimated the same distance to be 3/4 to 1 mile. The captain stated that from the point where he first sighted the threshold and the high intensity runway lights, which he said were clearly distinguishable, he could see the snow blower and about 1,000 feet of runway beyond the first runway intersection. The intersection is about 1,500 feet from the threshold. The captain requested a 40° flap setting; however, the second officer told the captain that 30° flaps were all that could be used. The captain then asked for a 30° flap setting, and the landing was made with a 30° flap setting. The captain stated later that descent was normal from MDA and that an "excessive" rate of descent did not develop. The first officer agreed. As the aircraft crossed the threshold, the second officer made a cabin announcement for the flight attendants to be seated.

According to the first officer, the airspeed as the aircraft crossed the threshold was reference speed +15 kn, and he began to look for runway distance markers but didn't see any. He recalled that after the aircraft was flared, it did not float. The touchdown was firm on the snow-covered runway, and the wing ground spoilers deployed normally. The first officer later said that "...shortly after the engines were placed in reverse, the red runway edge lights 8/ came into view." He believed that the aircraft touched down about 2,400 feet from the threshold. He was not apprehensive until he saw the runway's end.

According to the captain, the aircraft crossed the threshold at 200 to 250 feet above the ground and at an airspeed of "not over 20" kn above reference speed. He thought that he had touched down about 1,000 feet past the first runway intersection. He stated that although it was farther than he wanted, he was not concerned about using excessive runway. He started an early flare which he attributed to the 320-foot lateral placement of the runway edge lights. After he realized the actual height above the runway, he executed a step-down flare that caused the aircraft to float. The flare began at a speed of about V_{ref} + 15 kn. Although he didn't like the step-down flare as he performed it, the captain stated that it was acceptable to him. He then pushed the aircraft onto the runway ; the landing was firm, but not hard. The antiskid system released once and then operated normally. The captain tried to engage the thrust lever reversers several times before both reversers began to operate simultaneously. Directional control of the aircraft was not a problem throughout the landing. The first indication that the landing was in jeopardy, according to the captain, was when he saw what he believed were the red runway edge lights. The captain then realized that there was not sufficient runway length remaining to attempt to go around. He then attempted to steer the aircraft away from the approach light structure.

Based on the length of the aircraft's tire tracks in the snow, the touchdown point was near the centerline and about 2,375 feet from the

8/ Investigation and testimony at the public hearing disclosed that the runway edge lights on the last 1,700 feet of runway 25 are amber, not red. The only red lights are those which mark the departure end of the runway.

departure end of the runway, about 6,306 feet from the approach end of the runway.

The aircraft went off the departure end of the runway to the right of the centerline. The pilot stated that the nose wheel steering was adequate to take the aircraft to the right of the approach light structures. After striking several metal stanchions in the first row of terminal bar lights, which were locatd 200 feet off the end of the runway, the aircraft struck a shallow irrigation ditch 280 feet off the runway end. The aircraft veered farther to the right and stopped about 800 feet beyond the departure end of the runway on a magnetic heading of about 008°.

At 0743:27, the first officer notified the tower to call the fire trucks.

1.2 Injuries to Persons

Injuries	Crew	Passengers	Others
Fatal	0	0	0
Nonfatal	0	4	0
None	6	89	

1.3 Damage to Aircraft

The aircraft was damaged substantially.

1.4 Other Damage

Three approach lights on the first row of terminal bar lights, located 200 feet from the departure end of runway 25, were destroyed.

1.5 Crew Information

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

The flightcrew had received training in all nonprecision approaches; however, their training records showed that such approaches had been made from VOR navigational facilities. According to the captain, he had made several back course ILS approaches recently on regular scheduled flights. During these approaches, the visibility had been such that he was able to see the runway environment early enough to permit him to decend over the threshold at an acceptable height and speed. The critical maneuver in the nonprecision approach is the descent from minimum decent altitude to the runway touchdown zone; however, the captain did not have training or line experience where he had flown to a point immediately before the MAP without the runway environment in sight and where he was required to make a decision to land straight-in or to begin a missed approach.

1.6 Aircraft Information

The aircraft was certificated, equipped, and maintained in accordance with Federal Aviation Administration (FAA) requirements. (See Appendix C.) The gross weight and c.g. were within prescribed limits during take-off and landing.

1.7 Meteorological Information

The terminal forecast for Casper, issued by the National Weather Service Forecast Office at Cheyenne, Wyoming, at 0340 on March 31, 1975, valid for 24 hours beginning at 0400 was, in part:

0400 - 1400: Ceiling -- 3,000 feet overcast, visibility -- 5 miles, light snow, occasional ceiling -- 1,000 feet, obscuration, visibility -- 2 miles, light snow.

The official surface weather observations at Casper near the time of the accident were as follows:

0624 - Special, indefinite ceiling -- 800 feet obscuration, visibility -- 1 mile variable, light snow, wind -- 040° 14 kn, altimeter setting -- 29.68 inches, runway 07 -- runway visibility 1 1/4 miles, visibility -- 3/4 mile variable to 1 1/2 miles.

0656 - indefinite ceiling -- 800 feet obscuration, visibility -- 1 mile variable, light snow, temperature -- 23°F, dew point -- 19°F, wind -- 050° 12 kn, altimeter setting -- 29.68 inches, runway 07 runway visibility -- 7/8 variable to 1 mile, visibility -- 3/4 mile variable to 1 1/2 miles.

0748 - Special, indefinite ceiling -- 500 feet obscuration, visibility -- 1 mile, variable, light snow, temperature -- 23°F, dew point -- 19°F, wind -- 050° 8 kn, altimeter setting -- 29.70 inches, runway 07 runway visibility -- 7/8 mile variable to 1 1/8 miles, visibility -- 3/4 mile variable to 1 1/2 miles, aircraft mishap.

The area forecast which was issued by the National Weather Service Forecast Office at Kansas City at 0640, March 31, 1975, valid 0700 - 0100, was, in part, as follows:

Significant clouds and weather. Wyoming. Mountains occasionally obscured above 6,000 - 8,000 feet in clouds and snow with visibilities in valleys and plains occasionally below 3 miles, light snow. Tops above 20,000 feet.

Icing. Light, occasional moderate mixed icing in clouds and in precipitation behind cold front. Freezing level 8,000 feet southern Kansas sloping to surface northern Nebraska. Lowering to surface remainder area by 2200.

1.8 Aids to Navigation

The back course instrument approach to runway 25 at the Natrona County International Airport incorporates an ILS localizer signal which is transmitted on 116.3 MHz. The inbound course is 254°. The final approach fix is the intersection of the localizer course and the 184° radial of the Casper VOR, which is located 11.5 nmi from the fix. This fix, designated "Henning," is 3.8 nmi from the approach end of runway 25. An intermediate fix is provided at the intersection of the localizer course and the 156° radial of the Casper VOR. This intersection is designated "Evansville" and is located 9.3 nmi from the approach end of runway 25.

The Jeppesen approach chart, which depicts the Natrona County International Airport localizer back course for runway 25, dated February 22, 1974, was current at the time of the accident and was used by the flightcrew of Flight 470. The chart displayed the 201° radial of the Casper VOR pointing toward the approach end of runway 3. (See Appendix D.)

There were no known discrepancies to navigational aids reported at the time of the accident.

1.9 Communications

No communications difficulties were reported between the flightcrew and the air traffic controllers.

1.10 Aerodrome and Ground Facilities

Runway 25 at the Natrona County International Airport is an asphalt surfaced runway, 8,681 feet long and 300 feet wide. A Jeppesen approach chart notation states that the center 150-foot area of the runway is to be used. The elevation at the touchdown zone is 5,330 feet. High intensity runway lights are placed 10 feet from each side of the runway, or 320 feet apart, laterally. All elements were operating at the time of the accident, and the lights were being operated on the highest intensity setting (step 5). There are no approach lights or visual approach slope indicator (VASI) for runway 25.

