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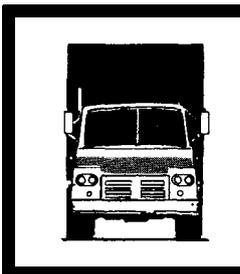
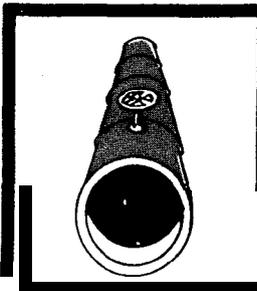
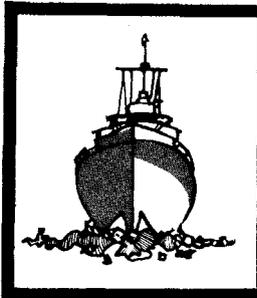
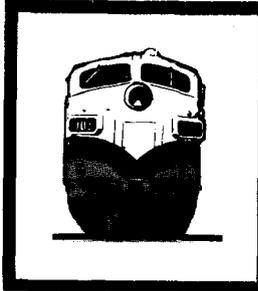
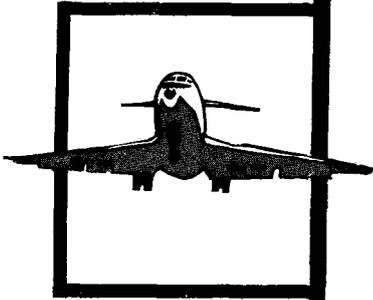
WASHINGTON, D.C. 20594

AIRCRAFT ACCIDENT REPORT

**RYAN AIR SERVICE, INC.,
FLIGHT 103, BEECH AIRCRAFT CORPORATION
1900C, N401RA,
HOMER, ALASKA,
NOVEMBER 23, 1987**

NTSB/AAR-88/11

UNITED STATES GOVERNMENT



TECHNICAL REPORT DOCUMENTATION PAGE

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<p>16. Abstract: About 1825 on November 23, 1987, a Beech Aircraft Corporation 1900C (Be 1900), N401RA, operated by Ryan Air Service, Inc., crashed short of runway 3 at the Homer Airport, Homer, Alaska. Flight 103 was a scheduled Title 14 Code of Federal Regulations Part 135 flight operating from Kodiak, Alaska, to Anchorage, Alaska, with intermediate stops in Homer and Kenai. Both flight crewmembers and 16 passengers were fatally injured; 3 passengers were seriously injured.</p> <p>The National Transportation Safety Board determines that the probable cause of this accident was the failure of the flightcrew to properly supervise the loading of the airplane which resulted in the center of gravity being displaced to such an aft location that airplane control was lost when the flaps were lowered for landing.</p> <p>The safety issues discussed in the report include the performance of the Be 1900, the Federal Aviation Administration's oversight of Ryan, and Ryan's management of its operation.</p>					
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EXECUTIVE SUMMARY

About 1825 on November 23, 1987, a Beech Aircraft Corporation 1900C (Be 1900). N401RA, operated by Ryan Air Service, Inc., crashed short of runway 3 at the Homer Airport, Homer, Alaska. Flight 103 was a scheduled Title 14 Code Federal Regulation Part 135 flight operating from Kodiak, Alaska, to Anchorage, Alaska, with intermediate stops in Homer and Kenai. Both flightcrew members and 16 passengers were fatally injured; 3 passengers were seriously injured.

The National Transportation Safety Board determines that the probable cause of this accident was the failure of the flightcrew to properly supervise the loading of the airplane which resulted in the center of gravity being displaced to such an aft location that airplane control was lost when the flaps were lowered for landing.

The safety issues discussed in the report include:

- the performance of the Beech 1900;
- the Federal Aviation Administration's oversight of Ryan; and
- Ryan's management of its operation.

Safety recommendations were addressed to the Federal Aviation Administration and the National Fire Protection Association.

AIRCRAFT ACCIDENT REPORT

RYAN AIR SERVICE, INC.
FLIGHT 103
BEECH AIRCRAFT CORPORATION 1900C, N401 RA
HOMER, ALASKA
NOVEMBER 23, 1987



1. FACTUAL INFORMATION

1.1 History of the Flight

On November 23, 1987, Ryan Air Service, Inc. (Ryan), was operating a Beech (Be) 1900C, N401 RA, as a regularly scheduled, passenger flight from Kodiak, Alaska, to Anchorage, Alaska, with intermediate stops in Homer and Kenai, Alaska. N401 RA, as RYA 102, departed Anchorage, where its fuel tanks were filled at 1605, and it arrived in Kodiak at 1709.

In Kodiak, the airplane was redesignated as RYA 103 with the same flightcrew. Seventeen male passengers, many of whom were hunters, and 2 female passengers, boarded the airplane and occupied the 19 available seats.

The airplane was emptied of cargo and no fuel was added. The Kodiak station agent stated that the first officer asked that the airplane be loaded "with 1,500 pounds of cargo." The agent thought the first officer's request was unusual because previous Be 1900 pilots, when operating with a full passenger load, had asked for 1,100 or 1,200 pounds of cargo. The station agent also said that the first officer told her, "Before we could get the 1,500 pounds on board, it would bulk out."

The baggage loader stated that, with the assistance of the captain and first officer, he loaded cargo into the compartments. In addition to suitcases, gun cases, frozen crabs, and two dogs in kennels, the cargo included "approximately 13-14 pieces" of packaged venison that weighed 795 pounds. The venison, which was destined for Kenai, had been stored overnight. The teletyped loading information from the Kodiak station agent to the Homer station agent indicated that 160 pounds of cargo was destined for Homer, 1,010 pounds for Kenai, and 267 pounds for Anchorage (a total of 1,437 pounds).

The baggage loader stated that, after loading the cargo, the tailstand¹ was "about 1 inch from the ground," and the lowest to the ground that he had ever seen a tailstand. He stated that typically the tailstand came to within "3 to 4 inches, maybe more" of touching the ground.

At 1737 (Alaska standard time), RYA 103 contacted Kodiak tower for its instrument flight rules (IFR) clearance to Homer. The Anchorage Air Route Traffic Control Center (ARTCC), the controlling air traffic control facility, issued the following clearance to RYA 103 through the Kodiak tower, "Cleared to Homer via V-438, to maintain 6,000; clearance void if not off by 0244 [Universal

¹A tailstand, to prevent the airplane from accidentally tipping onto its tail, was routinely used by Ryan when the Be 1900 was being loaded.

coordinated time].” The scheduled flight time to Homer was 33 minutes. Kodiak tower cleared RYA 103 for takeoff from runway 7 at 1742 (0242 Universal coordinated time (UTC). The local record weather observation in effect at Kodiak was, in part: “sky clear, visibility 15; temperature 31°, dewpoint 14°, wind 240” at 6; altimeter 29.36.”

A passenger on RYA 103 testified that he thought the airplane would “never become airborne” during the takeoff. He said that after the main gear lifted off the runway, the airplane then fell back to the runway and “accelerated for about another 15 knots” before it became airborne. The passenger stated that the airplane then seemed to climb out rather steeply.

The flightcrew retracted the gear and the 10” of takeoff flaps and then contacted the Anchorage ARTCC at 1744, while the airplane was climbing through 1,900 feet. RYA 103 was instructed to maintain 4,000 feet to the 40 DME² and to expect no delay. RYA 103 requested a visual flight rules (VFR) climb, and Anchorage ARTCC cleared the flight to 12,000 feet, “cleared to Homer via V-438.” At 1749, RYA 103 reported, “Level at 12,000 feet, on course V-438.”

At 1810, the Anchorage ARTCC cleared RYA 103 to descend to and maintain 6,000 feet and to expect an arrival delay at Homer due to a preceding IFR airplane. The ARTCC cleared the flight to hold on the Homer localizer, south at 7 DME, and to expect further clearance at 1825.

At 1818, RYA 103 contacted the Homer Flight Service Station (FSS) and requested the position of the preceding airplane, a deHavilland of Canada DHC-6, Twin Otter. The pilot of the Twin Otter reported his position. RYA 103 then asked the Homer FSS for the current Homer weather. The FSS specialist reported the Homer weather as: “1,500 scattered, 3,500 broken, 4,500 overcast, visibility 12; temperature 31° F, dewpoint 22; wind 340 at 9, altimeter 29.31.”

At 1819, the Twin Otter pilot cancelled his IFR clearance, and RYA 103 was cleared for the localizer/DME approach to runway 3. At 1824, RYA 103 reported a 2-mile final. At 1825, the Homer FSS specialist reported receiving a strong emergency locator transmitter signal on 121.5 MHz.

Ground witnesses described RYA 103 when it was on a short final approach to the Homer airport. Its wings began to rock back and forth and then it dropped steeply to the ground in a rather flat attitude. The airplane struck the airport perimeter fence before sliding to a stop on its belly.

The accident occurred during the hours of darkness at a latitude of 5938.8’ N and a longitude of 151°28.6’ W. There was no fire.

1.2 Injuries to Persons

<u>Injuries</u>	<u>Crew</u>	<u>Passengers</u>	<u>Other</u>	<u>Total</u>
Fatal	2	16	0	18
Serious	0	3	0	3
Minor	0	0	0	0
None	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	2	19	0	21

²Distance measuring equipment distance in nautical miles from a ground-based navigational aid.

1.3 Damaae to Aircraft

The airplane was destroyed in the accident. Its estimated value was \$3.4 million.

1.4 Other Damage

A portion of the airport's perimeter fence was damaged.

1.5 Personnel Information

The captain and first officer were qualified and certificated for the flight and had received the training required by current Federal regulations. (See appendix C.)

1.5.1 The Captain

The captain, 26, had been hired by Ryan on April 11, 1984, and had been assigned to the Be 1900 as a first officer. His flight training records showed that he had completed captain upgrade training on May 16, 1987, and that on May 19, 1987, he received his Airline Transport Pilot Certificate and was upgraded to captain. The captain's flight times, verified by his logbook, were as follows:

Total flight time	~	7,087 hours
Total time in Be 1900	~	4,420 hours
Pilot-in-Command time in Be 1900	~	714 hours

The captain's position with Ryan Air Service was his first regional airline job. He had worked previously as a flight instructor at a local fixed-base operation. Company training records showed that the captain had received weight and balance training during his upgrade training in May 1987 and again during recurrent training in October 1987.

In the previous 24 hours, 7 days, and 30 days before the accident, the captain had flown 7.5, 19, and 96 hours, respectively. There was nothing unusual reported about the captain's activities during the days before the accident.

On the morning of the accident, the captain arrived at work at 0600 for the 0730 scheduled check-in. He and the first officer flew a scheduled round trip between Anchorage and Iliamna, Alaska, in the morning and between Anchorage and St. Mary's, Alaska, in the early afternoon. The accident trip was the last scheduled trip of the day. Company personnel who saw the crew during the day reported nothing unusual in their behavior and said that they appeared to be working together well as a team. Crewmembers who flew with the captain described him as a capable and precise pilot who was very well trained on the operation of the aircraft.

1.5.2 The First Officer

The first officer, 40, had been hired by Ryan on October 16, 1986, and was assigned as an instructor/check pilot on single and light, twin-engine airplanes, as well as a ground school instructor. He was assigned to the Be 1900 on November 21, 1986, as a first officer. He completed initial training in the Be 1900 on November 20, 1986, and performed his most recent proficiency check on November 21, 1987. The first officer received weight and balance training during his Be 1900 initial training on November 20, 1986, and during recurrent training on November 19, 1987.

The first officer also had served as the company's "director of training" for at least a year before the accident. (See appendix D.) However, according to the company's president and its chief pilot, the first officer was not the director of training and his use of the title was unauthorized. There is no evidence that the company took action to prevent the first officer's use of that title. Both the

Federal Aviation Administration's (FAA) principal operations inspector (POI) and the principal maintenance inspector (PMI) and other Ryan personnel stated that they considered him to be Ryan's director of training.

Company records indicate that the first officer had accumulated the following flight times:

Total flight time	10,532 hours
Total time in Be 1900	300 hours (all as first officer)

The first officer's position with Ryan was his first regional airline job. Before joining Ryan, he had more than 10 years of experience as a flight instructor. He was hired as a flight engineer on the DC-6 airplane for a local air cargo company (1980). However, he failed his FAA oral *and was* terminated. At the time of the accident, the first officer was an FAA-designated pilot examiner for single-engine aircraft, for three models of multiengine aircraft (PA-23, PA-44, and P68-C), and for single-engine seaplanes.

In the 24 hours, 7 days, and 30 days before the accident, the first officer flew 7.5, 13, and 27 hours, respectively. Investigation of the co-pilot's activities in the days before the accident indicated nothing unusual. The first officer's flying skills on the Be 1900 were described by the chief pilot as "average."

1.6 Aircraft Information

The Beech Aircraft Corporation, 1900C was certificated under the airworthiness rules of Title 14 Code of Federal Regulation (CFR) Part 23 and was operated under 14 CFR Part 135 in passenger service. The pressurized cabin had seating for 19 passengers and 2 flightcrew members. (See figure 1.) The airplane was equipped with two Pratt and Whitney PT6A-65B turbine engines, flat-rated at 1,100 shaft horsepower, each with Hartzell four-blade, full-feathering propellers.

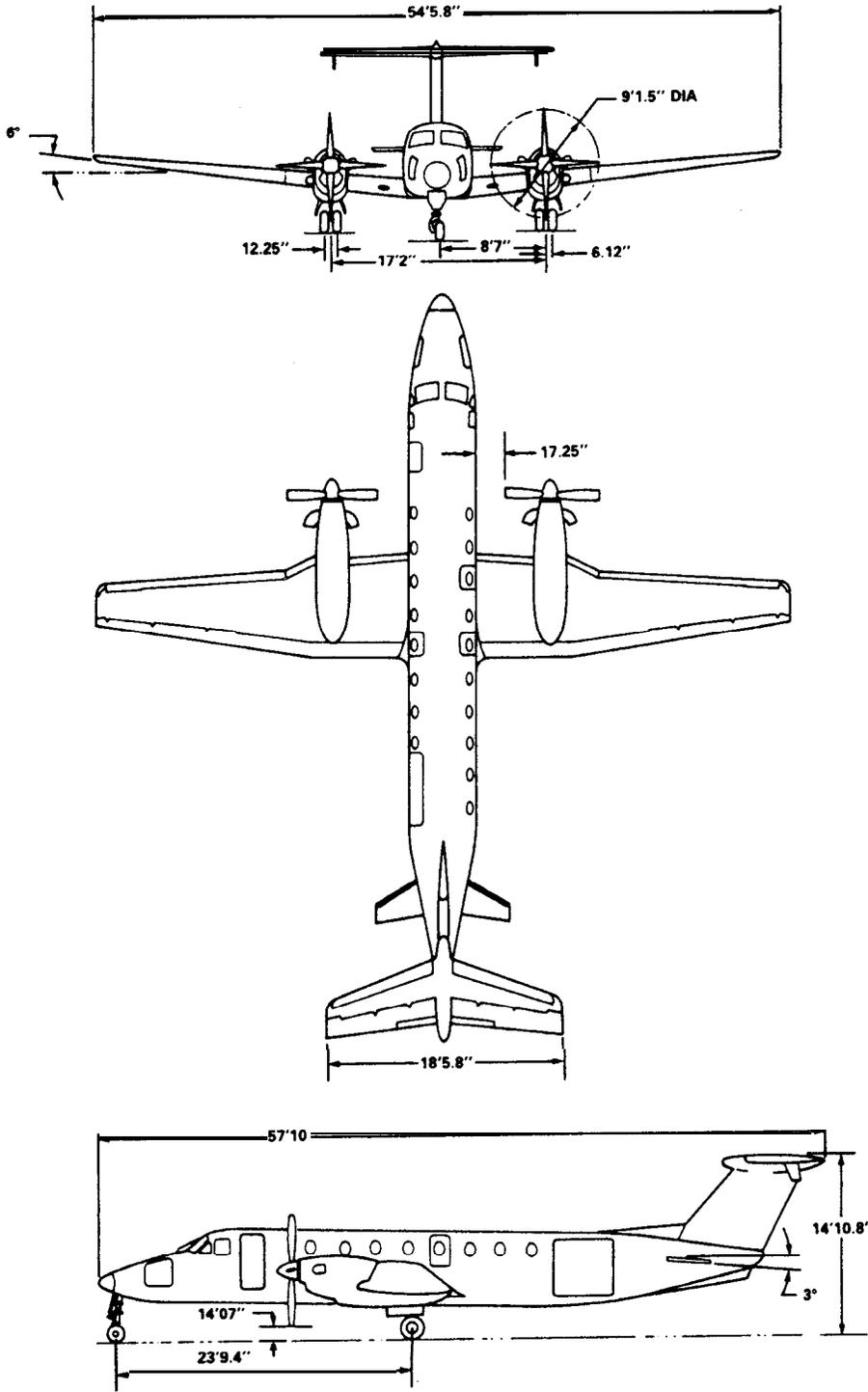
The airplane was equipped with pneumatic deicing boots on the leading edges of the wings, horizontal stabilizers, and stabilons which permitted flight into known icing conditions. Bleed air from the engines supplied air pressure to inflate and create a vacuum to deflate the boots. A three-position switch "Single--Manual--Off" on the pilot's sub-panel controlled the deicing boots. In the "Single" position, the boots on the outboard wing would inflate for about 6 seconds and then deflate. After the outboard wing boots had deflated, the inboard wing, horizontal stabilizers, and stabilon boots would inflate and deflate. In the "Manual" position, all the boots would inflate simultaneously and remain inflated until the switch was released. Beech recommended that to be most effective, 1 to 1 1/2 inches of ice be allowed to form on the deicing boots before inflating them.