Under 14 CFR 139, Certification and Operations, Land Airports Serving CAB-Certificated Air Carriers, Natrona County International Airport, was issued an Airport Operating Certificate effective May 21, 1973. On February 13, 1975, a Grant of Exemption was issued to exempt the airport from safety equipment requirements. The requirements provided for the acquisition of airport firefighting and rescue vehicles which met the requirements of 14 CFR 139.49(b)(2). The exemption terminated on May 15, 1975.

1.11 Flight Recorders

The aircraft was equipped with a Fairchild Model A-100 CVR, serial No. 2524. The CVR was not damaged and a normal readout of the tape was obtained.

The aircraft was also equipped with a Fairchild Model 5424 flight data recorder (FDR), serial No. 5513. The foil medium was undamaged and all parameters had been recorded. There was no evidence of recorder malfunction or recording abnormalities. A normal readout of the tape was obtained. (See Appendix E for approach profile and Appendix F for ground track.)

1.12 Wreckage

The aircraft ran off the runway to the right of the centerline and destroyed three approach lights on stanchions 200 feet off the end of the runway. The aircraft then collided with an irrigation ditch, and the right main landing gear assembly and the right powerplant separated from the aircraft. They were found 460 and 580 feet, respectively, off the end of the runway. The left main landing gear assembly separated partially and rotated aft. The left powerplant remained attached to the aircraft. The nose gear assembly collapsed rearward. The left and right wing trailing edge flaps were in the 30°, extended position. The flap indicator in the cockpit also indicated this position.

There was no evidence to indicate a failure of the aircraft's systems, structure, or powerplants before the aircraft left the runway surface.

Cockpit examination showed differences between instrument settings on the captain's and the first officer's instruments. The captain's airspeed bug was set at 130 kns, while the first officer's was set at 126 kns. The captain's radio altimeter was set at 300 feet, the first officer's at 200 feet.

The altitude warning selector was set at 22,000 feet.

An area of tire on the right main wheel trucks exhibited puncture breaks and scuffs that resembled revered rubber. The damaged tire area extended 3 to 4 inches on the sidewall and was found only on the right main wheel trucks. These trucks had separated from the aircraft when it impacted the irrigation ditch. The scuffing was angled to the tread line.

1.13 Medical and Pathological Information

Medical examination of the crewmembers revealed no evidence of preexisting physical or physiological problems which could have affected their judgments or performances.

During the evacuation, a passenger broke his wrist while helping another passenger.

1.14 Fire

There was no fire.

Casper Ground Control radioed the airport manager, who was in charge of the airport's emergency personnel, that Flight 470 had run off the runway. At the time, the airport manager and all emergency personnel were involved in snow-removal operations. The airport manager, who was supervising snow-removal operations alongside runway 25 when Flight 470 landed, saw the aircraft pass his location and disappear into a snow shower. En route to the accident scene, the airport manager requested that the tower controller give Western Air Lines station personnel clearance to proceed out to the aircraft and requested that Flight 470 be asked to change to the ground control frequency. The first person to arrive at the scene was the airport manager. When he arrived, the aircraft was being evacuated and there was no fire. Approximately 7 minutes, or longer, after the first notification of the accident, the airport's quick-dash firetruck arrived on scene. The firetruck driver did not inspect the wreckage for fire or for fire hazards.

The airport manager later recalled that when he reached the aircraft, he heard the auxiliary power unit running. He also noticed that the flight crewmembers were still aboard the aircraft. After assessing the situation and checking for injuries among the passengers, the airport manager directed his efforts toward getting the passengers transported to an airport hangar. The firetruck was used to help other vehicles transport occupants of the aircraft to an assembly point in the hangar.

1.15 Survival Aspects

This was a survivable accident.

When the aircraft stopped, each pilot opened his side window to determine if there was fire. Both stated that they saw none. The captain attempted to notify the cabin attendants to evacuate the passengers; however, the cabin public announcement microphone had come loose from its holder and could not be dislodged from under the captain's seat. The first officer performed routine cockpit security duties and then performed the "emergency evacuation" checklist to complete securing the cockpit. In his written statement, the first officer stated that, "Jack (the captain) then came up and turned the battery switch off." The fire extinguisher handles had been pulled and rotated as required. However, the pilots did not know if the extinguishers had activated. When the pilots left the cockpit, the evacuation of the cabin was complete.

After the aircraft stopped, the second officer immediately went into the cabin and saw that the passengers were leaving. The flight attendants asked if they were to evacuate, and the second officer answered affirmatively. He then opened the right forward exit door and the slide inflated. According to a flight attendant, the left forward exit door was difficult to open, but with the assistance of the second officer, the door was opened and the slide inflated normally. The second officer went out a forward door and around the left wing, where he helped three passengers

who had left the cabin by the overwing exit. He stated that the aircraft was on its belly. The second officer indicated that the level position of the aircraft aided the evacuation considerably. A flight attendant at the left rear door called to the second officer to straighten the evacuation slide which had partially inflated after being released. After it was straightened, the slide fully inflated; however, it deflated slowly when it was extended fully. The slide was punctured by barbed wire when it fell across a fence.

The flight attendant seated in the forward jumpseat said that after she had inflated the left entry door slide, passengers had opened the coat closet on the left side behind the entry door to retrieve garment bags and were blocking the aisle. She shouted for them to continue the evacuation and pushed the passengers to keep them moving out the exit.

Both flight attendants seated on the aft jumpseat said that during the ground slide, debris was flying around in the cabin. They said that the waste container came out of the storage bin in the aft galley and spilled garbage on the floor. When the aircraft stopped, both flight attendants began to open their respective doors. The flight attendant on the left side could not open the left aft door more than a crack. An off-duty flight attendant, who was sitting in seat 16B, helped her open the left door. The flight attendant then pulled the inflation handle for the evacuation slide, but it only partially inflated until the second officer straightened it.

The flight attendant on the right side went to open the right aft service door and a passenger helped her swing it open. She deployed the slide and began evacuating passengers. Both aft flight attendants stated that when passengers stopped coming to their exits, they saw several passengers in the center cabin area waiting to use the overwing exits. They shouted to the passengers to come to the rear and exit. After all the passengers were out, the flight attendants exited and attempted to assemble the passengers together.

Shortly thereafter, two flight attendants reboarded the aircraft to obtain personal belongings of the passengers and to obtain a first aid kit and oxygen bottles.

During the evacuation, one passenger broke his wrist while helping another passenger.

Of the three minor injuries, two were incurred during evacuation. The third was received when a passenger was thrown about as the aircraft was sliding to a stop.

1.16 Tests and Research

None were conducted.

1.17 Other Information

1.17.1 Uncontrolled Vehicular Traffic

Frontier Airlines Flight 603, a Convair 580, had been awaiting takeoff clearance on runway 25 when Flight 470 made its approach. The flightcrew of Flight 603 saw the aircraft pass above them as they held clear of runway 25. After the landing, Flight 603 was cleared to taxi to the takeoff end of runway 3. The Convair was held in takeoff position for further clearance until the tower controller could verify that the runway was clear of snow-removal equipment. At that time, the controller could not see the entire length of runway 3 because the visibility was reduced in most directions by falling snow. He was relying on information from a county vehicle to report when all vehicles were off the runway.

Immediately after Flight 603 was cleared for takeoff and was on the takeoff roll, the tower controller sighted three vehicles on a midfield taxiway approaching runway 3. Falling snow had limited visibility and the controller did not see the vehicles until they were almost entering the runway. He attempted to stop them by directing a hand-held red tower control light at the vehicles. The other controller attempted two radio transmissions to the aircraft in an attempt to stop it. The transmissions were broken, and a complete, single transmission was not made. The controller believed that the aircraft's speed was too great to stop before reaching the path of the vehicles. The Convair flew 60 to 80 feet above the cars. These vehicles were transporting the passengers from the disabled aircraft to an assembly point in hangar No. 3.