Ryan's FAA accepted weight and balance limits for the Beech 1900 were as follows:

	Weight (lbs)	<u>Forward Limit</u>	<u>Limit Aft</u>	Range Center of <u>Gravity</u>
(a) Takeoff	16,600	282.2	299.9	17.7
(b) Landing	16,100	281.4	299.9	18.5

Useable fuel capacity is 2,848 pounds (425 gallons).

BEECHCRAFT
1900 AIRLINER SERIES



Airplane Dimension

Figure 1 --Bech 1900C.

The accident airplane was equipped with three baggage compartments which had the following structural weight limit, in pounds:

Nose baggage compartment	150
Forward baggage compartment	250
Aft cargo compartment	
1) Forward section	880
2) Aft section	<u>6 3 0</u>
Total	1,910

The incomplete weight and balance calculations displayed on flightcrew's weight and load manifest (a plasticized card on which entries were made with a grease pencil) indicated the following:

<u>Item</u>	<u>Weight (lbs.)</u>	<u>Moment³/100</u>
Basic empty condition	9,162	25,906
Crew and crew baggage	360	464
Passengers (19)	3,230	10,540
Nose	--	--
Baggage Forward Cabin	250	409
Aft	--	--
Cargo	--	--
Fuel	1,608	4,831
Less taxi fuel	(-110)	(-300)
Takeoff condition	15,700	--

The airplane's aircraft and flight log indicated the following:

Takeoff weight	15,700 lbs.
Cargo	1,450 lbs.

Additionally, the flight log indicated a calculated center of gravity (CG) location of 299.5 inches aft of reference. (The aft CG limit for the takeoff or landing condition of the Be 1900, regardless of weight, is 299.9 inches aft of reference.)

1.7 Meteorological Information

The National Weather Service issued the following forecast for the Anchorage area at 2240 UTC:

Hazards valid until November 24, 1100 UTC, Flight precautions, IFR--Cook Inlet⁴--Susitna Valley--North Gulf Coast--Yukon.

Kuskokwim Delta--Bristol Bay: icing--Cook Inlet--Copper River Basin--North Gulf Coast. Turbulence--North Gulf Coast. Icing and freezing level valid until November 24, 1100 UTC.

³The weight of an object on an airplane multiplied by the distance of the center of mass of that object from a reference point on the airplane fuselage. On the Be 1900, the moment was measured in inch-pounds.

⁴Homer Airport is considered to be in the Cook Inlet region.

Cook Inlet--North Gulf Coast--Copper River Basin: Occasional moderate rime icing in clouds, in precipitation; freezing level to 10,000 feet.

The 1958 Homer hourly record observation stated:

1500 scattered, estimated ceiling 3,500 broken, 4,500 overcast, visibility 12; temperature 31°, dewpoint 23°, wind 050" at 10 knots, altimeter 29.32. Homer FSS issued notice to airmen (NOTAM) 11/009 describing runway conditions as patchy, thin ice on runway, sanded. A pilot report (PIREP) from a Twin Otter at 1815 at 5,000 feet from 10 miles north of Tustumena Lake, about 40 miles north of Homer, stated light chop and light occasional moderate rime icing in clouds. There were no PIREP's on file or reported between Kodiak and Homer.

Weather at Homer at the time of the accident was, in part:

1,500 scattered, 3,500 broken, 4,500 overcast; visibility--12 miles; temperature--31" F, dewpoint 23°, wind 050" at 10 knots, altimeter 29.37.

1.8 Navigation Aids

Not applicable.

1.9 Communications

There were no reported problems with airborne or ground communications equipment.

1.10 Aerodrome Information

The Homer Alaska Airport is owned and maintained by the State of Alaska. It is located 2 miles east of Homer, Alaska, adjacent to the Kachemak Bay. The field elevation is 78 feet above sea level. An FAA FSS is located at the airport.

The airport has one hard surfaced runway, 3/21, which is 7,400 feet long and 150 feet wide. U.S. Coast Guard and Alaska Air National Guard C-130 airplanes often operate at the airport. Additionally, three Part 135 scheduled carriers and three Part 135 nonscheduled carriers operate at the airport.

The following lighting and navigational aids are available for runway 3: a medium intensity approach light system, a visual approach slope indicator, and runway edge lighting. Runway 3 is served by a localizer/DME approach. All systems were operating normally at the time of the accident, and no alarms were heard by the FSS specialist. The systems were ground-inspected after the accident and no out-of-tolerance parameters were noted. The localizer/DME facility was flight-checked by the FAA on November 25, 1987, and was found to be operating within tolerance.

There was no fire or rescue equipment located at the airport, and none was required.

1.11 Flight Recorders

The airplane was not equipped with either a cockpit voice recorder or a flight data recorder and neither was required.

1.12 Wreckage and Impact Information

The airplane wreckage, located west of runway 3, was distributed along a distance of 159 feet, on a heading of approximately 355°. A video tape taken 4 hours after the accident revealed a rime ice accumulation up to 3/8 inch on the leading edges of the wings, horizontal stabilizers, stabilons, tailsets, vertical stabilizer, and nose cone. No other ice accumulation was observed on the airplane. The gear actuators indicated that the gear was down and locked at impact. (See figure 2.) The propeller blades of both engines, which were composed of composite material, were broken away at their hubs and were scattered along the wreckage path.

The fuselage came to rest with a slight list to the left side; the belly structure was compressed. The left side in the area of the wing was crushed by the upward displacement of the wing spar about 15 inches.

The skin was wrinkled from the nose and rearward along both sides of the fuselage. A longitudinal wrinkle extended along the center of the top of the fuselage from just aft of the cabin entrance door to the dorsal fin.

Both sides of the empennage were wrinkled at the pressure bulkhead joint. The lower empennage, aft of the cargo door, was crushed severely especially on the left side.

The lower wing surfaces were heavily damaged from their root end to outboard of the landing gear well. Numerous ribs were broken and/or crushed. The flap handle was in the up position. The left flap actuator attachment brackets were broken. The right flap actuator was found in an intermediate position, between 7" and 12". Company procedure was to select full (35") flaps when landing was assured.

The airplane's flight control system, including its cables, were found intact and functioning within acceptable parameters. The cockpit stabilizer manual trim wheel and the associated trim cables were found in the full nose-down position and against the full nose-down stops, respectively.

According to rescue personnel, none of the passenger seats were found attached to the floor or side wall seat tracks. Seat back frames were twisted and bent, and several had separated from the pivot bracket that attached them to the seat pan frame. Seat pan frames had separated and were bent downward. The seat pan fabric that supports the seat cushion was torn through. Several seats were missing one or both seat legs, while some seats had separated legs. The seatbelts were found attached to the seats and were fully operational.

The cockpit seats were attached to their two seat tracks and were in place. The seat pan fabric was found torn on both seats. The right seat had separated downward from the front of the seatpan frame tubes.

1.13 Fire

There was no fire.

1.14 Medical and Pathological

The captain and 13 passengers were found fatally injured at the wreckage. The first officer and 6 passengers were alive. They were transported to local hospitals where their conditions were stabilized. The seven survivors were then transported by air to hospitals in Anchorage. The first officer and one passenger died en route and two passengers died in the Anchorage hospital on November 24. The 18 who were killed died as a result of the blunt force musculoskeletal and internal injuries that had been sustained during the impact sequence.



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Figure 2.--Wreckage of RYA 103.

Three passengers who survived had sustained serious injuries. A 16-year-old male in seat 3-B, a 26-year-old male seated in either seat 7A or seat 8A, and a 22-year-old female who had been in seat 6B. (See figure 3.)

Toxicological tests were performed on urine and other body specimens obtained from the captain and the first officer. The results were negative on a drug screen that included alcohol, antidepressants, sedatives, barbiturates, tranquilizers, amphetamine and methamphetamine, cocaine, marijuana metabolites, and phencyclidine.

1.15 Survival Aspects

1.15.1 Survivability

When rescue personnel arrived at the accident site, they observed the left front cabin door opened and lying on the ground. Except for one male passenger, the remaining airplane occupants were in their seats with their seatbelts still fastened. Rescue workers removed passengers through the open left front cabin door because the left and right overwing emergency exits were too narrow to accommodate passengers on backboards and because the left rear cargo door was jammed shut. The hinges on that door had to be cut off to gain entry into the rear cabin. Rescue personnel attempted to gain access to the cabin by cutting into the left rear cargo door and widening one of the cabin windows. However, they were hampered because the fuselage skin kept springing back. Because cargo and seats were blocking the way through the rear door, passengers were removed through the main cabin entry door. During the extrication process, the cabin interior was disturbed by rescue personnel and as a result, the exact position of many of the bodies and passenger seats could not be determined.

1.15.2 Crash

The passenger seats were certificated according to the inertia loads in 14 CFR 23.561, i.e., 3.0 G. upward, 3.0 G. downward, 9.0 G. longitudinal, and 1.5 G. lateral. These values are increased by 1.33 to take into account the strength of the fittings or attachments for the seats. Beech exceeded the requirements 14 CFR Part 23 and statically tested the seats to the following criteria: 5.25 G. upward, 8.25 G. downward, 12 G. longitudinal, and 2.85 G. lateral. The three-place bench seat was tested to 4.2 G. upward, 7.2 G. downward, 12 G. longitudinal, and 2.4 G. lateral.

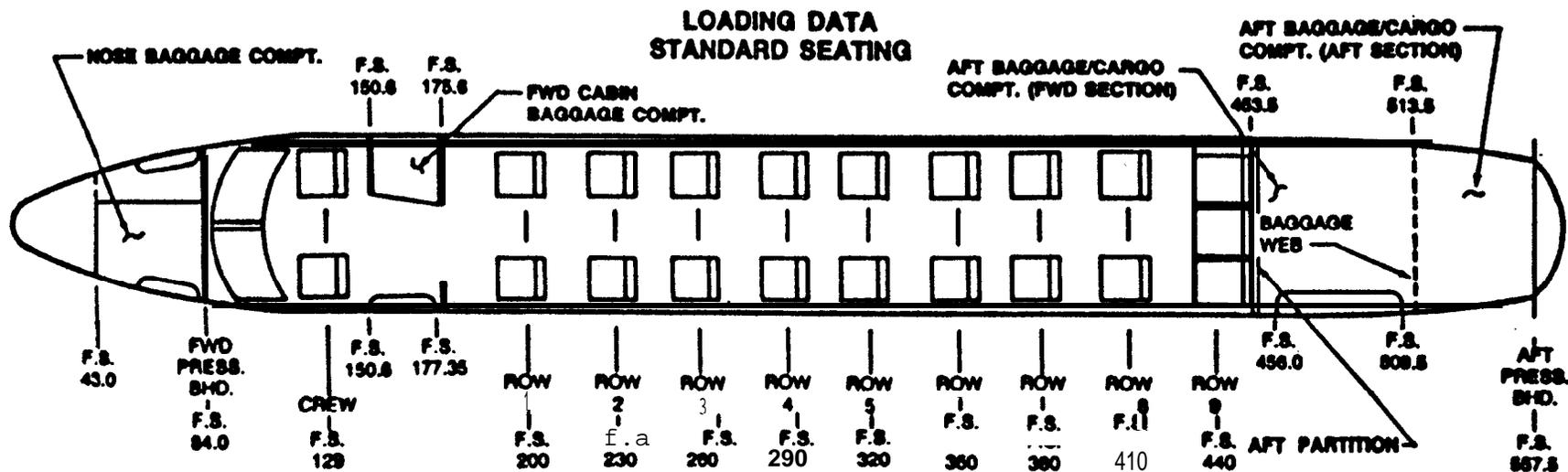
Using the airplane's attitude at impact, an assumed impact velocity, and the crush damage to the fuselage, the Safety Board determined the values of the average accelerations that occurred at initial impact along the airplane's longitudinal, lateral, and vertical axes. The range of those accelerations were 7.01 to 10.40 Gs. longitudinal, 4.8-7.23 Gs. lateral, and 19.80-35.7 Gs. vertical. The vertical velocity change was about 42 feet per second.

1.15.3 Crash/Fire Rescue Response

At 1825, the Homer Volunteer Fire Department was notified of the crash by the Homer police dispatch. One rescue unit, two medic units, a "retired" ambulance (used only in emergencies and on special occasions), one engine company, and two tankers arrived on scene between 1839 and 1845.

Although there was no fire, the emergency medical services chief requested firefighters to apply foam on the airplane and around areas that presented a fire hazard.

Two difficulties impeded rescue activities. First, the rear cargo door was deformed at the lower door latch and would not operate. Attempts to open the cargo door using a "Hurst" spreader (JL-32B) with standard tips was not successful because the fuselage ripped and reduced the force on



BAGGAGE/CARGO LOCATION	CAPACITY - POUNDS	CENTROID (FUSELAGE STATION)
NOSE BAGGAGE COMPARTMENT	180	65.8
FORWARD CABIN BAGGAGE COMPARTMENT (INCLUDES UP TO 100 POUNDS WHICH MAY BE SUSPENDED FROM CLOTHES ROD)	250	163.6
AFT BAGGAGE/CARGO COMPARTMENT - FWD SECTION	860	463.5
- AFT SECTION	630	633.0

NOTE:

1. For compartment loadings which result in only partial utilization of total compartment volume, load items must be distributed or secured in a manner to preclude shifting under normally anticipated operating conditions.

Figure 3.--Beech 1900C interior.

the door and because the fuselage material kept springing back into place. Another attempt was made to gain cabin access by widening the farthest aft window area after it was knocked out. This was abandoned because the fuselage material closed in on the rip after the spreaders were removed. The top of the cargo area was finally opened by cutting the continuous hinge at the top of the door with an air chisel, causing the top half of the door to fold down and allow access into the rear of the cabin through the cargo area. Rescue workers stated it would have been helpful to have information on the best locations to cut into the fuselage.

The second difficulty involved the location of the master switch to shut off the electrical power on the airplane. When rescuers first arrived on the scene, the instrument panel lights and the exterior beacon light were on. Rescuers were unable to locate a clearly marked master switch which presented a particular problem in attempting to extricate the first officer from his seat. One rescue worker stated :

Panel lights were still on at this time, and I was unable to find a master switch. I did turn off an overhead switch marked "Panel Lights." An attempt was made at copilot extrication. The seat belt was cut, but when the copilot was moved slightly, [electrical] arcing occurred in the instrument panel. I then placed O₂ on the copilot at 10/LPM and waited for assistance in shutting off the electrical system. I could do no more for the copilot until electrical shutdown.