In a statement to the Safety Board, the captain of Frontier Flight 603 said:

> "The tower cleared Frontier 603 down runway 21 to hold in position on runway 3. Taxiing down runway 21 the only ground vehicles I observed were the snow removal equipment at the east side of runway 21. After holding in position on runway 3 for some time, the tower cleared Frontier 603 for take off. I asked the tower if the runway was clear of snow removal equipment; they answered that it was. At about 80 Kts the tower said, 'Frontier 60-,' without finishing the transmission. About two seconds later I made a normal rotation and noticed two vehicles approaching runway 3 from my left at a high-rate of speed. The vehicles continued across runway 3 and we went over the top of them at what I would estimate at between 60 and 80 feet."

1.17.2 Excerpts from Western Air Lines Operations and Training Manuals

Operations Manual

Section 3-12, page 1, dated August 1, 1974:

PILOT NOT FLYING STANDARD CALLOUT PROCEDURES

"All IFR Approaches

A. At final approach fix or outer marker

1. Call altimeter readings and compare with approach plate.

B. Call 1000' above touchdown (above TDZ for approach to straight in minimums or above airport elevation for approaches to circling minimums).

C. Call 500' same as above.

D. Call 100' above minimums.

E. Call minimums

NOTE: ON NONPRECISION APPROACHES (NO GLIDE SLOPE REFERENCE) AT 500' ABOVE FIELD LEVEL, CALL EACH 100' ABOVE FIELD LEVEL.

F. Call deviations of one dot or more from localizer or glide slope.

"On All Approaches Including VFR When Below 1000' From Touchdown

A. Call sink rate of 1000 fpm or more.

B. Call out the airspeed if it is within 10 kts. of the minimum airspeed for that intermediate flap setting (flaps 1 thru flaps 30).

C. Call airspeed if in excess of V_{REF} + 10 or if the airspeed is reduced to V_{REF}.

"Use of Radio Altimeter

A. Set to 1500' on Climb Checklist (both Pilots).

B. During all approachs (VFR-IFR), when 1500' light comes on, call out MDA light on and set to 200 feet. (This procedure applies to both high and low minimum Captains.)"

EMERGENCY EVACUATION

AFTER AIRPLANE COMES TO A STOP

STANDBY POWER SWITCH . . . . . BATTERY

BRAKES . . . . . AS REQUIRED

EMERGENCY EXIT LIGHTS . . . . . ON

FLAPS 40

SPEEDBRAKES . . . . . DOWN/DETENT

START LEVERS . . . . . CUTOFF

FIRE SWITCH OVERRIDE BUTTONS (3). . PUSH

FIRE SWITCHES (engines & APU-if) . PULL & ROTATE

EVAC CMD . . . . . EVACUATE, EVACUATE

BATTERY SWITCH . . . . . OFF"

Training Manual

Section 2-8, page 53, dated October 15, 1971:

"Use of Radio Altimeter.

A. Set to 1500' on Climb Checklist (both Pilots).

B. During Approach (when flying on instrument conditions) call out MDA light ON and RESET .

NOTE: SET THE RADIO ALTIMETER TO DH FOR THE ILS APPROACH. SET IT AT 300' FOR ALL NON-PRECISION APPROACHES AND NOT AT MDA. THE 300' SETTING ON THE NON-PRECISION APPROACH CONSTITUTES A RADIO ALTIMETER WARNING GATE AND IS NEVER TO BE SET TO PUBLISHED MINIMUMS."

Section 2-8, page 62-63, dated October 15, 1971:

"Non-Precision Approaches

Good judgement in flap usage and airspeed selection is a prime consideration on non-precision approaches. Variable factors may effect the performance of the aircraft to such a degree that it is impossible to follow the approach profile on the letdown plate.

Examples of these variables are:

A. Tailwind on approach

B. Necessity of maintaining 55% N_1 to provide ample heat for engine anti-icing.

C. A 10 mile procedure turn limitation.

To accommodate these and other situations which may vary, it is often necessary to extend flaps earlier and to reduce speed sooner than recommended. Exercise caution in flap usage and never place the aircraft in a configuration which would make recovery difficult or impossible in the event of sudden engine failure.

NOTE: EXERCISE CAUTION IF USING FLAP DRAG TO EXPEDITE DESCENT. HIGH RATES OF DESCENT AND STEP DOWN ALTITUDES COMMON TO NON-PRECISION APPROACHES CAN BE A HAZARDOUS COMBINATION UNLESS THE PILOT IS CAREFUL NOT TO OVERSHOOT DESIRED LEVEL OFF ALTITUDES. HIGH SINK RATES ARE NEVER RECOMMENDED. THE MUCH MORE ACCEPTABLE TECHNIQUE OF REDUCING APPROACH SPEEDS ALONG WITH ASSOCIATED REDUCED DESCENT RATES SHOULD ACCOMMODATE ALL DESCENT PROFILES."

Section 2-8, page 76, dated October 15, 1971:

"Factors Affecting Landing Distance

"Floating just off the runway surface before touchdown must be avoided, as this procedure uses a large portion of the available runway. If the airplane should be over the recommended speed at the point of intended touchdown, deceleration on the runway is about three times greater than in the air. The airplane should be landed as near the 1000' point as possible rather than allowed to float in the air to bleed off speed.

"Consider an airplane that would normally approach at 130 kts. and require a normal landing distance of 4000'. With other conditions constant, flying over the threshold with 10 kts. excess speed at 140 and touching down 10 kts. over speed would increase total landing distance only 350'. If this 10 kts. excess speed is bled off in the air before touchdown, landing distance will be increased by about 1200 to 1500.

"Height of the airplane over the end of the runway also has a very significant effect on total landing distance. For example, flying over the end of the runway at 100' altitude rather than 50' could increase the total landing distance results primarily because of the length of runway used up before the airplane actually touches down. Glide path angle also effects total landing distance. Even while maintaining the 50' height over the end of the runway, total landing is increased as the approach path becomes flatter. Glide path angle is a function of pilot technique and best results will be obtained at a normal ILS glide slope angle."

2. ANALYSIS AND CONCLUSIONS

2.1 Analysis

The aircraft was certificated, equipped, and maintained according to regulations. The gross weight and c.g. were within prescribed limits during takeoff at Denver and during the approach to Casper.

Based on its investigation, the flightcrew's statements, and the performance analysis, the Safety Board concludes that the aircraft's power plants, airframe, electrical and pitot/static instruments, flight control, and hydraulic and electric systems were not factors in this accident.

The flightcrew was route- and airport-qualified into Natrona County International Airport. Further, both pilots had made frequent and recent approaches into the airport, particularly the back course ILS approach to runway 25.

The Weather

Although visibility was reported to be variable from 3/4 to 1 1/2 miles, witnesses' statements and testimony revealed that very localized snowshowers had reduced the visibility in portions of the airport to less than 3/4 mile. The flightcrew of Flight 470 reported that they had the runway in sight 3/4 mile from the threshold; however, they could not see more than 12 runway lights ahead of them while on the runway. These runway lights are 200 feet apart; therefore, the surface visibility available to the flightcrew probably was less than 1/2 mile. The flightcrew stated that forward visibility decreased as they progressed down the runway. This observation was verified when the flightcrew stated that they were not able to see the end-of-runway lights until shortly after touchdown. The touchdown point was 2,375 feet from the runway end; therefore, forward visibility at that point was probably less than 1/2 mile.

After the runway had been plowed, 2 to 3 inches of light snow had fallen before the approach of Flight 470, and the entire airport surface was covered. Because of this thin layer of snow, the runway edge was indiscernible. The lack of contrast between the runway and surrounding terrain and the 320-foot lateral displacement of the runway edge lights may have given the captain the false impression of being lower than he actually was. This false impression may have caused the captain to flare the aircraft higher above the surface of the runway than he should have desired; however the Safety Board believes that the captain should have been aware of this impression and should have taken action to compensate for it.