It took rescue workers about 45 minutes after their arrival to shut off the electrical power. In the interval, an unidentified person approached the first officer's window and offered assistance to the rescuers in disengaging the electrical power. However, the unidentified person disappeared before any attempt was made to disengage the power. A firefighter, who happened to notice an open cover on the right wing, found the battery, and with the assistant airport manager's assistance, disconnected it. He also pulled some fuses.

1.16 Test and Research Information

1.16.1 Component Disassembly

Disassembly of the powerplants, propellers, navigation equipment, and other components including the autopilot and the deicing valves, showed no evidence of preexisting damage or malfunction.

1.16.2 Flight 103 Weight and Balance

Safety Board investigators removed and weighed all cargo, checked baggage, and carry-on baggage. The cargo and baggage weighed 2,283 pounds; however, some of the articles had been subjected to wetness from snow and firefighting foam before weighing. Actual passenger weights were obtained for the 19 passengers; the average weight of each passenger was 190.5 pounds. Included in the initial and all subsequent weight and balance computations were the weights of two dogs, one weighing 64 pounds and the other weighing 81 pounds. The dogs, who survived the accident, were transported in kennels loaded into the forward portion of the aft cargo compartment.

The Safety Board calculated the least and most conservative weight and CG location values, based on the actual passenger and cargo weights and known cargo locations on the airplane. Because the exact distribution of cargo between the forward baggage compartment, cabin, and aft cargo compartment was not known, two weight and balance calculations were made to provide a range of CC location.

Condition "A"

	<u>Weight (lbs.)</u>	<u>Moment /100</u>
1. Airplane empty weight	9,163.4	25,911.2
2. Crew and crew baggage	320.0	412.8
3. Passengers	3,619.5	11,811.0
4. Baggage and cargo		
a. Nose	82.5	54.0
b. Forward cabin baggage	250.0	409.0
c. Carry-on (cabin)	147.2	448.9
d. Aft baggage		
1) Forward section	1,353.0	6,541.8
2) Aft section	<u>451.0</u>	2,403.8
Subtotal aft	[1,804.0]	
Total baggage and cargo	[2,283.7]	
5. Fuel		
1) Ramp (Kodiak)	1,836.5	5,513.8
2) Taxi/runup	<u>-110.0</u>	<u>-326.0</u>
6. Takeoff condition	17,113.1	53,180.3
7. Calculated CC = 310.76 inches aft of reference		

Condition "A" calculations would have resulted in a takeoff weight from Kodiak of 513.1 pounds over maximum gross takeoff weight, with a CG 10.86 inches aft of the limit.

The fuel burned en route to Homer caused the CC to move further aft. Therefore, it was necessary to recalculate a new weight and CG location at the time of impact.

8. Fuel burned en route	-828.8	-2,520.1
9. Condition before crash	16,284.3	50,660.2
10. Calculated CG = 311.10 inches aft of reference		

The landing weight of RYA 103 at Homer was calculated at 184.3 pounds over the maximum allowable landing weight, with a CC located 11.20 inches aft of the limit.

Condition "B"

The second calculation assumed that more of the cargo was in the forward cabin baggage compartment which resulted in shifting the CG location forward. This calculation offered the most conservative, i.e., forward CG location. It also assumed a 10 percent water absorption of the soft bags due to absorption from ground-based moisture and reduced their weight by 52.3 pounds. Condition "B" resulted in the following weight distribution:

	<u>Weight (lbs.)</u>	<u>Moment /100</u>
1. Forward cabin baggage	307.5	503.1
2. Carry-on	133.7	408.0
3. Aft baggage		
a. Forward section	1,304.1	6,305.3
b. Aft section	340.6	1,815.4
Subtotal aft	[1,644.7]	
Total baggage and cargo	[2,231.4]	

Condition "B" resulted in a calculated CG of 308.33 inches aft of reference or 8.43 inches aft of the limit on takeoff from Kodiak. The takeoff weight was computed to be 16,997.8 pounds or 397.8 pounds over the maximum gross takeoff weight limit.

Allowing for 828.8 pounds of fuel burned en route to Homer, the estimated landing weight of RYA 103 was 16,169 pounds or 69 pounds over the maximum allowable landing weight. The resultant CG was calculated to be 308.54 inches aft of reference or 8.64 inches aft of the aft limit due to the rearward movement of the CC as the fuel was consumed.

1.16.3 Flight Test

In March 1988, the Safety Board observed a series of flight tests on the Be 1900 designed to examine the airplane's flight characteristics when the CC is moved beyond the aft limit. The weight, balance, and other characteristics of RYA flight 103 approximated closely those parameters of the test airplane. The tests employed water tanks which, by transferring water across tanks, allowed the CG of the airplane to be moved aft as much as 11 inches beyond the aft limit. The original certification testing was conducted to 299.9 inches aft.

In the test sequences, the airplane climbed to altitude with the CG in the normal range. Once at altitude, approximately 10,000 feet, a predetermined amount of water was transferred aft until the test CG of 7 inches aft of the aft limit, in flight, was obtained. One takeoff was accomplished with the CG approximately 1.5 inches aft of the aft limit. One landing was accomplished with the CG approximately 3.5 inches aft of the aft limit. Taxi tests were accomplished with the CG as much as 8 inches aft of limit.

The tests showed that the static stability of the airplane deteriorated rapidly as the CG moved aft. Extending flaps in the aft CC configuration caused the static stability to deteriorate further. With flaps up, the airplane's static stability was essentially neutral with a CG 7 inches aft of limit. Neutral static stability was obtained at 20" of flap at approximately 3.5 inches aft of limit. At a CG 7 inches aft with the flaps up and in level flight, the degraded dynamic stability required constant pilot attention. At any CC aft of the neutral point, the static stability of the airplane became negative, resulting in an unstable airplane. With the flaps down, elevator travel limits may be reached. Maximum continuous power may require additional elevator travel for recovery. With a CG as much as 11 inches aft of limit, the airplane could pitch up in spite of full nose-down elevator application.

After the flight tests, the Beech Aircraft Corp pilot who flew the test airplane stated that at CG 8 inches aft of the limit, the nose wheel became very light and lifted off the ground if a bump were encountered, but the airplane was controllable during taxi. However, in cruise configuration with the CG 7 inches aft of the limit, constant pilot input was required to maintain speed and altitude. With the flaps at 20° and the CC 7 inches aft of the limit, they believed a safe landing would be possible. The pilot believed that while the airplane could be taxied with a CG 11 inches aft of the limit, for safety reasons, no in-flight tests were conducted with the CG more than 7 inches aft of the limit. The pilot believed that if very little or no flaps were extended, takeoffs would still be possible at CG 11 inches aft of the limit. Normal takeoffs were conducted with 10" of flaps extended. With the flaps extended, the pilot stated that the controllability of the airplane was very dependent on CG. If the flaps were extended 35" and the CC was 11 inches aft of the limit, the pilot and Beech performance engineers believed that it would not have been possible to control the airplane during landing. In this situation, an encounter with turbulence, a power change, a sudden control input, etc., could upset the airplane to a condition where there would be no elevator control available with which to effect a recovery.

Information from the certification tests to approve operation of the Be 1900 in icing conditions indicated no significant decrease in flight controllability or handling characteristics of the airplane with an accumulation of 1 to 1 1/2 inches of ice on its leading edges. In addition, within the normal CG range, variations in the airplane's pitch controllability or changes in the stall characteristics, with ice accumulations as much as 1/2 to 2 inches, were minimal. (See figure 4.) Further, within the normal CG range, no noticeable change in stall characteristics, flaps up or down, resulted from ice accumulations varying from 1/2 inch to 2 inches.



Figure 4.--Ice accumulation on leading edge of the stabilon of the Be 1900 during certification tests.

1.17 Other Information

1.17.1 Ryan Air Service, Inc.

Ryan began as Unalakleet Air Taxi in 1960, serving small communities in western Alaska with a single-engine airplane. In 1971, it acquired an additional single-engine and light, twin-engine airplane, while continuing to serve western Alaskan communities from its base in Unalakleet. In 1979, the company entered into a contract with Wien Air Alaska to serve four villages from Unalakleet. In 1980, the company changed its name to Ryan Air Service and expanded its service to two villages on St. Lawrence Island. In 1981, Ryan operated into communities that had been served from Nome by Wien Air Alaska. In the spring of 1981, Ryan purchased its first twin-engine, turbine

airplane and based it in Anchorage, serving four communities, Iliamna, McGrath, Galena, and Unalakleet, for Wien Air Alaska. In 1983, the company acquired a second, different type twin-engine, turbine airplane.

During the early 80s, Ryan began a period of expansion. According to its president, rather than increasing its operations, it chose to acquire other, established, air taxi operators in Alaska. In June 1983, it purchased McGrath Air Service based in McGrath. In September of that year, it purchased Munns Northern Airlines, giving the company facilities and bases in Nome and Kotzebue. In the autumn of 1983, Ryan ceased operating for Wien and began a code-sharing arrangement for Alaska Airlines. In the spring of 1984, the company purchased its first Be 1900, and some months later, traded a twin-engine, turbine airplane for an additional Be 1900. In June 1985, the company purchased Nelson Island Air Service, adding 29 villages, primarily in southern Alaska, to its route structure.

In May 1986, the company transferred its operations center to Anchorage, having had its center in Nome for most of the 1980s. Ryan's president stated that the decision was made because, "...we were spending most of our time in Anchorage, and we should headquarter here to streamline our accounting and corporate operations further." Later that year, Ryan added service between Anchorage and Dillingham, Kodiak, Kenai, and Homer. At the time of the accident, Ryan had seven operating hubs with crew bases at each of the hubs and four maintenance bases located throughout the State. According to the president of Ryan, the most significant operating problem the company faced in its operating structure "... has been [integrating] employees from the acquired fixed-based operators that we purchased."

In late 1984, the company president relinquished his authority as the director of operations along with authority over all company flight operations, including weight and balance determination procedures and cargo loading. The person who was appointed in 1984 to be the director of operations was dismissed in February 1987. He told the Safety Board that he personally investigated employee allegations of improper weight and balance determinations and disciplined employees when they failed to follow correct procedures. For example, he disciplined a station agent who, according to several company pilots, attempted to coerce pilots to fly overweight aircraft.

The director of operations characterized the relationship between the FAA and Ryan, while he was associated with the company, as "most often hostile." "It seemed," he told the Safety Board, "that there was always an investigation of some sort ongoing. Many were generated by discharged employees who had been fired with good cause and who could not sustain civil action in court." Further, he stated that he "...often wondered why we got so much attention from the FAA while other carriers never saw an inspector. On a personal note, I sometimes wondered if I should go ask how much we would have to pay and to whom should we pay it. There was a clear disparity in surveillance and enforcement."

According to the president of Ryan, he dismissed the director of operations after he was informed of the results of an FM inspection in February 1987 which found numerous instances of poor and inadequate recordkeeping.

In April 1987, the president of Ryan hired a new director of operations. Before his employment with Ryan, the new director of operations had been employed as a POI inspector in the FAA's Alaska Region. Shortly thereafter, the president of Ryan appointed a new chief pilot.

The new director of operations and the chief pilot took several steps which they believed would improve morale among Ryan employees and would enhance compliance with FAA directives. These included establishing regular contact with personnel among the Ryan stations in Alaska. In addition,

they developed and wrote a new company operations and policy manual and developed new and more rigorous weight and balance computational procedures. (See section 1.17.2)

Ryan began service to Kodiak in the fall of 1986 during Kodiak's deer hunting season. During the season, which lasted from September to December, Ryan experienced heavy load factors of passengers and cargo. Ryan provided a "hunter's special" rate for excess baggage that reduced the expense for transporting large amounts of game meat (18 cents per pound rather than the regular 44 cents per pound).

At the time of the accident, Ryan had eight operating bases and provided commuter service to 85 airports across Alaska. Ryan employed 250 persons, 50 of whom were pilots and operated the following types of aircraft:

	<u>Number</u>	<u>Type</u>
	3	Be 1900
	12	Cessna 402
	8	Cessna 207
	2	Cessna 208 (Caravan)
	2	Partenavia P68C
	<u>2</u>	Cessna 185
Total	29	

Ryan, in accordance with 14 CFR Part 135, placed responsibility for weight and balance determinations on the flightcrew. At the Kodiak station, a gate agent checked passengers and baggage and completed the flight manifest and a ramp agent loaded the baggage on the aircraft, often with the flightcrew's assistance. Because of the volume of baggage present during the hunting season, the Kodiak station agents developed a procedure of using informal worksheets for arithmetic computation of baggage loads. Weights were not written on the individual pieces of cargo, but rather were memorized by the baggage loader. The manifest for RYA 103 indicated two arithmetic errors which resulted in the loading of an additional 1 IO pounds of extra cargo to the airplane. Further inspection of the weighing and loading procedures was not possible because of the absence of written documentation.

1.17.2 Ryan Weight and Balance Policies

Ryan's FAA-accepted Operations Manual stated that:

1. The center of gravity will be determined by the flight crew prior to departure of each leg of each flight. In multi-engine aircraft it must be recorded on forms provided by the company and held for 30 days at the home base.
2. Flight crew shall wait until passengers are seated, note their position and then compute weight and balance.
3. Flight crew shall supervise the loading of all passengers, cargo, mail, and baggage, note the position of each and then will complete the weight and balance computations.

In accordance with the provisions of 14 CFR Part 135 and its FAA-accepted operations manual, Ryan used an average weight for adult and child passengers and their handheld luggage. The average weights could be used, in place of actual weights, if the passengers on board were "standard," i.e., reflective of the average weight of passengers on Ryan flights. Ryan was required

to use actual weights when nonstandard passenger groups, such as athletic squads or groups where the average weight obviously did not conform with the average passenger weight, were onboard.

The Ryan operations manual specified that:

- a. An average weight of 160 pounds (summer) may be used for adult passengers during the calendar period of May 1 through October 31.
- b. An average adult of 165 pounds (winter) may be used for each adult passenger during the calendar period from November 1 through April 30.
- c. An average of 80 pounds may be used for children between the ages of 2 and 12. Children above 12 years of age are classified as adults for the purpose of weight and balance computations. Children less than 2 years old are considered "babes in arms."
- d. The above passenger weight includes minor items normally carried by a passenger, such as handbags and attache cases.
- e. Use of average passenger weight is not authorized in the case of flights carrying passengers whose average weight obviously does not conform with the normal standard weight.

In addition, the manual stated:

Actual passenger weight may be determined before boarding by weighing each passenger along with minor articles carried on board by the passenger. If minor articles are not weighed, pilots should estimate the weight of such articles. The actual passenger weight may also be determined by asking each passenger his weight and adding that to a predetermined constant to provide for handcarried articles and also to cover possible seasonal effect upon passenger weight due to variance in clothing weight.

At the time of the accident, company policy at Kodiak restricted the cargo and baggage load to 1,100 pounds whenever there was a full passenger load. Six months after this accident, the FAA increased the minimum average passenger weight to 180 pounds for all operators in Alaska.

At the time of the accident, Ryan crewmembers entered weight and balance information on a plastic-covered form, using a grease pencil which allowed the information to be erased easily. Ryan crewmembers did not, nor were they required by 14 CFR Part 135, to maintain a duplicate copy supporting the determination of a flight's weight and balance information, at a central facility maintained by the company. Rather, crewmembers often performed weight and balance calculations after an airplane had been loaded and engine starting procedures begun.

1.17.3 FAA Surveillance

Ryan held Air Carrier Certificate No. ANC AL 499 which authorized it to conduct commuter air carrier and on-demand charter operations under 14 CFR Part 135. The certificate-holding office was FAA Flight Standards District Office (FSDO) No. 63, Anchorage, Alaska. Before August 1, 1986, FAA FSDO-61, Fairbanks, Alaska, held the certificate.