The Approach and Landing

During the descent from cruising altitude, the second officer completed the required landing data card for the pilot's reference during the

approach to Casper. The information on the card listed the wind velocity as higher than the maximum allowable tailwind component of 10 kn for landing on runway 25. 9/ The card also contained the comment that a 30° flap setting would be required for landing because the flight had encountered weather conditions en route conducive to airframe icing; a 40° flap setting could not be used. The aircraft's gross weight restricted the use of full flaps because of a climb gradient limitation in the case of a missed approach.

When the second officer computed the aircraft's gross weight for landing, he subtracted the preplanned fuel burnoff from the actual takeoff gross weight. A more accurate landing weight could have been obtained by subtracting the actual fuel burnoff from the actual takeoff gross weight. The actual gross weight, when computed in this fashion, was several hundred pounds under the climb gradient limitation for the use of 30° flaps on runway 25. Since the captain had contemplated a missed approach, this weight limitation should have been considered when he selected a runway for landing, particularly in view of the prevailing wind. According to the captain's testimony, he did not realize that the weight of the aircraft might be a limitation during the approach.

The Safety Board believes that a decision to overfly runway 25 and to make a full ILS approach to runway 07 would have been prudent under the conditions which existed. This decision would have provided a favorable wind and, most importantly, glide slope information would have provided altitude guidance to the runway threshold in the reduced visibility.

The approach, as executed, was not stabilized, even though the aircraft was properly configured. According to the FDR readout and testimonies of the captain and the first officer, the airspeed was from 15 kn to 25 kn above the reference speed (130 kn) for this approach. No attempt was made to reduce the speed to the acceptable tolerance of reference speed plus 10 kn.

The FDR also shows that the aircraft's descent rate after departing the final approach fix was about 750 ft./min. This rate would have been acceptable had a headwind existed; however, with a tailwind the rate should have been increased to place the aircraft at the MDA at a sufficient distance from the runway threshold to continue the approach safely and to cross the threshold at or near the recommended height of 50 ft. The captain stated that the aircraft was at 300 ft. at 3/4 to 1 mile from the runway. If the captain's assessment of his altitude was correct, only a small increase in the descent rate would have been required to put the aircraft in the correct position for landing.

The captain may have controlled his altitude more successfully had the first officer made descent callouts every 100 feet from 500 feet above the touchdown zone elevation. These required calls were not made. This accident emphasizes the need for flight crewmembers to continue to make

9/ Later in the approach, between Evansville Intersection and the final approach fix, the Casper approach controller updated the weather report and the wind fell within allowable tolerance for landing.

required, as well as meaningful, callouts including altitude and airspeed, until the pilot flying is assured that the aircraft will stop on the runway or that the missed approach procedure has begun.

The captain did not determine, nor did he receive through required callouts assistance in determining, the effect of true airspeed on ground speed, which, in turn, was affected by a following wind. This oversight placed the aircraft farther down the runway during the flaring maneuvers than the captain desired or realized. Although the captain's control of height was limited by altitude restrictions until he saw the runway environment, his control of airspeed was more flexible. He did not plan, however, to reduce speeds to an acceptable minimum. According to the captain's testimony, he realized that the aircraft was crossing the runway threshold at a height of at least 200 feet and at a speed of at least 140 kn. At that point the captain should have begun a missed approach. The reduced visibility which prevented the flightcrew from seeing the departure end of the runway and its approach lighting structure may have caused the pilot to continue his attempt to land.

Aircraft performance charts showed that after the aircraft touched down on the runway and reverse thrust was initiated, a go-around was impossible on the remaining runway. The captain's only recourse was to attempt to slow the aircraft and to steer clear of the light structures off the departure end of the runway.

The Emergency Evacuation

The difference between this accident and similar accidents with low impact forces was that the wreckage did not burn or explode. The immediate evacuation actions on the part of the second officer and the flight attendants were commendable; however, the Safety Board believes that the decision by the captain and the first officer that fire, or the potential for fire, was not present, was not prudent.

One engine had been torn from the aircraft; the other was in position under the left wing. Numerous other ignition sources were present, such as "hot" electrical wiring and the auxiliary power unit which was running. Had any of these ignition sources contacted spilled fuel or hydraulic fluid under pressure, a disastrous fire could have resulted. The captain and the first officer immediately should have completed their emergency shutdown checklist and should have assisted in the evacuation of passengers. An assessment of fire potential could have been made after the evacuation was completed, at which time a more thorough inspection of the wreckage could have been undertaken.

Three problems encountered during the evacuation could have been detrimental to the safety of the passengers and crewmembers if fire had erupted.

First, at least two of the main cabin exits were difficult to open. The forward flight attendant's difficulty with the left forward entry door and an aft flight attendant's difficulty with the left rear entry door apparently were quite similar. That is, they both were able to rotate the handle partially and the doors opened partially; however, the doors then appeared to jam in that position. There are two possibilities which could explain the difficulties with the door: (1) The latching mechanisms may have been affected by the crash forces and fuselage deformation; (2) the emergency evacuation girt-bars were hooked up and the added force required to pull the slide pack out of its container may have been greater than the flight attendants anticipated.

Second, obstructions blocked passengers attempting to exit the aircraft. These obstructions consisted of items, such as cove-light covers, which broke loose inside the cabin and pieces of carryon baggage which were dislodged during the accident. Several passengers stated that they had difficulty getting from their seats to the exits because of these various items. The forward flight attendant said that a briefcase from beneath a passenger seat blocked the cockpit doorway until she was able to kick it out of the way. Finally, the contents of a trash container were dumped on the floor in the aft galley area; however, the trash did not adversely affect the evacuation.

Third, a coat closet door on the left front side of the cabin just aft of the forward entry door created an obstruction. The closet has a door which latches toward the back of the aircraft and the hinges are forward. When open, the door comes within about 2 inches of a cabinet on the right side of the aisleway. If the door is opened farther, it swings entirely around and eventually reaches the bulkhead aft of the entry door. Thus, the door travels 270° from the closed position until it latches against the forward wall. According to the flight attendant's statement and testimony, during the evacuation several passengers stopped to open the coat closet door and retrieve their belongings. While they were doing this, the entire aisle was blocked to the forward exits. Similarly, the flight attendant was blocked from directing the passengers to the forward exits. Eventually, she was able to latch the door in its fully opened position, but not before the evacuation had been delayed considerably.

The length of time to evacuate the aircraft was not determined. There were estimates from crewmembers and passengers that it was accomplished in as little as 60 seconds. However, in view of the numerous minor delays that occurred, and the fact that there were 92 adult passengers aboard, it is more likely that the evacuation lasted over 1 minute and possibly as long as 2 to 3 minutes.

Rescue

Although rescue activities did not affect the outcome of the accident, the potential for injury, death, and property loss was extremely

high. The crewmembers of Flight 470 were responsible for the control of the passengers and for their welfare when the evacuation was complete. This control was maintained to a point by the flight attendants, who, at the direction of the captain, gathered the passengers and accompanied them to a control point in a hangar. The flight attendants assumed control and checked for injuries while awaiting ambulances for the injured and instructions for disposition of the other passengers. The responsibilities which the flight attendants assumed were within the scope of their emergency duties and were carried out well.

However, one action by the flight attendants is considered questionable. After the evacuation, two flight attendants reboarded the aircraft to obtain personal belongings of the passengers and to obtain a first aid kit and the oxygen bottles. According to the attendants' statements, they did not see the firetruck at the scene, yet they reentered the damaged aircraft. The potential for fire or explosion was very real since fuel had been spilled and one of the aircraft's damaged engines was under the wing. Aircraft jet engine components contain enough hot metal to ignite fuel -- up to 20 minutes after engine shutdown. Furthermore, the control valve on one of the walk-around oxygen bottles in the overhead rack had been opened in the accident and oxygen was being discharged. The need to obtain a first aid kit and an oxygen bottle may have appeared valid at the time; however, when the risks are considered, the potential danger outweighed any benefit.