The POI and two assistants assigned to Ryan also oversaw ERA Helicopters, inc., and Reeve Aleutian Airways, Inc. The FAA designated three pilots from Ryan to conduct flight checks of pilots

in the Be 1900. The checks included FAR 135.293 competency tests, FAR 135.297 proficiency tests, and FAR 135.299 line checks.

One operations inspector, who was type-rated in the Be 1900 airplane, was assigned to the FAA's Alaska Region. The inspector was located at FAA FSDO-61. FSDO-63 had one operations inspector with a waiver to test Airline Transport Pilot applicants in the Be 1900. Sixteen operations inspectors at FSDO-63 were qualified to conduct surveillance and inspections. Both the POI of Ryan from Anchorage and his predecessor from Fairbanks testified that the company president cooperated with them and responded positively to their requests.

From October 1, 1986, until the accident, the FAA performed the following inspections of Ryan operations. (Maintenance and avionics inspections have not been listed.)

<u>Type of Activity</u>	<u>Number of Inspections</u>
Technical Assistance	1
Evaluate Training Program	2
Observe Emer Evac/Ditching	1
MEL Revision	13
Operations Specification Revision	1
Approval of Check Airman	3
Type Rating--Oral	3
Type Rating--Aircraft	5
Technical Assistance	1
Field Office Indepth Inspection	2
Facilities Inspection/Line Station	4
Manual/Procedures	4
Ramp Inspections	28
Enroute--Cockpit Inspections	56
Enroute--Cabin Inspections	1
Training Program	5
Crew/Dispatcher	2
Trip Records	2
Check Airman	19
Proficiency/Competency Check	8
Facility	1
Ramp Inspections (FAR Part 91)	1
Incident Investigations	3
Occurrence (Turn Back, Etc.)	4
Enforcement/Legal Action	1
Complaint--Resolved	5
Occurrence (Turn Back, Etc.)	1
<u>Type of Activity</u>	<u>Number of Insoections</u>
Enforcement	3
FOEB MMEL	2
Aviation Education and Safety Promotion	1
Operation Total	183

The FAA recorded 22 enforcement actions against Ryan from December 1980 to the time of the accident. Ten letters of corrections concerned pilot recordkeeping (3), airport security (2), hazardous materials (1), operations specifications (2); a forward observer seat (1), and multiengine operation with inoperative instruments or equipment installed (1). Six warning letters concerned recordkeeping (2), maintenance (2), use of noncurrent aeronautical charts (1), and airport security (1).

Four enforcement investigations resulted in no enforcement action. On March 3, 1985, Ryan Air Service, Inc., paid a \$9,000 civil penalty for using the services of a nonqualified pilot-in-command for commuter air carrier operations. This penalty was the most that Ryan had actually paid in fines for violations of FARs.

On September 17, 1986, an FAA inspector was contacted by a former Ryan Air Service mechanic. The Ryan employee stated that he was representing three Ryan pilots who alleged that Ryan was pressuring its pilots to fly overweight/unsafe aircraft. The pilots were willing to cooperate with the FAA by providing documentary evidence of alleged instances of Ryan's overweight operations and direct testimony that Ryan's management condoned and encouraged the overweight operations. However, they were willing to cooperate with the FAA only on the condition that they be granted immunity from prosecution by the FAA. One of the pilots was the captain of RYA 103, who was a first officer at the time.

The FAA inspector forwarded the request for immunity to his superiors in the flight standards division of the FAA's Alaska Region. In turn, that request was forwarded to the Alaska Regional Counsel. The request for immunity was denied. The FM inspector was told of the decision, and he informed the former Ryan Air Service mechanic who had made the request. The Regional Counsel said that after deliberating the matter, only the U. S. Attorney was empowered to grant immunity. He did not contact the U.S. Attorney because he considered it a third party request with "little or no support." There is no evidence that he took other action on the request. However, in response to the allegations, the FAA's FSDO inspected Ryan's weight and balance procedures and examined records of weight and balance calculations of Ryan flights performed during the prior 30-day period. The result of this inspection was the finding of one incorrect weight and balance determination of a Ryan flight. As a result, the FSDO processed a violation against Ryan.

At the time of the accident, one FAA Enforcement Investigative Report relating to recordkeeping, pilot training, and testing was in progress. Findings were a result of a February 1987 base inspection of Ryan. The POI, who had documented the alleged violations, characterized the violations as "flagrant" and testified that he initially had recommended a total of \$250,000 in civil penalties against Ryan. He based the size of the recommended civil penalty on a FAA formula which provided the maximum civil penalty of \$1,000 for each violation, multiplied by the number of months that each violation existed. The POI had submitted the recommended civil penalty with what he considered sufficient supporting documentation through his superiors within the FSDO-63 and the flight standards division of FAA's Alaska Regional Office. All recommended penalties were then forwarded to the FAA's Alaska Regional Counsel. The Regional Counsel's office twice returned the violation enforcement case to the POI. They asked for additional documentation to support the recommended penalties. In reconsidering the sanction, the POI stated that he had considered recommending that Ryan's Air Carrier Operating Certificate be suspended; however, such action would have seriously affected Ryan's work force and would have disrupted air service to a number of small communities in Alaska. As a result, the POI decided to propose a large civil penalty, which he believed would have as much of an impact on Ryan as a certificate suspension but without impact to its employees or passengers. In addition, he believed that a civil penalty was consistent with previous FAA actions against similar alleged violations which were upheld in various appeal processes.

After the second disapproval of the recommended penalty, the POI recalculated his recommended sanction against Ryan, using a formula provided to him by the Regional Counsel and then resubmitted the violation enforcement case along with a new recommendation that Ryan be assessed a \$25,000 civil penalty. The Regional Counsel's office subsequently reduced the amount of the recommended civil penalty to \$16,500 because it believed the supporting evidence was inadequate.

The FAA's Alaska Regional Counsel stated that he and his staff reviewed enforcement cases to determine the nature of violation, to determine the sufficiency of evidence presented to support the alleged violation, and to decide whether the violation should be handled as an administrative matter. They routinely change sanctions and proposed penalties that are recommended by aviation safety inspectors and the flight standards division.

Following the accident and after allegations about the safety of Ryan's operations and the degree of its compliance with Federal Aviation Regulations (FARs), the Alaska Regional Counsel, on December 30, 1987, issued an Order of Investigation of Ryan Air Service, Inc., to determine Ryan's compliance with FARs. The FAA assembled a team of inspectors to conduct a special inspection of Ryan Air Service, Inc. The inspection began in early January 1988.

During its inspection of Ryan's maintenance facilities, the special inspection team found that during the previous 6 months, Ryan's airplanes had not been maintained in accordance with an FAA-approved maintenance manual. That is, Ryan's methods of rounding the number of hours accrued by an airplane at times resulted in required inspections being performed several hours after the inspection has actually been required. The leader of the inspection team stated that violations found by the team were "sufficiently obvious" and that he believed Ryan's intent to violate FARs could be discerned. As a result of the team's findings, the evidence from the November 23, 1987, accident, and previous documented deficiencies, the FAA discontinued the inspection and initiated a consent order. Under this order, Ryan agreed to cease operations until changes in company management and procedures had been carried out. Ryan agreed to the consent order and ceased its operations in January 1988. Ryan resumed operations, on a considerably *smaller scale than before* the accident in the summer of 1988. (See appendix D.)

1.17.4 Accident History

According to the Safety Board's accident/incident data, Ryan airplanes were involved in 10 accidents with 12 fatalities to the time of the accident. The data indicate that:

- (1) On July 12, 1980, a Cessna 402 struck the side of a hill near Golovin, Alaska, at cruise airspeed. Low ceilings and fog were reported in the area. Eight people *aboard the airplane were killed.*
- (2) On March 19, 1981, near Teller, Alaska, a Cessna 207 encountered icing, low ceiling, and visibility. The pilot elected to land with ice on the windshield. The airplane stalled and flipped over on impact. There were three minor injuries.
- (3) On October 16, 1984, the pilot of a Beech 3NM failed to extend the landing gear while attempting to land at Selawik, Alaska. There were no injuries.
- (4) On January 31, 1985, the pilot of a Cessna 206 lost directional control after aborting a takeoff from Unalakleet. The investigation revealed that the pilot failed to remove a rudder gust lock. The airplane departed the end of the runway. There were no injuries.

- (5) On February 7, 1985, a Cessna 207's left main gear struck and killed a snowmobile driver at Koyuk, Alaska. The investigation revealed that the pilot landed about 600 feet short of the runway threshold.
- (6) On December 15, 1985, the pilot of a Cessna 207, operating under VFR, flew into an area of low ceiling, fog, and freezing rain. The pilot and three passengers received serious injuries when the pilot attempted a go around at Napaskiak, Alaska, in freezing rain conditions.
- (7) On February 11, 1986, a Cessna 207 struck the ground after departing Nome, Alaska. Weather conditions at the time included freezing rain. All three persons on board were killed.
- (8) On June 16, 1986, a Cessna 207 struck power lines and crashed at St. Mary's, Alaska. The pilot, the only person on board, was killed. The investigation showed that the pilot had been flying in formation with another airplane.
- (9) On September 17, 1986, a Cessna 207 overran the runway on landing at Mountain Village, Alaska. The investigation found that brake failure was a factor in the accident.
- (10) On November 20, 1987, a Cessna 208 ran off the end of the runway on landing at Atmautluak. There were no injuries.

Since July 12, 1981, Ryan had nine reported incidents. The incidents include a propeller strike, a door opening in flight, a forced landing of a Cessna 207 after the engine failed, two damaged nose gear incidents, one collapsed main gear, main gear tires deflating after landing, and one engine shutdown due to low oil pressure.

2. ANALYSIS

2.1 General

The pilots were properly trained and certificated to conduct the flight in accordance with applicable FARs. There was no evidence of medical problems which would have adversely affected the flightcrew's ability to conduct the flight. They had received the required duty break before the accident.

The airplane was maintained in accordance with applicable FARs. There was no evidence of preexisting airplane structures, systems, or powerplant malfunctions which could have affected the flight. The evidence indicated that each powerplant was at a relatively high power setting at the time of impact.

The Safety Board examined airplane performance, pilot performance, company operations, and FAA surveillance to determine if they contributed to the cause of the accident. Further, the crash survivability issues were examined.

2.2 Aircraft Performance

The investigation revealed that the airplane's leading edges were coated with up to 3/8 inch of rime ice when it crashed. Although any ice accumulation would have affected the airplane's performance, the Safety Board believes that under allowable CG loading, the amount of ice that was found would have had only minimal effect upon the airplane's controllability. For example, the airplane flight manual recommends that for optimum de-icing performance 1 to 1 1/2 inches of ice be allowed to accumulate before the airplane's de-icing boots are to be activated. During the icing certification tests of the airplane, no significant differences in flight controllability or handling characteristics were noted with 1 1/2 inches of ice on the leading edges. Consequently, because considerably less ice than that amount was found on the airplane, the Safety Board concludes that ice accumulation on the airplane did not cause the accident.

The results of the investigation indicate that the loss of control of Ryan Air flight 103 resulted directly from an excessively aft CG. The out-of-limits CG occurred because the aft cargo compartment had been loaded with from 1,600 to 1,800 pounds of cargo. With the passenger and fuel load present on RYA 103, any cargo weighing more than approximately 850 pounds in the aft compartment would have displaced the CG beyond the aft limit. The CG would have moved still further aft as the airplane consumed fuel.

The investigation indicated that the total weight of the cargo including carry-on articles and the two hunting dogs was 2,283 pounds. Assuming an allowance of 150 pounds for carry-on articles, then RYA 103 was overloaded about 600 pounds beyond the first officer's request. This resulted in a CG that was 8 to 11 inches aft of the aft limit.

The Safety Board believes that the baggage handler may have become confused when the first officer said, "Before we get the 1,500 pounds on board, it would bulk out." Had the airplane been loaded *in* accordance with the first officer's request of 1,500 pounds, the accident might have been avoided. A 1,500-pound cargo load, assuming that 250 pounds was placed in the forward compartment, would have resulted in a CG about 3.5 inches aft of the rear limit, and according to the results of the flight test, even with the CG this far aft of the limit the airplane could have been controllable.

However, that flight test did indicate that a similarly loaded Be 1900 with a CG approximately 7 inches aft of the limit could suffer a loss of control (pitch-up), particularly during approach when full flaps were to be extended. The effects of the extreme aft CG could have further adversely

affected airplane control since required pilot input on approach would have exacerbated rather than alleviated the airplane pitch-up tendency. That is, the combination of the slower airspeed, the extended flaps, and the power changes that the crew used to bring the airplane into an approach and then into a landing configuration would have increased the already dangerous tendency of the airplane to pitch up beyond the ability of the pilot, irrespective of pitch, power, or flap setting changes, to regain pitch control.

The fact that the gear was found in the down and locked position, the flap handle in the up position, the right flaps in the 7" to 12" position, and the stabilizer trim in the full nose-down position indicates that the pilot may have attempted to raise the flaps after initially selecting full flaps. He may have recognized the adverse effects of the extended flaps on the airplane's stability. However, because of the extreme aft CG, full extension of flaps could have exacerbated the airplane's upward pitching tendency beyond the capability of the pilot to counter even if he used maximum nose-down elevator.

As the pilots of the flight test explained, if the captain had then added power to regain airspeed lost following full flap selection and the resultant pitch up of the airplane, his ability to control the airplane as it continued the pitch-up moment would have been reduced. The captain at that point may have added still more power and/or retracted the flaps in an attempt to either execute a go-around or reduce the pitch up of the airplane. However, either action would have further compromised airplane control since adding power would have continued the pitch-up tendency and raising the flaps would have increased the airplane's-stall speed. In either event, RYA 103 would have experienced a full stall from either the increased pitch or the retracted flaps resulting in a rapid vertical descent. In fact, the nature of the damage to the airplane, the full nose-down trim, the intermediate flap position, and the witness descriptions of the airplane's attitude when it struck the ground supports this scenario. Consequently, the Safety Board believes that because of the extreme aft CG, and pilot actions to regain airplane control following flap extension, the airplane stalled as the pilot raised the flaps.

Despite the fact that the airplane was overloaded beyond the first officer's request, the pilots were responsible for accurate weight and balance computation. Neither the captain nor the first officer fulfilled his responsibility for determining the airplane loading and for calculating an accurate weight and balance before departure. Although Ryan's procedures clearly spelled out appropriate methods of determining weight and balance, the investigation demonstrated that these procedures were not followed.

2.3 Pilot Performance

The evidence indicates that the flightcrew of RYA 103 disregarded company procedures in loading the airplane. They failed to properly complete the weight and balance card before they began to taxi, and they failed to accurately determine within an acceptable CC range the amount of cargo that should have been loaded into the airplane. Further, they recorded an incorrect CG in the airplane log. Because Ryan developed and the FAA accepted crew procedures for each of these steps, the Safety Board attempted to examine why the crew failed to follow them.

The evidence indicates that the first officer, within proximity to the captain, gave improper directions to the ramp agent on the amount of cargo to place on the airplane. The captain failed to counter the direction of the first officer as he should have. It is possible that the first officer's status within the company, a managerial figure involved in training, may have influenced the captain to keep silent when prudence should have dictated otherwise.

Yet, given the first officer's position in the company, as someone responsible for the training of others, the Safety Board is concerned about his disregard of regulations and procedures. As a training instructor, he should have been especially sensitive to the need for strict adherence to

procedures concerning weight and balance. However, he was a relatively junior pilot on the Be 1900 with considerably less experience on that airplane than he had accrued on single-engine and light, twin-engine airplanes. It is possible that his direction to the ramp agent reflected more his knowledge of other, less sophisticated airplanes with their considerably smaller cargo capacities and where such procedures, while improper, may not have had the same effect on airplane control as they had on the more sophisticated Be 1900. Moreover, in the Alaskan aviation environment, such attitudes often characterize what the Safety Board has referred to in the past as the “bush pilot syndrome.”⁵ This syndrome describes “a pilot’s casual acceptance of the unique hazards of flying in Alaska to a pilot’s willingness to take unwarranted risks to complete a flight.” The Safety Board believes that, given the first officer’s extensive experience flying light, relatively unsophisticated aircraft in remote areas of Alaska and his relative inexperience in flying sophisticated aircraft in scheduled 14 CFR Part 135 operations, he may have manifested this attitude in giving directions to the ramp agent in Homer.