For several reasons, firefighting vehicles and personnel did not arrive in a timely fashion. The driver, who was designated to operate the firetruck, was operating a snowplow on runway 3/21 at the time of the accident. He was first alerted of the crash by radio transmission which said that Flight 470 had overrun the runway. The airport manager called him and ordered him and one other man to get the firetrucks and to tell the other personnel to continue plowing.

Since the airport manager did not call for a general emergency response by his rescue personnel, he probably had downgraded the need for such response. Similarly, the emergency response personnel were given the impression that the emergency was less than major. The airport manager had apparently based his actions on his analysis at the accident scene and the flightcrew's radio call that there was no fire.

Uncontrolled Vehicular Traffic

The Safety Board is greatly concerned about the near-accident about 10 minutes after Flight 470 had overrun runway 25. If Frontier Airlines Flight 603 had collided with the uncontrolled vehicles which were crossing the active runway, the result could have been disastrous.

The Safety Board believes that positive action should have been taken by the airport manager, in concert with the control tower, to insure that

the critical areas of the airport remained closed until a thorough assessment of the emergency situation had been made. The Safety Board believes that all vehicular traffic on an airport should either be radio-equipped or under the direct control of a vehicle which is radio-equipped, particularly in minimum visibility conditions.

2.2 Conclusions

(a) Findings

1. There is no evidence of aircraft structure or component failure or malfunction before the aircraft overran the departure end of runway 25.

2. The flightcrew was aware of the airport and weather conditions at Casper.

3. The visibility conditions for runway 25 were slightly worse than forecast or reported.

4. The flightcrew was aware that the approach to runway 25 would be made with a following wind.

5. The flightcrew was aware of the 320-foot lateral separation of the runway edge lights.

6. The flightcrew was aware of the short distance between the final approach fix and the runway threshold.

7. The captain did not consider all factors when he planned his approach to runway 25.

8. The captain realized that his aircraft was higher and faster than normal when it crossed the runway threshold.

9. The first officer did not make all of the required airspeed and altitude callouts during the approach.

10. The second officer did not monitor the flight instruments as required and therefore did not assist the captain in his decisionmaking process.

11. The flightcrew did not realize how much runway had been overflown when the captain made the final decision to land.

12. Low vertical and lateral visibility made it difficult to judge speed, height, and distance.

13. After touchdown, little difficulty was encountered in braking or steering the aircraft clear of ground objects.

14. Aircraft evacuation was completed in a timely manner by the second officer and the flight attendants.

15. The captain's and the airport manager's decisions that no danger of fire or explosion was present were premature. Because of these decisions, emergency equipment would not have been readily available if fire had erupted from any one of the many sources.

16. The airport manager did not take positive action to close the airport until the situation was assessed properly or to control the nonradio-equipped vehicular traffic on the airport operational areas.

(b) Probable Cause

The National Transportation Safety Board determines that the probable cause of this accident was the failure of the pilot-in-command to exercise good judgment when he failed to execute a missed approach and continued a nonprecision approach to a landing without adequately assessing the aircraft's position relative to the runway threshold. Contributing to the accident were the excessive height and speed at which he crossed the approach end of the runway and the failure of other flight crewmembers to provide him with required callouts.

RECOMMENDATIONS

As a result of this accident, the National Transportation Safety Board has submitted a recommendation to the Federal Aviation Administration. (See Appendix H.)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ JOHN H. REED
Chairman

/s/ FRANCIS H. McADAMS
Member

/s/ ISABEL A. BURGESS
Member

/s/ WILLIAM R. HALEY
Member

LOUIS M. THAYER, Member, did not participate in the adoption of this report.

October 30, 1975

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APPENDIX A

INVESTIGATION AND HEARING

1. Investigation

The Safety Board was notified of the accident about 0800 on March 31, 1975. An investigator from the Safety Board's Denver Field Office, and two investigators from the Safety Board's headquarters in Washington, D.C., went immediately to the scene. Working groups were established for operations, systems/structures, flight data recorder, and cockpit voice recorder. The witness interrogation and the weather, human factors, maintenance records, and powerplants aspects of the investigation were handled by the established groups.

Participants in the onscene investigation included representatives of the Federal Aviation Administration, Western Air Lines, Inc., Air Line Pilot's Association, and the Board of Trustees, Natrona County International Airport.

2. Public Hearing

A 3-day public hearing was held at the Ramada Inn, Casper, Wyoming, beginning May 20, 1975. Parties representated at the hearing were: The Federal Aviation Administration, Western Air Lines, Inc., Air Line Pilot's Association, National Weather Service, Board of Trustees, Natrona County International Airport, Transport Workers Union, and the Professional Air Traffic Controllers Organization.

APPENDIX B

CREW INFORMATION

Captain Jack A. Mylenek

Captain Jack A. Mylenek, 38, was employed by Western Air Lines, Inc., on January 17, 1966. He holds Airline Transport Pilot Certificate No. 1512825, with ratings in airplane multiengine land B-737 and airplane single-engine land. He was upgraded to pilot-in-command of Boeing 737 aircraft on July 5, 1972. His first-class medical certificate was updated on December 20, 1974, and was issued without limitations.

Captain Mylenek's last proficiency check was performed satisfactorily in compliance with 14 CFR 121.441. His last en route competency report was completed satisfactorily in compliance with 14 CFR 440 on August 23, 1974. He had accumulated about 6,698 total flight-hours, 2,000 hours of which were in B-737 aircraft. He had 854 flight-hours of instrument time.

First Officer Anthony J. Cavalier

First Officer Anthony J. Cavalier, 39, was employed by Western Air Lines, Inc., on July 15, 1968. He holds Commercial Pilot Certificate No. 1859308, with ratings in airplane multiengine land, Douglas DC-3, and instruments. His first-class medical certificate, issued without limitations, was updated on July 8, 1974.

His last Flight and Simulater Proficiency Report was completed on January 21, 1975. He had accumulated about 8,900 total flight-hours, of which about 2,000 hours were in Boeing 737 aircraft. He had about 2,500 flight hours of instrument time.

Second Officer Charles W. Glasscock

Second Officer Charles W. Glasscock, 35, was employed by Western Air Lines, Inc., on June 13, 1969. He holds Commercial Pilot Certificate No. 1345624, with ratings of airplane single- and multiengine lane, rotorcraft-helicopter, instruments. His first-class medical certificate, issued without limitations, was updated on July 12, 1974.

During the period of his employment, observations of his competency, when performing as a flight crewmember while en route, were recorded three times by a designated check airman.

Flight Attendants

All three flight attendants were qualified in accordance with applicable regulations for emergency training.

Last recurrent training:

Jeanne Travis	-	March 13, 1975
Marilyn Axtell	-	March 14, 1975
Jane K. Rither	-	May 15, 1974

All three flight attendants were qualified in the B-707, B-720, B-727, and B-737 aircraft.

APPENDIX C

AIRCRAFT INFORMATION

Boeing 737-247*, Serial No. 20131, N4527W, was registered to Western Air Lines, Inc. It was certificated and maintained according to procedures approved by the FAA. At the time of the accident, the aircraft had accumulated 14,076.46 flight-hours.

Flight Hours Since Checks:

Service Check (300 hrs.)	149.03
C Check (100 hrs.)	992.36
3,000 hr. Check	2,523.56
TARAN Check (8,000 hrs.)	3,442.17

Engines:

Pratt & Whitney	JT8-9
L. H. Engine S/E	674285
Total Time	11,168:59
TSMV	2,776:27
R. H. Engine S/N	674210
Total Time	12,737:47
TSMV	4,385:59

*247 is a company designation of the 200 series aircraft.