2.4 Company Management

Ryan management appeared to be aware that the company’s rapid growth of the early 1980s would necessitate changes in its management. The company responded by creating several managerial positions and delegating appropriate authority to the individuals who filled those positions. Nevertheless, Ryan management’s efficacy may have been reduced because the president performed many routine duties in addition to carrying out critical decision-making activities. For example, he was the first FAA-designated check airman on the Be 1900 for Ryan, he hired many pilots and other company employees, and he fired some when he considered it necessary. He personally interacted with the FAA and made many major decisions on compliance issues and all decisions on enforcement actions. He conducted check rides and flew regularly scheduled flights as a flightcrew member. He also was involved in most major financial transactions, and he served as the company representative before local and State authorities and civic organizations. Thus, he may have failed, due to distraction or to insufficient time available, to execute properly his managerial duties in some of these more critical operational areas.

Nevertheless, despite the demands on the company president’s time, the evidence indicates that he was responsive to the requests of the FAA. Both the POI from Anchorage and the POI from Fairbanks, who had overseen Ryan, testified that they had found the company president cooperative. While the FAA continued to find that Ryan violated recordkeeping requirements of the FARs, the Safety Board was unable to find a systematic pattern to these violations.

Rather, the evidence indicates that the company president attempted to improve the oversight of Ryan’s flight operations as well as its compliance with FARs. However, the Safety Board believes that Ryan’s attempts did not consistently improve either its operations or the record of its compliance with FARs. For example, in 1984, after Ryan operations had increased in size, the company president hired someone to perform the duties of director of operations. However, that person did not appear to have been effective as the director of operations. Certainly, that person’s description of the nature of the relationship between Ryan and the FM during his tenure can be characterized as adversarial at best. This may account for the numerous inspections that the FAA performed of Ryan operations as FAA personnel may have noted that he believed that they were treating him and Ryan unfairly.

At the same time, the director of operation’s supervision of Ryan operations also may have been less than fully effective. During his tenure, Ryan was acquiring and consolidating several smaller carriers, many of which had unique operational characteristics and procedures, into its

⁵Aviation Special Study--Air Taxi Safety in Alaska (NTSB/AAS-80-03).

operations. If Ryan's director of operations was not sensitive to the needs of *those employees, then* employee morale could suffer. Examples of poor integration and consolidation of different airlines, with divergent management styles and philosophies, have occurred among large domestic carriers that have experienced mergers and consolidations. The resultant strain on employee and management relations have, in those cases, resulted in disrupted operations. This could account for the attempt of several Ryan employees, including the captain of RYA 103, to allege to the FAA, over a year before the accident, that the company had pressured pilots to use improper weight and balance procedures. These allegations were not supported by the findings of an FAA inspection that followed the allegations.

During this interval, Ryan also experienced the most accidents and incidents in its history. While most of these were relatively minor, involving single-engine, single-pilot operations in remote areas of the State, often in extreme environmental conditions, the fact remains that most of the accidents and incidents were operational in nature. The Safety Board believes that the accident record of Ryan during the tenure of the director of operations, provided sufficient cause for the company to undertake a systematic examination of its operations and to take remedial action to correct perceived deficiencies. This was not done.

Following the results of the February 1987 inspection, the company president dismissed the director of operations, and 2 months later, it hired a replacement. Certainly the quality of the person selected to serve as the new director of operations, a former FAA POI, reflected the company president's commitment to improve the record of Ryan's adherence to FARs. The new director of operations, with a new chief pilot, quickly attempted to remedy one area of perceived company weakness by revising Ryan's manual, including company weight and balance procedures. The Safety Board believes that Ryan acted correctly, albeit belatedly, in effecting those personnel changes. The actions that the new director of operations and the new chief pilot subsequently took to address those deficiencies in company operations and in the company's dealings with the FAA were appropriate. Because of the history of Ryan's relationship with the FAA before February 1987, the Safety Board believes that the company president had sufficient cause to replace the existing director of operations sooner than he did with someone of equal stature and experience to the individual who was hired in April 1987 to serve in that capacity. Therefore, given the evidence, the Safety Board believes that the overloading of RYA 103 and the improper determination of weight and balance was a result of inadequate adherence to company and FAA procedures by the flightcrew of RYA 103 and not a result of inadequate adherence to company policy or to company action or inaction.

Nevertheless, the evidence indicates that despite these corrective actions, deficiencies in company management remained. For example, testimony at the Safety Board's public hearing revealed that although the first officer had claimed that he was and the FAA had considered him to be the company director of training, he was not, in fact, considered so by the company. Yet, there is no evidence that Ryan took action in response to the first officer's apparent misuse of this important title. Further, there is no evidence that during 1985 and 1986 when they had six accidents, Ryan undertook a systematic examination of its operations to determine if there was a possible company-related deficiency underlying the accidents and incidents. Rather, the company responded to the accidents and incidents by taking action against the particular crewmembers involved; which may have been due to the suggestions of Ryan's director of operations. The Safety Board believes that the proper company response should have been to examine its hiring practices, its training and checking programs, and its methods of oversight of its operations to determine how any of these areas could be improved.

In summary, the evidence indicates that at the time of the accident, Ryan properly trained its crews in weight and balance procedures and attempted to adhere to relevant regulations concerning weight and balance. Further, FAA personnel who regularly interacted with the company stated that the company attempted to maintain its operations in accordance with regulations. These beliefs are supported by the actions, albeit belated, of the company president. Therefore, given the

nature of this accident and the evidence gathered in its investigation, the Safety Board concludes that despite certain weaknesses in the company's management, these weaknesses did not contribute to the cause of the accident.

2.5 FAA Surveillance

Since October 16, 1984, Ryan airplanes were involved in eight accidents. Seven of the accidents were pilot-judgment related. During this time, Ryan began a period of rapid growth which involved a major expansion of its route structure by purchasing several air taxi operators. Ryan also introduced several new airplanes into its fleet, including the Be 1900, moved its operations base from Unalakleet to Nome and finally to Anchorage, and appointed a new employee for the position of director of operations. The FAA was thus responsible for the surveillance of an operator that was undergoing a major evolution both in the scope and complexity of its operations. Moreover, surveillance of Ryan was particularly challenging given the many remote sites, far flung routes, and often extremely harsh conditions in which the company operated.

Yet, despite the challenges it faced, the evidence of the FAA's oversight of Ryan suggests that its surveillance was adequate at the POI/PMI levels. However, because of inadequacy within the FAA's management, the subsequent effectiveness of that surveillance was compromised. Testimony from and records of surveillance of FAA inspectors directly responsible for overseeing Ryan indicate that those inspectors were attempting to improve Ryan's compliance with the FARs. This can be noted from the repeated inspections of Ryan and the attempts to document instances of violations of FARs and bring about subsequent enforcement action.

However, the fact that enforcement actions against Ryan were not being processed successfully to completion after examination by the FAA's Alaska Regional Counsel, suggests that weaknesses existed with the FAA's Alaska Region that limited the FAA's ability to carry out its oversight mandate. The ability of the FAA to levy penalties against operators is among its most potent instruments to bring about an operator's compliance with regulations. If this ability is compromised, then the FAA may no longer have the ability to bring about compliance from an operator that may be unwilling to do so. At the same time, the FAA's Regional Counsel has the responsibility to oversee the quality of proposed enforcement actions so that they are consistent with legal requirements and can withstand possible appeal. The evidence indicates that inadequate communication existed between two functions of the FAA--the oversight function within its flight standards division and its legal function within the Regional Counsel's office--which adversely affected its overall enforcement ability.

The POI of Ryan twice submitted a proposed \$250,000 civil penalty through his superiors in the flight standards division before a penalty 1/10 the size of the initial proposal was accepted by the Regional Counsel, who then reduced it even further to \$16,500. Since the flight standards personnel responsible for initiating the enforcement actions had been employed in their respective functions for several years, they should have been able to propose and support a penalty that could adequately withstand the scrutiny of the Regional Counsel. Similarly, the Regional Counsel should have been able to communicate effectively his legal concerns to flight standards personnel so that, following the initial review, only one attempt would have been needed to forward a civil penalty against Ryan that would have been found acceptable.

Other examples of poor communication within the FAA's Alaska Region also exist. The Regional Counsel disapproved the request for immunity from Ryan pilots for what he said were sound legal reasons but with no evidence that he attempted to pursue other possible alternatives that may have satisfied their request. Certainly, he should have been aware of the serious nature of the allegations and attempted to find a legal alternative that could have been acceptable to the pilots. Because he did not, the pilots' request was disapproved, no alternatives were proposed, and

the FAA missed an opportunity to document allegations of serious potential violations of the FARs that had a direct affect on flight safety.

Since the accident, the Alaska Regional Counsel has retired, and more important, the FAA has reorganized its management structure. This has resulted in direct oversight of flight standards and Regional Counsel in all FAA regions, functions by appropriate personnel based at FAA headquarters.

As a result of its preliminary investigation of this accident on March 14, 1988, the Safety Board recommended that the FAA:

A-88-41

Amend 14 CFR Part 135 to require that commuter air carrier certificate holders maintain, for at least 90 days, copies of the completed load manifest and the weight and balance documentation that support the calculated total weight of the aircraft and its center of gravity location.

In a response to Safety Recommendation A-88-41 dated May 20, 1988, the FAA stated that it was in the process of conducting in-depth inspections of approximately 30 commuter air carrier certificate holders selected from approximately 173 operators. The FAA response further stated that the final report on these inspections would be completed by January 1, 1989. The Safety Board has placed Safety Recommendation A-88-41 in an "Open--Acceptable Action" status pending the FAA report on the ongoing inspections.

The Safety Board also believes that the special FAA inspection of Ryan, which in a 2-week period found sufficient evidence to remove from service most of Ryan's fleet due to its unairworthy condition, was thorough and adequate. The team performed the type of high level, in-depth inspection over a brief period of time that often eludes those responsible for daily surveillance. Although the leader of the special inspection team stated that the violations were sufficiently obvious that he believed the intent to violate FARs could be discerned, the Safety Board believes that the intense, directed focus of the special inspection team helped them to discover the alleged violations, and as a result, do not indicate potential inadequacies in the routine surveillance.

2.6 Survival Aspects

2.6.1 Passenaer Seats

The calculated average dynamic crash inertia loads exerted on the seats in the downward and sideward directions in this accident exceeded both the test limits specified by 14 CFR 23.561 and the static loads to which the seats were tested by the manufacturer. The calculated average crash inertia load in the forward direction did not exceed that specified by the regulations (9 G.) or the manufacturer's inertia force criteria (12 G.). However, the highest deceleration loads calculated were in the downward direction and those were 5 to 10 times the ultimate inertia load specified by the regulations and 2 to 4 times the static load applied to the seats in the tests conducted by the manufacturer.

In this accident, the passengers remained secured to their seats by the seat-mounted seatbelts. All seatbelts were examined and found to be fully functional. However, all of the seats separated from their floor- and wall-mounted seat tracks, thereby negating the effectiveness of the seatbelts.

When the seats separated from the tracks, the passengers tumbled about and struck interior structure, other seats, and occupants. Seat damage also was typical of damage which would be expected from vertical decelerations of the magnitude calculated by the Safety Board (19.8 to 35.7 G.).

The majority of the injuries sustained by the passengers were as a result of secondary impact after the seats separated from their tracks. Also, some injuries, such as aortic ruptures, were typical of a severe vertical deceleration.

Effective August 15, 1988, the FAA amended the airworthiness standards of 14 CFR Part 23.6. The regulations implemented new test standards for seat/restraint systems of small general aviation airplanes in the normal, utility, and aerobatic category, i.e., those airplanes with nine passenger seats or less. Each seat/restraint system must comply successfully with dynamic tests according to specific test conditions.

Seats to be installed in the first row must successfully complete tests that subject the seat to a deceleration in the vertical direction that reaches a minimum peak of 19 Gs. in not more than 0.05 second. Other seats must be tested to a vertical deceleration minimum of 15 Gs. occurring in not more than 0.06 second. The vertical velocity change of the test article must not be less than 31 feet per second.

Seats to be installed in the first row must successfully complete tests that subject the seat to a deceleration in the longitudinal direction that reaches a minimum peak of 26 Gs. in not more than 0.05 second. Other seats must be tested to a deceleration in the longitudinal direction of 21 Gs. occurring in not more than 0.06 second. The change in velocity of the test article must not be less than 42 feet per second. Certain additional provisions must be included in these tests to account for airplane yaw and floor warpage.

The acceleration and velocity change calculations in this accident show that the crash loads generated in the vertical direction exceeded the new dynamic testing criteria of 14 CFR 23.562. Nevertheless, had the seats in this airplane been designed to the new standards, they may have been capable of withstanding the dynamic loads and structural distortions that occurred and probably would have dissipated more efficiently the energy generated in the accident. Thus, had these seats been designed to the new standards, the severity of the occupants' injuries may have been reduced and more passengers could have survived.

The rulemaking process to require dynamic testing of seats for airplanes certificated under 14CFR Part 23 was initiated after the rulemaking process that proposed the establishment of commuter category airplane within the provisions of 14 CFR Part 23. However, the final action for the adoption of standards for the commuter category airplane was not complete when the Notice of Proposed Rulemaking to establish new seat/restraint standards for Part 23 airplanes was published. Therefore, the commuter category airplane with 19 passenger seats or less was not addressed in the final rule issued on August 15, 1988.

For the past 20 years, based on data collected during its accident investigations, the Safety Board has issued numerous recommendations to the FAA which require dynamic testing of aircraft seats. For a number of reasons, the FAA has rejected the Safety Board's recommendations. One reason cited was a lack of sufficient crash data even though the Board had amassed considerable crash data through numerous accident investigations over the years.

In 1983, the General Aviation Safety Panel (GASP), a government/industry group that included representatives of the General Aviation Manufacturers' Association, recommended specific test loads and velocity changes that formed the basis for the recent CFR Part 23 rule changes. The Safety Board provided to the GASP Committee crashworthiness data from its then on-going

⁶Part 23 -- Small Airplane Airworthiness Review Program, Amendment No. 1.. Federal Aviation Administration, Federal Register/Vol. 53, No. 157 / Monday, August 15, 1988.

crashworthiness studies.⁷ The Safety Board concurred with the GASP proposals, and in 1985 it recommended that the FAA adopt them.

The Safety Board is disheartened that the FAA has delayed for two decades needed safety crashworthiness improvements in small airplanes and is just now addressing commuter category airplanes. However, the Safety Board is aware that the FAA has initiated a rulemaking project to address dynamic testing of seats for airplanes certificated in the commuter category (up to 19 seats), such as the Beech 1900. The Safety Board urges early completion of this project.

2.6.2 Extrication

Rescue personnel removed passengers through the open left front cabin door. Because the three overwing exits were too narrow to accommodate passengers on backboards, rescuers attempted to gain access to the cabin by cutting the left rear cargo door and widening one of the cabin windows. Rescuers had difficulty in cutting the cargo door free because the fuselage skin kept springing back into place. The attempt to widen the cabin window was abandoned for the same reason.

Information on recommended forceable entry locations would have resulted in quicker access into the cabin and to the passengers. As it was, passengers had to be removed one at a time through the main cabin door. The seven passengers arrived at the hospital in Homer between 48 to 78 minutes after the first rescue units arrived at the crash site. Survivors would have arrived at the hospital sooner had it been possible to remove more than one passenger at a time from the airplane.

Moreover, rescue personnel had to exercise extreme caution when they cut into the fuselage because they believed that fuel lines and electrical wires would be severed--fuel had been spilled and the electrical system was still energized during the extrication of survivors. Given the spilled fuel and several ignition sources in the cabin, the potential for a fire was great. Obviously, firefighters and rescue personnel must know exactly where forceable entries can be made into aircraft without endangering themselves and trapped survivors.