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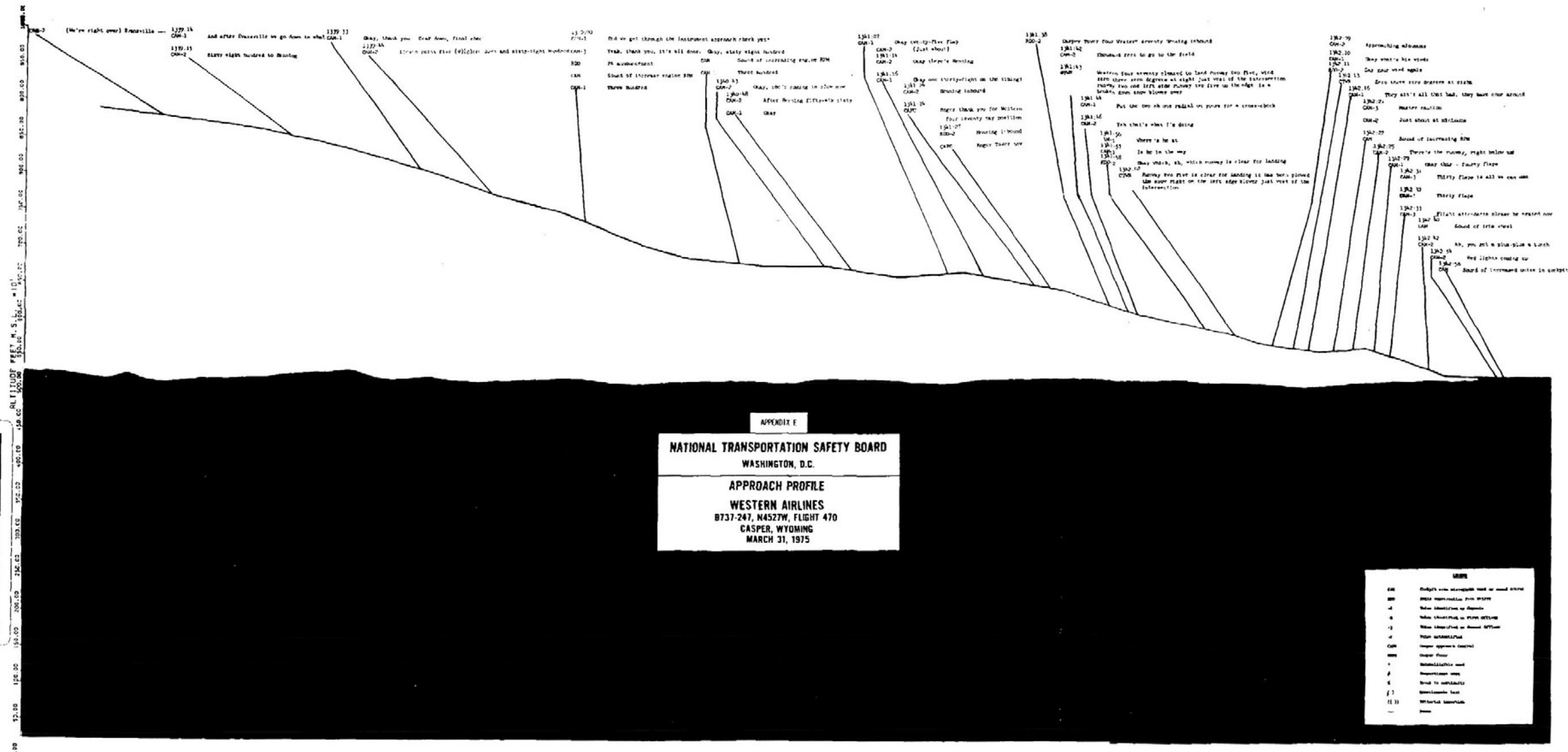

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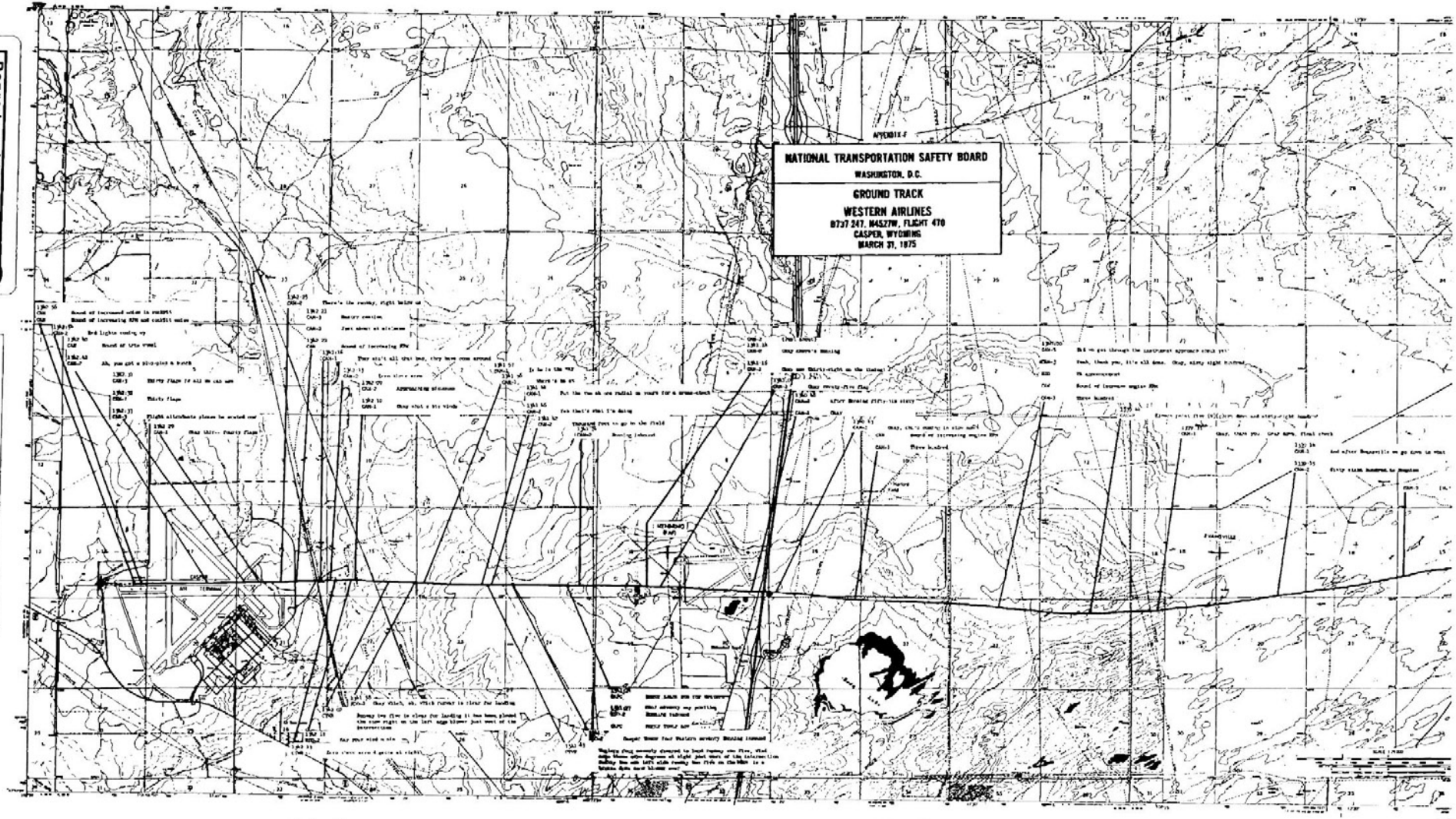