Another problem faced by rescuers was their inability to locate the master switch to shut off the electrical power. When rescuers arrived on scene, the pilot and first officer were still in their seats and the instrument panel had been forced down onto them. During the 45 minutes it took for rescue personnel to locate and disconnect the battery, the first officer could not be removed from his seat because movement in the area resulted in electrical arcing in the instrument panel.

Examination of the cockpit revealed that the master switch was located on the lower left of the captain's instrument panel. It was a black-colored lever with white letters labeled MASTER SWITCH which were clearly visible under normal conditions. However, in the cockpit it was difficult to see the master switch lever. The importance of disconnecting electrical power in any accident is obvious--to negate the potential as an ignition source for a catastrophic fire and to allow for expeditious removal of injured crew and passengers.

Information in the form of Crash Crew Charts pertaining to forcible entry, normal exit points, location of fuel and electrical lines, and location of batteries for various commercial airplanes are contained in the National Fire Protection Association's document 402M--*Aircraft Rescue and Fire Fighting Operational Procedures*, 1984. However, the Crash Crew Charts apply to larger commercial aircraft similar to the Boeing 727, de Havilland Dash 7, and McDonnell Douglas DC-10. A search of

⁷Safety Reports--General Aviation *Crashworthiness Project: Phase Two--Impact Severity and Potential Injury Prevention in General Aviation Accidents* (NTSB/SR-85/01); and Phase Three--*Acceleration Loads and Velocity Changes of Survivable General Aviation Accidents* (NTSB/SR-85/02).

available literature failed to discover any document that contains small airplane charts for use by crash, fire, and rescue personnel. The Safety Board believes that with the proliferation of commuter airplanes, there is a need for training aids for crash, fire, and rescue agencies that provide support for smaller airplanes that operate under 14 CFR Part 135.

3. CONCLUSIONS

3.1 Findings

1. The airplane was certificated, equipped, and maintained in accordance with Federal regulations.
 2. The flightcrew was certificated, qualified, and had received the training and off-duty time prescribed by Federal regulations.
 3. The airplane was loaded with approximately 600 additional pounds of cargo beyond the 1,500 pounds the first officer requested.
 4. When the wing flaps were extended for landing at Homer, pitch control was reduced due to effects of the aft CC condition of the airplane.
 5. The ice accumulation on the leading edges of the airplane did not cause but may have contributed to the increase in stall speed.
 6. Ryan attempted to comply with FAA requests; however, FAA inspection revealed a pattern of inadequate recordkeeping.
 7. Flight tests conducted after the accident indicated that, without any ice accumulation, airplane control could be lost by extending the flaps when the airplane's CC was displaced about 7 inches beyond the aft limit. The CG of the accident airplane was calculated to be 8 to 11 inches aft of the allowable aft limit.
 8. The flightcrew did not comply with company or FAA procedures which required them to compute a CC before departure, and they employed improper procedures to determine the airplane's weight and balance.
 9. Communication between the flight standards inspectors and the regional counsel within the FAA's Alaska Region was inadequate and contributed to a breakdown of the effectiveness of the FAA's oversight of Ryan.
 10. The accident was partially survivable, according to area of the fuselage occupied; however, vertical deceleration forces exceeded design standards of the airplane's seats.
 11. The first officer's removal from the airplane was delayed because rescue personnel had difficulties in shutting off the airplane's electrical power.
 12. Rescue personnel did not know where it was safe to cut the fuselage to gain additional access to the passengers.
 13. Published information pertaining to the airplane's electrical power shutdown and the most suitable areas to cut into a fuselage was not available to rescue crews.
-

3.2 Probable Cause

The National Transportation Safety Board determines that the probable cause of this accident was the failure of the flightcrew to properly supervise the loading of the airplane which resulted in the center of gravity being displaced to such an aft location that airplane control was lost when the flaps were lowered for landing.

4. RECOMMENDATIONS

As a result of its investigation, the National Transportation Safety Board made the following recommendations:

--to the Federal Aviation Administration:

Expedite the rulemaking project to provide for dynamic testing of seat/restraint systems for airplanes in the commuter category. (Class II, Priority Action) (A-88-158)

--to the National Fire Protection Association:

Expedite the publication and dissemination of information on airplane access points, fire hazard zones, interior fuselage arrangements, the master power switch, and battery locations for airplanes with 10 or more seats. (Class II, Priority Action) (A-88-I 59)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ JAMES L. KOLSTAD
Acting Chairman

/s/ JOHN K. LAUBER
Member

/s/ JOSEPH T. NALL
Member

/s/ LEMOINE V. DICKINSON, JR
Member

JIM BURNETT, Member, dissented.

December 20, 1988

On February 3, 1989, Jim Burnett, Member, filed the following concurring/dissenting statement:

I agree with the probable cause as adopted, however, I believe that it is incomplete. The following additional material should be included in the probable cause:

Contributing to the severity of the occupants' injuries was the inability of the aircraft's seats to withstand the crash forces; had these seats been designed to the standards which the Board has advocated for over twenty years, the severity of the occupants' injuries may have been reduced and more passengers could have survived.

In addition, I do not believe the report as revised reflects the specific intent of the Board meeting. For example:

1. The following discussion is found in the official transcript at page 28, line 01, through page 35, line 21.

See Addendum # 1 (appendix F of the report).

In response to this whole discussion and in response to the Board's discussion of amendment to the report, the following single sentence appears at page 18 in the accident report:

At the time of the accident, company policy at Kodiak restricted the cargo and baggage load to 1,100 pounds whenever there was a full passenger load.

I think this sentence fails to capture the tenor of the Board's discussion.

2. In reading the official transcript and comparing it to the accident report, I noticed that in two instances Member Nall requested that more information be included in the final report. This was not done.
3. I requested that the report state more clearly in the analysis section that even though ice accumulation on the airplane did not cause the accident, we elaborate that icing was not even a safety issue in that there was no mismanagement of the deicing system by the crew, the flight into icing conditions was not improper, and the deicing system performed as designed. The report fails to make this explicit.

/s/ JIM BURNETT
Member

5. APPENDIXES

APPENDIX A

INVESTIGATION AND HEARING

1. Investigation

The National Transportation Safety Board was notified of the accident about 2200 eastern standard time on November 23, 1987. An investigative team was dispatched from the Washington headquarters to the scene the following morning. Investigative groups were established for operations, structures, systems, powerplants/ propellers, survival factors, and human performance. Parties to the investigation were: the Federal Aviation Administration; Ryan Air Services, Inc.; Pratt and Whitney; Hartzell Propellers; Beech Aircraft Corporation; and the State of Alaska.

2. Public Hearing

A public hearing was held on April 6-8, 1988, in Anchorage, Alaska. Parties to the hearing included the Federal Aviation Administration; Ryan Air Services, Inc.; Beech Aircraft Corporation; and the State of Alaska.

APPENDIX B
AIR TRAFFIC CONTROL TRANSCRIPT

(0235)

(0236)

0237:04 RYA103 Kodiak Tower Ryan one oh three clearance on request
to Homer please

0237:11 ADQ ATCT Ryan one oh three **clearance on** request

0237:33 ADQ ATCT Line clear -- one oh three how soon before you are
ready to taxi

0237:41 SEC 13 Anchorage Center -- sector thirteen

0237:43 ADQ ATCT Kodiak request clearance

0237:43 RYA103 It'll be just about two or three minutes

0237:44 ADQ ATCT On Ryan one oh three says he'll be ready to taxi in
two or three minutes

0237:48 SEC 13 **Alright** Ryan Air one oh three -- cleared to the
Homer airport from Kodiak airport via victor four
thirty eight -- maintain -- six thousand squawk five
three zero four clearance void if not off by -- zero
two four four -- center time now zero two three
eight and one quarter

0238:12 ADQ ATCT GB

0238:13 SEC 13 MX

0238:14 ADQ ATCT Ryan one oh three -- I have a clearance but there's a void time of three minutes from now

0238:27 RYA103 Okay one oh three we should be off by then

0238:32 ADQ ATCT Roger advise when ready to copy

0238:33 RYA103 Roger go ahead

0238:34 ADQ ATCT Ryan one oh three cleared to the Homer airport -- victor four thirty eight climb and maintain six thousand -- Anchorage Center frequency will be one two five point one -- then squawk five three zero four

0238:53 RYA103 Ryan one oh three to Homer victor four thirty eight to maintain six thousand we'll expect higher en route center on one twenty five one squawk five three zero four

0239:01 ADQ ATCT Ryan one oh three **readback** correct wind calm altimeter two nine three six

0239: 05 RYA103 Roger

0240:43 RYA103 Kodiak Ryan one oh three in taxiing

0240:46 ADQ ATCT Ryan one oh three roger taxi to ah runway seven

0240: 49 RYA103 One oh three

0240:57 ADQ ATCT Ryan one oh three runway seven cleared for takeoff

0241:02 RYA103 Roger Ryan one oh three

0241:53 RYA103 And Ryan one oh three is departing seven

0241:56 ADQ ATCT One oh three

0242:12 ADQ ATCT Kodiak

0242:14 SEC 13 Kodiak Anchorage Center sector thirteen is Ryan Air one oh three off yet

0242:17 ADQ ATCT Yeah he is just departing the runway now four two GP

0242:20 SEC 13 Thank you MX

0243:21 ADQ ATCT And Ryan one oh two **Markair** forty five is due in in about ah just about ten minutes from now you might

keep your eye open for him you can contact center on
one twenty five point one

0243:30 RYA103 Ryan one oh three roger we have **Markair** in sight
we're going to center good night

(0244)

(0245)

(0246)

(0247)

(0248)

(0249)

END OF TRANSCRIPT

(0235)

(0236)

0237:32 SEC 13 Anchorage Center -- sector thirteen

0237:35 ADQ ATCT Kodiak request clearance -- on Ryan one oh three
says he'll be ready to taxi in two or three minutes

0237:45 SEC 13 **Alright** Ryan Air one oh three -- cleared to the
Homer airport from Kodiak airport via victor four
thirty eight -- maintain -- six thousand squawk five
three zero four clearance void if not off by -- zero
two four four -- center time now zero two three
eight and one quarter

0238: 09 ADQ ATCT GP

0238:10 SEC 13 MX

(0239)

(0240)

(0241)

0242:10 ADQ ATCT Kodiak

0242:11 SEC 13 Kodiak Anchorage Center sector thirteen is Ryan Air one oh three off yet

0242:15 ADQ ATCT Okay he is just departing the runway now four two GP

0242:18 SEC 13 Thank you **MX**

(0243)

0244:03 **RYA103** Anchorage Center Ryan Air one oh three off Kodiak at four two out of nineteen hundred for six thousand we have **Markair** in sight

0244:08 SEC 13 Ryan Air one zero three roger ah report passing one zero miles of Kodiak VORTAC established on victor four thirty eight

0244:16 RYA103 Roger Ryan one oh three

0244:34 SEC 13 Ryan Air one oh three climb and maintain four thousand cleared to the forty mile fix north of Kodiak no delay expected

0244:40 **RYA103** Ryan one on three roger request a VFR climb

0244:43 SEC 13 Ryan one on three roger climb in VFR conditions -- standby -- **Markair** forty five say altitude leaving

0244:55 SEC 13 **Markair** forty five roger Ryan one oh three climb in VFR conditions through eight thousand climb and maintain one two thousand -- and now cleared to Homer via victor four thirty eight

0245:08 RYA103 Roger victor four thirty eight VFR through eight thousand to maintain one two thousand Ryan one oh three

(0246)

(0247)

0248:52 SEC 13 Ryan one oh three report reaching one two thousand

0248:57 RYA103 Ryan one oh three and we're established northbound

0248:58 SEC 13 Ryan one oh three roger

(0249)

(0250)

(0251)

(0252)

(0253)

0254:26 RYA103 Anchorage center Ryan one oh three is level at one two thousand

0254:30 SEC 13 Roger report passing six zero miles north of Kodiak

0254:36 RYA103 Roger Ryan one oh three

(0255)

(0256)

(0257)

(0258)

(0259)

(0300)

(0301)

0302:18 RYA103 Center Ryan Air one oh three is six zero miles north of Kodiak

0302:20 SEC 13 Ryan one oh three roger contact Anchorage one two five point niner four zero miles south of Homer

0302:28 RYA103 Roger report to Homer on one twenty five point nine
Ryan one oh three -- good night

0302:36 SEC D5/6 Go ahead on the green light

0302:38 SEC 13 Yeah sector thirteen Ryan Air one oh three Homer

0302:40 SEC D5/6 Yeah

0302:42 SEC 13 Your control for lower MX

0302:44 SEC D5/6 Thank you golf **yankee**

(0303)

(0304)

(0305)

(0306)

(0307)

END OF TRANSCRIPT

(0259)

(0300)

(0301)

0302:37 SEC D5/6 Go ahead on the green light

0302:38 SEC 13 Yeah sector thirteen Ryan one oh three Homer

0302:41 SEC D5/6 Yeah

0302:42 SEC 13 Your control for lower MX

0302:44 SEC D5/6 Thank you golf **yankee**

(0303)

(0304)

(0305)

0306:53 HOM FSS Homer

0306:54 SEC D5/6 Yeah Homer sector -- five got an inbound for you

0306:58 HOM FSS Go ahead

0307:00 SEC D5/6 Ryan air one oh three Beech nineteen hundred out of Kodiak Homer at zero three one five for the **localizer** DME runway three golf **yankee**

0307:08 HOM FSS Thank you double R

0307:57 RYA103 Ryan one oh three thirty five south of Homer level at one two thousand landing

0308:27 RYA103 Center Ryan one oh three

0308:29 SEC R5/6 Ryan air one oh three Anchorage Center the Homer altimeter two niner three two go ahead

0308:35 RYA103 Roger nine three two currently thirty five south of Homer level at one two thousand Homer at one seven landing

0308:41 SEC R5/6 Ryan one oh three roger standby for lower altitude

0308:45 RYA103 Roger

(0309)

0310:04 **SEC R5/6** Ryan one oh three descend and maintain six thousand
maintain six thousand

0310:07 **RYA103** Ryan one oh three out of one two thousand for six
thousand

0311:55 **SEC R5/6** Ryan one oh three there's **gonna** be a little delay
getting into ah Homer we've already got an ERA twin
otter on approach at this time where would you like
to hold at

0312:04 **RYA103** Ryan one oh three how about the seven DME fix on the
localizer

0312:11 **SEC R5/6** Ryan one oh three roger cleared to hold on the seven
DME south on the Homer localizer maintain six
thousand expect further clearance at zero three two
zero

0312:24 **RYA103** Roger Ryan one oh three is cleared to the seven DME
fix on the localizer to hold south maintain six
thousand EFC zero three two zero

0312:31 **SEC R5/6** Roger six that is correct and make it zero three two
five on expect further clearance

0312:36 **RYA103** Okay zero three two five

(0313)

(0314)

(0315)

(0316)

0317:50 SEC R5/6 Ryan air one oh three center

0317:53 RYA103 Ryan one oh three go ahead

0317:54 SEC R5/6 Roger ah not getting any transponder reply could you
-- reset your transponder on five three zero four
for me

0318:04 RYA103 Okay one oh three reset squawk five three zero four
and we're entering holding at this time

0318:10 SEC R5/6 Ryan one oh three roger

0319:27 SEC R5/6 Ryan one oh three what approach do you **wanta** make
into ah Homer

0319:32 RYA103 Ryan one oh three we'll stick on the ah **localizer**
DME runway three

0319: 36 SEC R5/6 Ryan air one oh three roger cleared for the localizer runway three approach to the Homer airport -- and the only traffic I've got for you VFR is that ERA twin otter is ah one zero miles to the northeast of the Homer VOR coming in on the localizer back course approach out of four thousand feet at this time VFR contact Homer radio for airport and weather advisories and I just got your transponder reply

0319:56 RYA103 Ryan one oh three roger good day

0320:21 HOM FSS Homer

0320:22 SEC D5/6 Anchorage sector five ah inbound Ryan one oh three now estimating Homer zero three two five KE