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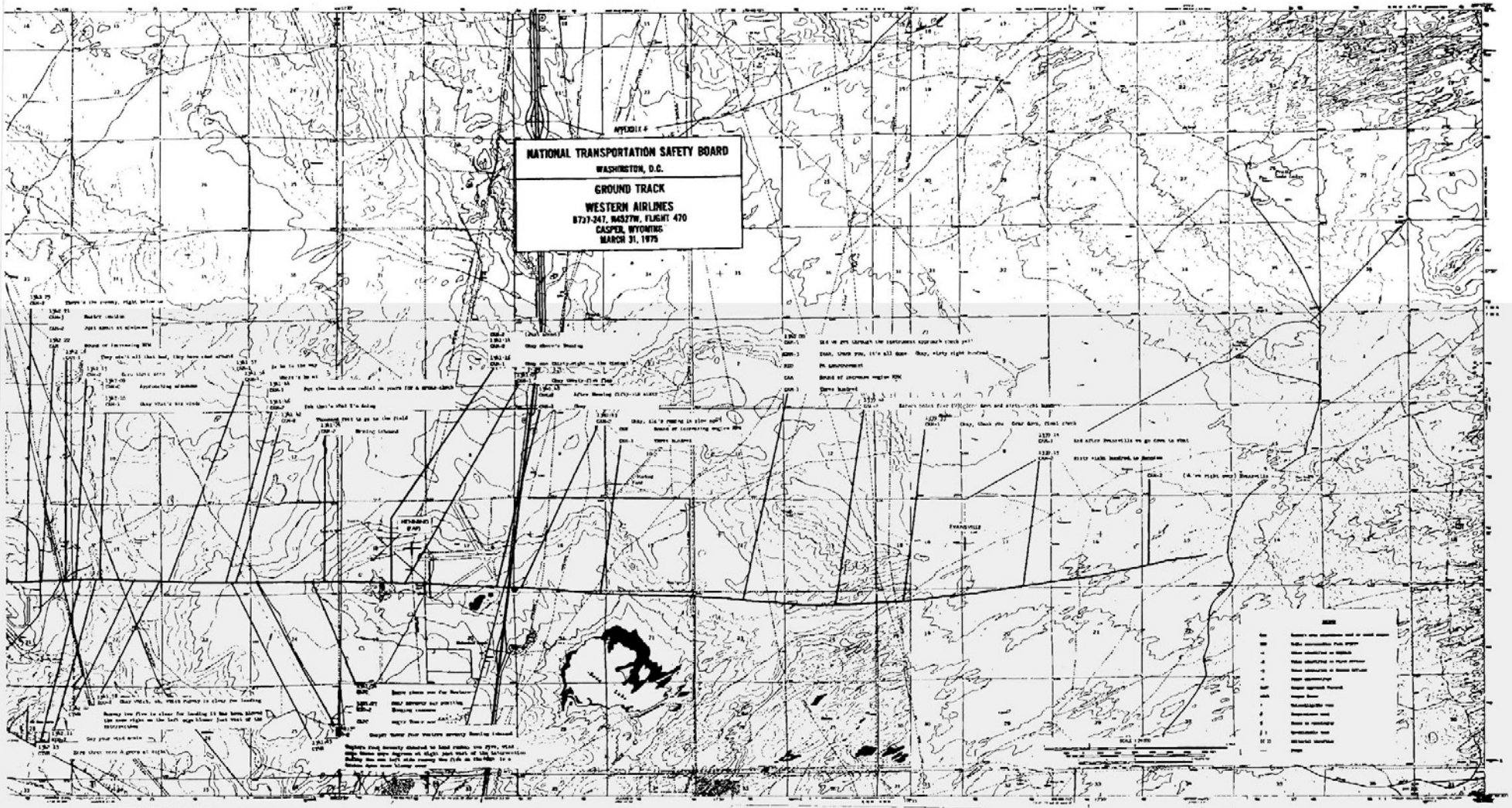

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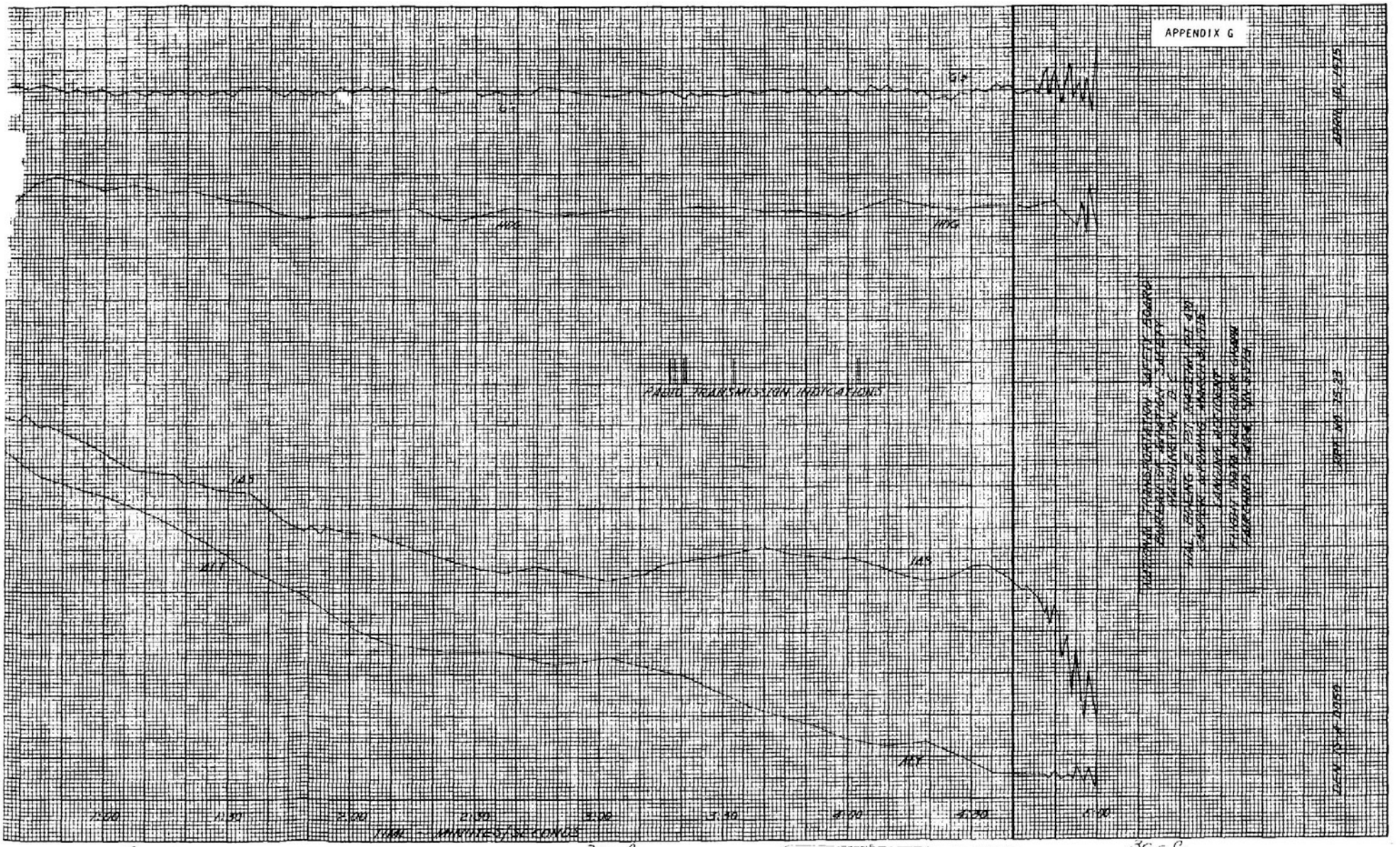