0320:27 HOM FSS Double R

(0321)

(0322)

(0323)

(0324)

(0325)

(0326)

(0327)

(0328)

0329: 22 SEC D5/6 Anchorage sector **five**

0329: 23 HOM FSS Yeah this is Homer I'm advising you I believe there
has been an aircraft accident at the Homer airport I
we're checking into it now I will call you back as
soon as I can will you advise your supervisor

0329: 32 SEC D5/6 Will do KE

0329:33 HOM FSS Double R

(0330)

(0331)

(0332)

(0333)

(0334)

0317:41 RYA Haner radio Ryan one oh three twenty three six

0317:45 HOM Ryan one oh three Homer radio

0317:46 RYA Hey whats the position on the twin otter

0317:53 ERA Yeah we just intercepted the arc and we'll cancel here as soon as we can

0318:05 HOM Ryan one oh three ~~Homer~~ did you copy

0318:15 HOM Ryan one oh three Haner radio one two three three two one

0318:21 RYA Yeah ~~Homer~~ radio Ryan one oh three go ahead

0318:23 HOM Rogertwinottersahon the arc atthistimon a back course approach

0318:28 RYA OK thanks andwhat's your current weather

0318:31 HOM Haner weathers one thousand five hundred scattered, estimated ceiling of ~~three~~ thousand five hundred broken four thousand five hundred overcast visibility one two the temperature three one dew point is ah two two the wind ah three four zero at niner and altimeters two ninerthreeone

0318:54 RYA Ryan one oh three roger

0320:21 HOM Haner

0320:22 ZAN Anchorage Sector five inbound Ryan one oh three now ~~estimating Homer~~ zero three two five K E

0320:27 HOM Double R

0321:38 RYA **Homer** radio Ryan one oh three is nine D M E on the **localizer** cleared for the approach to runway three

0321:45 RYA Ryan Air oneohthree **Homer** radiatoroger **and ah** ERA forty eight ah eighty whats ah **your** position on the back course please

0321:55 ERA Ah **show** us seven D M E and were **gona** circle for three forty eight eighty

0322:00 HOM And you did **copy** the position of the Ryan

0322:03 ERA Yeah I believe we have him in sight

0322:06 HOM Roger thank you

0323:15 ERA And **Homer** traffic ERA forty eight eighty entering a right **downwind** for three **Homer**

0323:44 RYA And Ryan one oh three **coming** up on a two mile finalrunwaythree

0324:52 RYA **ELT ACTIVATED**

0325:32 HOM ERA forty eight eighty Homer whats your **position**

0325:35 ERA ERA forty eight eighty were abut a mid field (UNINTELLIGIBLE)right downwind

0325:42 HOM Ryan Air one oh three **Homer** whats your position

0325:51 HOM ERA forty eight eighty do you see Ryan Air

0325:54 ERA I believe Ryan Air he landed already he reported a two mile final about four minutes ago so he may have taxied in we'll give a look over-there see if he's on the ground

0326:13 ERA Ya I believe he's taxied in already

0326:28 HOM Ryan Air one oh three **Homer** radio

0326:35 HOM An ERA forty eight eighty I'm receiving a strong **ELT** and I don't see Ryan on the ground can you check the approach end of the runway

0326:43 ERA Yah we'll do that we'll hit our one twenty one five

0327:10 HOM An Ryan Air one oh three **Homer** radio

0328:41 HOM ERA forty eight eighty off to your left there is that the aircraft

0328~46 ERA Ah I can't really tell

0329:15 HOM Line clear

0329:22 ZAN Anchorage sector five

0329:23 HOM Yeah this is Haner I'm advising you I believe theres been an Aircraft Accident at the Homer airport I were check into it **now** I'll call you back as soon as I **can (UNINTELLIGIBLE)** will you advise your supervisor

0329:31 ZAN Will do KE

0329:33 HOM Double R

0329:41 ERA **And** Haner radio ERA forty eight eighty we'll go ahead and park and walk around **down** there for you

0329:47 HOM Ah ERA forty eight eighty **Homer** say again

0329:49 ERA We'll get shut **down** here in a few minutes **and** I'll walk **down** to the end of the runway and lock

0329:54 HOM Ah roger

0329:57 HOM Do you see the rotating beacon there ah locks like maybe on the ah **taxiway**

0330:05 ERA Ah can't say I do

0330:09 HOM OK right off the end of the runway just to the right there theres a white rotating beacon I can see it ah can you **ah taxi down** there and ah give me an idea of where its at

0330:20 ERA OK

0330:23 SCA Haner radio South Central eighty three taxiing out **IFR** Anchorage

0330:38 SCA **Haner radio South Central eighty three**

0331:02 SCA Homer radio South Central eighty three

0331:09 HOM **South Central eighty Homer standby** please

0331:25 HOM South Central eighty **Homer** can you look do you see a rotating beacon about your three o'clock position a white one

0331:37 SCA Were looking I don't see it there

0331:40 HOM Roger can you shine your light on it I believe thats a Ryan Air flight and I need to know ah I need to **confirm thats** it and ah also to get sane information on it

0331:51 HOM **How** far off the runway is he

0332:04 SCA Frankly don't know what ah where hes at ah over here on my left **now**

0332:08 HOM Affirmative that white rotating beacon I believe its an aircraft

0332:38 SCA I **can't** tell if its an aircraft from right here but hes looks like hes got two hundred feet or so

0332:46 HOM OK can ya can you see ah an easy way to get ah out there

0333:11 HOM Line clear

0333:14 SCA Thats an airplane sitting there **alright**

0333:18 HOM Can you see an easy way to get out there sir

0333:23 SCA Right here by the beacon there looks like you got a road goes over closest to him

0333:27 HOM Thank you

 ZAN Anchorage Center Area Manager **Hodges**

0333:31 HOM Yeah this is ah **Homer** flight service and ah Ryan Air one oh three has had an accident ah on the approach into **Homer** ah I don't have any **information** other than he appears to be two hundred yards off the end of the runway ah the rotating beacon of the aircraft is visible and ah the're trying to get **some** people out there **now** thats all I can tell you ah its not anywhere near the runway and ah I don't see any problem with the ah ah use of the runway or **taxiway**

0334:00 ZAN OK so use of the runway and **taxiway** are still ah I **mean** the airport is still **useable**

0334:07 HOM Ah yes sir

0334:08 ZAN OK thank you very much

0334:10 HOM OK

0334:11 ZAN **And** ah **Homer**

0334:12 HOM Yes

0334:12 ZAN If you would advise me further of and details you have as far as aircraft aircraft damage or injuries please

0334:19 HOM **will** do

0334:20 ZAN *Thank you*

(0335:00)

(0336:00)

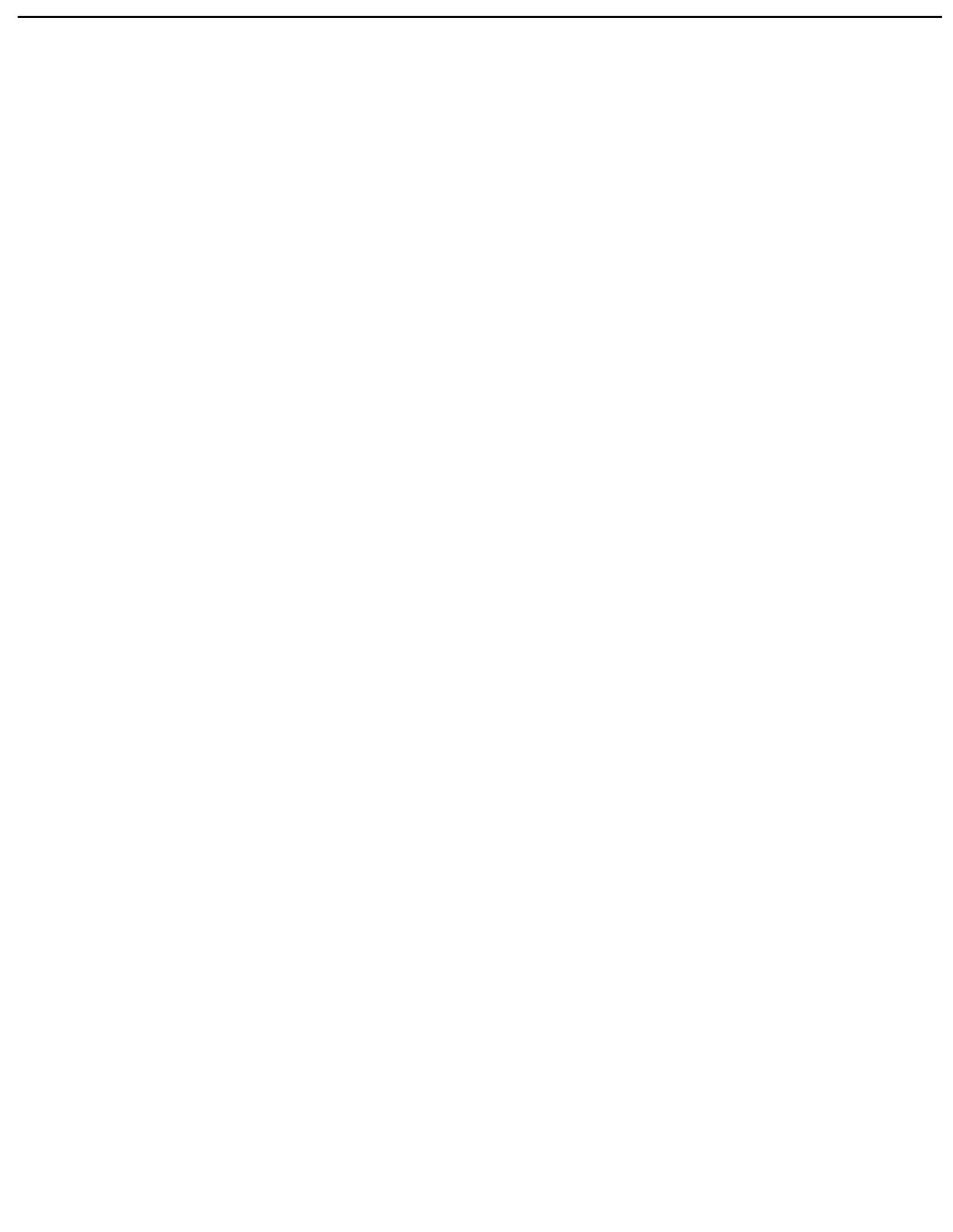
(0337:00)

(0338:00)

(0339:00)

(0340:00)

END OF TRANSCRIPT



APPENDIX C
PERSONNEL INFORMATION

Captain Robert J. Deliman, Jr.

Captain Robert J. Deliman, Jr., 26, held Airline Transport Pilot Certificate 227068494, with the following ratings and limitations: airplane multi-engine land, type ratings in the Be 1900 and the Be 300. Captain Deliman had commercial pilot privileges with the rating of airplane single-engine land. He held a valid FAA First Class Medical Certificate with no limitations dated September 28, 1987.

First Officer Gareth L. Stoltzfus

First Officer Gareth L. Stoltzfus, 40, held an Airline Transport Pilot Certificate 1952362, with the following ratings and limitations: airplane multiengine land, commercial privileges airplane single-engine land and sea. He also held a flight instructor rating with the limitations of airplane single- and multiengine, and instrument airplane. He also held a ground instructor certificate, with advanced and instrument ratings. First Officer Stoltzfus was an FAA-designated examiner, as well as a company check airman on single-engine aircraft and the Cessna 402. Mr. Stoltzfus held a valid FAA First Class Medical Certificate with no limitations dated October 13, 1987.

APPENDIX D
CORRESPONDENCE OF GARETH STOLTZFUS



International Business Plaza
1205 E. International Airport Road, Suite 201
Anchorage, Alaska 99518
907-562-2227

November 4, 1986

FAA/FSDO-63
Attn: Mr. Charles Lund
601 Airpark Place, Suite 216
Anchorage, Alaska 99502

Mr. Lund,

This company has hired Mr. Gareth Stoltzfus, ATP 1962352, to accomplish and supervise flight training. He will be employed in both single and multi-engine aircraft. He has completed company training in the single engine aircraft at this time. Request you assign an Operations Inspector to observe flight tests conducted by Mr. Stoltzfus under

FAR 135.293a, 135.293b, and 135.299. After he has been approved by your office as a company check airman in single engine aircraft, we will start training as a check airman in multi-engine aircraft to include FAR 135.297 checks.

Also request that he be added to our list of flight and ground instructors. I will revise our training manual accordingly at the earliest possible date.

Your assistance is appreciated.

A handwritten signature in dark ink, appearing to read "Frank H. Wasmer".

FRANK H. WASMER
DIRECTOR OF OPERATIONS



International Business Plaza
1205 E. International Airport Road, Suite 200
Anchorage, Alaska 99518
907-562-2227

September 10, 1987

Mr. Louis J. Gossen
Principal Operations Inspector
Federal Aviation Administration
4510 W. International Airport Rd.
Anchorage, AK. 99502

Dear Mr. Gossen:

Pease delete Mr. Dale W. Walters from our list of check airmen.
Mr. Walters is no longer an employee at Ryan Air.

Thank you,

Ryan Air Service, Inc.

Yana Karlberg for

Gareth L. Stoltzfus
Director of Training

GLS/lk



International Business Plaza
1205 E. International Airport Road, Suite 201
Anchorage, Alaska 99518
907-562-2227

May 28, 1987

Mr. Louis J. Gossen
FSDO-63
4510 W. International Airport Road
Suite 302
Anchorage, Alaska 99502-1088

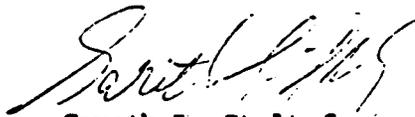
Dear Mr. "Gossen: _____ --

We are **requesting** that you reissue a letter of authorization for Dennis Ryan, holder of Airline Pilot Certificate No. 574302665, to be a **Check** Airmen and to conduct **operation** experience **FAR** 135.244 based on his **authorization** from **FSDO-61**. Copy of current letter is enclosed.

Thank you.

sincerely,

Ryan Air Service, Inc.


Gareth L. Stoltzfus
Director of Training

RYAN AIR
FAR 135 PILOT TRAINING

CERTIFICATE OF TRAINING

I certify that Richard Foff Merculief
Name

meets requirements under FAR 135 to perform duty as a:

Company check airman 135.244

Company flight instructor _____

Company ground instructor _____

Company hazmat instructor _____

and has received all training required by FAR 135 and the
Ryan Air FAR 135 Pi&t Training Manual.



Signature

07-08-87

Date

Gareth Stoltzfus

Typed Name

Director of Training

Title

APPENDIX E
RESULTS OF FAA SPECIAL INSPECTION OF RYAN

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Executive Summary

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Section 1 - Operations Findings

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Section 2 - Airworthiness Findings

10 - 17 Pages

Attachment 1, Original Pages
(Corrected Pages inserted in the Report)

EXECUTIVE SUMMARY

On December 30, 1987, Donald H. Boberick, Manager, **AAL-7**, issued an Order of Investigation designating Counselor Leland S. Edwards, Jr. to serve as presiding officer **in** the matter of the investigation of Ryan Air Service, Inc., holder of Air Carrier Operating Certificate No. ANC-AL-499 (**UATA**).

Subject Order of Investigation was issued to **determine** if Ryan Air Service, Inc. is capable of conducting each kind of operation for which it has been authorized in compliance with the Federal Aviation Act of 1958 and the Federal Aviation Regulations.