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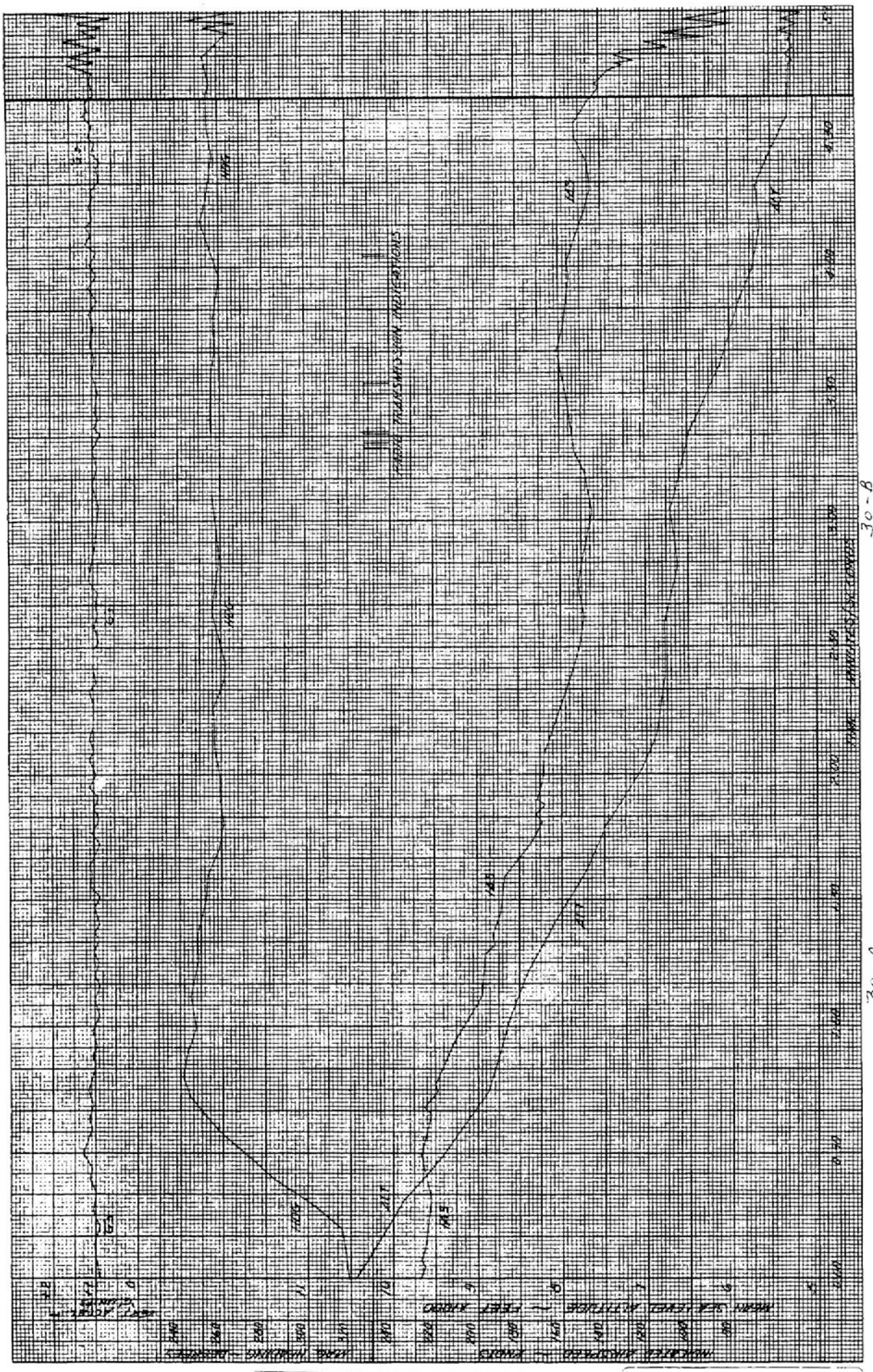

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NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

APPENDIX H

ISSUED: November 23, 1975

Forwarded to:
Honorable James E. Dow
Acting Administrator
Federal Aviation Administration
Washington, D. C. 20591

SAFETY RECOMMENDATION(S)

A-75-84

On March 31, 1975, Western Air Lines, Inc., Flight 470 (a B-737) ran off the end of runway 25 after a back course ILS approach to Natrona County International Airport, Casper, Wyoming. The National Transportation Safety Board's investigation of this accident revealed inadequacies in the implementation of the Federal Aviation Regulations which pertain to crewmember emergency training. Specifically, the Safety Board believes that the provisions of 14 CFR 121.417 (c), regarding crewmember emergency drills in the operation and use of exits and evacuation slides, are not being accomplished adequately by some airlines.

During the above accident, the aircraft left the runway surface, struck three approach light structures and an irrigation ditch and stopped 800 feet beyond the departure end of the runway. When the order was given to evacuate, occupants deplaned through four main exits and two overwing exits. Two flight attendants reported difficulties in opening the left forward and left rear main cabin doors. The difficulties with the doors apparently were similar -- both flight attendants were able to rotate the door handles and partially open the doors, but they were unable to open the doors farther. Eventually, the flight engineer fully opened the forward door and an off-duty flight attendant helped to open the rear door.

Two possible reasons for these difficulties are: (1) The door structures or mechanisms may have been deformed by crash forces or fuselage deformation, or (2) the force necessary to pull the evacuation slide out of the door mounted slide pack may have been greater than the flight attendants anticipated.

The Safety Board does not believe that the first possibility has any basis. Examination of the wreckage revealed that all four cabin doors operated normally following the accident and no evidence of damage to their mechanisms was noted. Additionally, our evaluation of the accident kinematics revealed that the crash forces in this accident were within those set forth in 14 CFR 25.561 (b) as constituting a "minor crash landing."

APPENDIX H

Honorable James E. Dow

Require air carriers to comply with the provisions of 14 CFR 121.417 (c) (4) by the use of accurate and realistic equipment and procedures which accurately simulate emergency conditions, including the forces involved in opening exits in the emergency mode; and require that during each flight attendant's initial and recurrent training he operate emergency exits which duplicate the forces encountered and actions necessary when such exits are opened in the emergency mode. (Class II)

REED, Chairman, McADAMS, THAYER, BURGESS, and HALEY, Members, concurred in the above recommendation.

By: John H. Reed
Chairman

APPENDIX H

Honorable James E. Dow

The second possibility is a more plausible explanation of the flight attendants' difficulties with the doors. Western Air Lines fulfills the provisions of 14 CFR 121.417, Crewmember Emergency Training, by the use of films, aircraft familiarization, and an evacuation training mockup. Both flight attendants had received initial and recurrent emergency training using an actual aircraft door and using the mockup containing a B-737 door; however, neither flight attendant had ever opened an aircraft exit door with an evacuation slide attached; nor is Western's mockup door equipped with a slide. Our investigators noted that the forces required to operate the mockup door are noticeably less than those required to open an actual aircraft door with the slidepack attached. Thus, we believe that neither flight attendant was adequately prepared to anticipate the forces necessary to open a cabin door in the emergency mode.

Recently, the Safety Board's investigation of a United Air Lines DC-10 emergency evacuation at Seattle International Airport on October 16, 1975, disclosed that two operable exits were not used. Preliminary information indicates that the flight attendant who attempted to open them concluded that they were inoperative because the actions involved in the movement of the handles to activate the door opening cycle were different than those which she had encountered in recurrent emergency training. Specifically, the required handle motion in the aircraft was more than twice that in the training mockup. This case further illustrates the need for representative procedures and equipment during training to facilitate transfer of learning experiences.

The Safety Board has previously identified similar situations which indicated shortcomings in flight attendant training. For instance, several cases were cited in the Board's special study, "Safety Aspects of Emergency Evacuations from Air Carrier Aircraft." As a result of that study, the Safety Board recommended that 14 CFR 121.417 (c) be amended to eliminate the provision which permits demonstration rather than performance of drills in operation and use of emergency exits (A74-114). We expressed the same concern in proposals submitted for the FAA's First Biennial Operations Review. The Safety Board is aware of the FAA's efforts, such as Air Carrier Operations Bulletin No. 73-1, issued May 7, 1973, to emphasize "hands-on" training, and we support these efforts; however, we are concerned that the "hands-on" training may not always be realistic.

The Board realizes that the use of actual aircraft doors with evacuation slides attached may be impractical; however, we do believe it is reasonable to require training in a mockup that is realistic.

In view of the above, the National Transportation Safety Board recommends that the Federal Aviation Administration:

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