The following areas were identified to be examined:

- Weight and balance/load manifest versus actual conditions
- Check airman training/usage
- Pilot training
- AD compliance (records versus actual hardware)
- Maintenance programs (records, training, etc.)
- MEL procedures/usage

A team of investigators was formed in order to assist Mr. Edwards under the Flight Standards National Aviation Safety Inspection Program, as follows:

Theodore Cavoris (Team Leader), AEA-FSDO-11, Operations

Thomas Campbell, ANE-FSDO-63, Operations

Joel Schlossberg, AEA-FSDO-27, Airworthiness

Michael Daniel, **Maintenance** Coordinator, **ASW-FSDO-63**

Allen **Booher**, ASE-FSDO-63, Avionics

Bruce Walker, Operations Coordinator, **AAL-FSDO-63**

Theodore Hutton, **ANM-207**, Airworthiness

Ryan Air Service, Inc. was started by Wilfred Ryan, Sr. as Unalakleet Air Taxi in January 1960 as a family business. From a small on-demand air taxi business it grew into a scheduled commuter air carrier. In 1977, Wilfred Ryan, Jr. took over as **president** upon the death of his father. In 1979, Ryan Air incorporated and changed the name to Ryan Air, Inc. In August 1963, Ryan purchased **Munz** Northern Airlines of **Nome** and in 1985 they purchased Executive Charter Service of Bethel. On August 1, 1986, Ryan Air transferred their Air Taxi Certificate from the Fairbanks to **Anchorage District Office**.

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Ryan Air operates the following aircraft:

2	Beechcraft 1900, 2-engine turboprop	19	pax
72	Cessna 402C , 2-engine recip ,	9	pax
2	Partenavia P68C , 2-engine recip,	6	pax
8	Cessna 207 , 1-engine recip,	6	pax
2	Cessna 208, 1-engine turboprop,	9	pax
2	Cessna 18S , 1-engine recip,	3	pax
<u>28</u>	Total		.

Ryan Air employes a total of 248 people as follows:

48	pilots
0	flight attendants
0	dispatchers
28	mechanics
<u>172</u>	others (e.g. ticket agents, baggage handlers, etc.)
<u>248</u>	Total

Ryan Air has eight crew bases as follows:

Anchorage
Bethel
McGrath
St. Marys
Unalakleet
Fairbanks
Nome
Kotzebue

Ryan Air has four maintenance bases as follows:

Anchorage
Nome
Unalakleet
Bethel

Ryan Air flies to 85 cities and villages throughout Alaska and one Canadian city, Dawson. They are presently negotiating for route authority to Siberia USSR. Ryan Air is the largest air taxi commuter in Alaska.

Ryan Air does not have assistants for their **Director of Operations**, Director of Maintenance or Chief Pilot, all of whom are situated in Anchorage,

Ryan Air was originally certificated **as** an Air Taxi in the Fairbanks FSDO.

The team assembled on January 4, 1988, at Anchorage, Alaska pursuant to the authority contained in Sections 313, 609 and 1004 of the Federal Aviation Act of 1958, as amended (**49** U.S.C. 1354, 1429 and 1484) and Part 13 of the Federal Aviation Regulations (**14** CFR Part **13**).

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The inspection commenced on January 5, 1988, at the Alaska Regional Office with an inbriefing with Tom Westall, AAL-200, and Counselor Edwards, AAL-7. This was followed by a meeting with Dick Andrews, Acting Manager, AAL-FSDO-63 and his staff.

On January 6, 1988, the team reviewed Ryan Air's records located at FSDO-63.

On January 7, 1988, the team conducted an inbriefing with Ryan Air's management team. Following this inbriefing, the team began its inspection of Ryan Air's operations and maintenance.

An inspection of the pilot records indicated that Ryan Air apparently reviewed these records in anticipation of the team's arrival. The records were "impeccable" and were found to be in agreement with the pertinent aircraft records or aircraft used for training.

During an inspection of Ryan Air's maintenance facility at Nome, the team learned that Ryan's aircraft were not being maintained in accordance with an approved maintenance manual during the previous three to six months. (The same discovery was later made by the team at Ryan Air's Bethel maintenance facility.) This finding prompted the team's decision to desist from conducting enroute inspections on Ryan Air's aircraft as Ryan was unable to demonstrate that their aircraft were airworthy.

The Ryan Air Inspection Team would like to express their sincere gratitude to all the FAA personnel in AAL-200 and AAL-FSDO-63 who assisted the team in carrying out their investigation. It is doubtful that the Ryan Air Inspection Team could have carried out their responsibilities without their valued assistance. The Ryan Air Inspection Team could have carried out their responsibilities without their valued gratitude to the Ryan Air employees who cooperated with the team. They were polite and helpful regardless of their work schedule or the hour of day or night.

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1.2 Operations Specifications

1.3 Training Programs

1.4 **Enroute** Inspections

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1.1 MANAGEMENT

Description

Hr. Wilfred P. Ryan, Jr., is the President of Ryan Air Service. Mr. Dick Bottini is the Director of Operations. Mr. Paul Swanson is the Chief Pilot. Mr. Phil Hoversten is the Director of Stations and Mr. John Eckels is Vice President Finance.

All of the foregoing personnel and all company records ^{situated} ~~are situated~~ at Ryan Air's main business office located at:

International Business Plaza
1205 E. International Airport Road, Suite 201
Anchorage, Alaska 99518
Telephone: (907) 582-2227

Ryan Air has designatd nine Check Airman, six Flight Instructors and 11 Ground Instructors.

There are no Assistant Chief Pilots in the Ryan Air organization. Operational control is primarily conducted ~~from~~ Anchorage.

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1.2 OPERATIONS SPECIFICATIONS

Ryan Air's Operatlons Specifications were reviewed and *found* to be appropriate to Ryan **Air's** operations authorizations and In compliance with pertinent **FARs**.

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1.3 TRAINING PROGRAMS

EIR 88AL630012: Partenavia Model P68-C, Cessna Model 402C, Beechcraft Model 1900C; date occurred: 1/7/88; FARs believed violated: 135.327(a), 135.327(b)(1)(2)(3), 137.117(c)(2).

1. Ryan Air, Inc. failed to prepare and keep current a written ~~training~~ ^{training} program curriculum for each type of aircraft for each crewmember ~~required~~ ^{required} for that aircraft. Ryan's Partenavia aircraft were operated under Part 135 without the benefit of a training program for those aircraft. This is contrary to FAR 135.327(a) and 135.327(b)(1)(2)(3). The Partenavia aircraft were operated under FAR 135 without the required training programs in place for at least one year.
2. Ryan Air, Inc. operated aircraft under FAR 135 when the passenger briefing cards did not contain all information required by FAR 135.117(c)(2), which states in part that each card must contain instructions necessary for the use of emergency equipment on board the aircraft. Passenger Briefing Cards in use by Ryan were deficient in that:
 - a. PAX briefing cards in the Cessna 402C did not contain instructions for the use of the fire bottle or the donning of life vests.
 - b. PAX briefing cards in the Partenavia did not contain instructions for the use of the fire bottle or the location and use of life vests.
 - c. PAX briefing cards in the Beechcraft 1900C did not contain instructions for the use of the fire bottle or the location and use of life vests.

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1.4 ENROUTE INSPECTIONS

The Ryan Air Inspection Team conducted eight **enroute** inspections. The team **ceased conducting** enroute inspections **when** it ascertained **that** Ryan Air's aircraft **may not be airworthy**. (See Executive Summary and EIR 88AL630010 and EIR 88AL630012 (2))

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2.2 Airworthiness Directive Compliance (records vs actual)

2.3 **Maintenance** Programs (records, training, *etc.*)2.4 **MEL** Procedures/Usage

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2.1 MANAGEMENT

Description

Hr. Freeman Staltzfus is the Director of **Maintenance** and is located at **Ryan's** maintenance facility at Anchorage International Airport.

Hr. Albert P. **Ivanoff** is the Chief Inspector and is located at Ryan Air's main business office at Anchorage, AL. •

There are no Assistant Directors of Maintenance in the Ryan Air organization. Mr. Staltzfus stated he visits *each* of the outlying maintenance bases each week but information gathered in the field does not support that contention.

The team found Ryan's four aaintnanc**t bases** operating exclusive of one another with only a modicum of coordination, **standardization** or control exacted by Ryan Air's management.

Inspection Data

Ryan Air's company organization and personnel duties and qualifications were reviewed and found to be in compliance with the **FARs**.

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2.2 AIRWORTHINESS DIRECTIVE COMPLIANCE (Records vs Actual)

EIR 88AL630005: Cessna Model 207, Registration No. N73210; date occurred 07/09/86; FARs believed violated: 39.3, 135.25(a)(2), 135.439(a)(1), 135.439(a)(2)(v).

Ryan Air, Inc. operated an aircraft contrary to FAR 39.3 in that the aircraft was not operated in accordance with AD 85-10-02. AD 85-10-02 requires inspection of the aircraft induction system air box at 100 hour intervals. The AD was due at 4899 hours aircraft total time but was not complied with until 5087 hours. This operation was also contrary to FAR 135.25(a)(2) in that the subject aircraft did not meet all applicable airworthiness requirements of CFR 14, Chapter 1, which includes compliance with Airworthiness Directives.

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2.3 MAINTENANCE PROGRAMS (Records, Training, etc.)

EIR 88AL630006: Cessna Model 208, Registration No. N9376F; date occurred 01/01/88; FARs believed violated: 91.169(a)(1)

Ryan Air, Inc. has violated FAR 91.169(a)(1) by operating an aircraft that had not been inspected in accordance with an annual inspection within the preceding 12 calendar months.

EIR 88AL630007: Beechcraft 1900C, Registration No. N12333; date occurred: Continuous; FARs believed violated: 135.5, 43.12(a)(1), 43.12(b), 43.11(a)(2), 135.439(a)(2)(iv).

Ryan Air, Inc. has made intentionally false entries in the aircraft maintenance records for the subject aircraft by recording inspection completion on even hour increments in lieu of recording actual inspection completion times. This is contrary to FAR 43.12(a)(1) which forbids persons (operators) from making intentionally false entries in the aircraft records. The operator has stated that this was done for "convenience". FAR 43.11(a)(2) requires recordation of total time in service at the time inspections are completed. This was not done. FAR 135.439(a)(2)(iv) requires the operator to make a record of the current inspection status of each aircraft. Ryan has violated this regulation also by entering incorrect information in the aircraft records, thereby failing to record the current inspection status of the aircraft. The subject aircraft was overflown required inspections on at least four occasions. Since required inspections are outlined on Ryan's Operations Specifications (Part D), FAR 135.5 has been violated which forbids operation of aircraft in violation of the Operations Specifications.

EIR 88AL630008: Cessna Model 207, Registration No. N9475M; date occurred: 07/14/86; FARs believed violated: 91.167, 135.5.

FAR 91.167 requires an aircraft to be test flown after undergoing maintenance that may have appreciably affected its flight characteristics or performance in flight, prior to carrying passengers. Ryan's maintenance manual also stipulates that aircraft will be test flown after certain maintenance is performed which, in effect, is a regulatory requirement by the wording of FAR 135.5 which forbids the operator from operating in violation of their certificate, the maintenance manual being part of their certificate. Ryan Air, Inc. has operated an aircraft contrary to these regulatory requirements in that the subject aircraft was operated, carrying passengers, after removal and reinstallation of all primary flight control surfaces, without the benefit of the required test flight.

EIR 88AL630009: Beechcraft Model 1900C, Registration No. N6778R; date occurred: 11/28/87; FARs believed violated: 91.52(d)(2), 135.5.

Ryan Air, Inc. operated an aircraft with an emergency locator transmitter (ELT) battery installed that had exceeded 50% of its useful life (as determined by the battery manufacturer) contrary to FAR 91.52(d)(2). This operation was also in violation of FAR 135.5 in that Ryan's Operations Specifications stipulate that the ELT battery will be replaced as required by the manufacturer.

EIR 88AL630011: Beechcraft Hodel 1900C, Registration No. N6778R; date occurred: 07/31/87; FARs believed violated: 135.413(b)(1), 135.5.

Ryan Air, Inc. has operated an aircraft in violation of FAR 135.413(b)(1) by failing to replace a cycle limited part as required by their maintenance manual and the continuous airworthiness maintenance program outlined therein. Because the maintenance manual is part of the Operating Certificate and because specific cycle limitations are enumerated on the Operations Specifications approved for Ryan, FAR 135.5 has been violated because the certificate holder has operated contrary to their Operations Specifications. The part in question is a bushing which is installed at the point where the main landing gear actuator is attached to the fuselage of the aircraft. The bushing is limited to 7500 cycles but had accumulated 8837 cycles as of* 01/07/88.

EIR 88AL630013: Beechcraft model 1900C, Registration No. N6778R; date occurred 03/02/87 and 05/28/87; FAR believed violated: 135.5, 135.413(b)(1), 135.443(2)(i), 135.443(2)(ii).

Certain **Critical** maintenance tasks are identified as required inspection items (RII). Qualified, trained individuals in the maintenance organization are authorized to conduct the required inspections after the critical tasks are completed or at an appropriate time while the work is in progress. Installation of all fuel system components has been identified by Ryan as RII items. Ryan Air, Inc. has violated FAR 135.5 by failing (on two separate occasions) to perform required inspections after removal and replacement of fuel flow transmitters as stipulated in their manual, chapter 2, page 21, which is a part of the certificate. FAR 135.5 states in part that the certificate holder shall not operate in violation of the certificate. FAR 135.413(b)(1) requires the operator to conduct its maintenance in accordance with its manual which, in this case, it did not. Finally, FAR 135.443(2)(i) and 135.443(a)(ii) specifically require the certificate holder to have items identified as RII items inspected by an authorized inspector prior to approving the aircraft for return to service. Failing to perform an inspection of the fuel flow transmitters after replacement was contrary to this requirement.

EIR 88AL630014: Model N/A, Registration No.: N/A; date occurred: Continuous; FAR believed violated: 91.52(d)(2) and 135.5.

In violation of FAR 135.423(a) and (b), Ryan Air, Inc. has failed to maintain an organization adequate to perform its maintenance and required inspections in accordance with all applicable FARs. The current organization is deficient in the following areas:

1. The Required Inspection Item (RII) program does not always function within the provisions of F&R 135.427(b)(2) and (3) as evidenced by their failure to perform required inspections in several instances when it was appropriate to do so.

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2. Compliance with Airworthiness Directives (AD) is not accomplished or tracked systematically resulting in operation of aircraft to which an AD applies contrary to the requirements of that AD.
3. Tracing and replacement of life limited parts is not adequately controlled as evidenced **by** the continued operation of aircraft with components installed which have **exceeded** their established life limits.
4. Maintenance training **is inadequate** in that many maintenance personnel have not received training pertaining to specific company procedures, including RII, maintenance record entries, aircraft alteration, company procedures and others.
5. The Continuing Analysis, and Surveillance (**CAS**) program outlined in Ryan's maintenance manual, although approved by the Anchorage Flight Standards District Office, does not fully satisfy the regulatory requirements for that program (reference FAR 135.431). Also, there is little indication that the program, as approved, is administered conscientiously or that corrective action relating to specific problem areas has been initiated.
6. Tools and test equipment that require periodic test and/or calibration are not systematically identified and serviced in accordance with specific manufacturer's recommendations creating a situation where the status and accuracy of the equipment often is unknown. Maintenance personnel in the field were not aware of the current status of certain tools and test equipment when quizzed **by** team members and were not certain how the tracking system was supposed to **function**.
7. The established maintenance, preventive maintenance and alteration programs do **not ensure** that contract maintenance performed by other persons is performed in **accordance** with Ryan's manual. In several instances, maintenance was performed by persons/agencies **for** Ryan contrary to Ryan's *procedures*. In these cases, required inspections (**RII**) were **not** performed, maintenance record **entries** were not made properly and required test flights were not accomplished.
8. The competency of certain maintenance personnel, including the Director of Maintenance, is in question regarding specific **regulatory requirements** relating to inspection and maintenance of aircraft. This is evidenced by the fact that Ryan's Cessna 208 aircraft were operated for more than 12 calendar months without receiving an annual inspection as required **by** FAR **91.169(a)(1)**. Ryan maintenance personnel believed that the aircraft were being maintained **under** a progressive **inspection** program, however, that program was never presented to the local FSDO for approval as required **by** **91.169(d)**, in **which case the** request would have been handled as an Approved Aircraft Inspection Program (**AAIP**). Lack of knowledge, with respect to FAR 135 maintenance requirements, is the *major* cause of this situation.

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9. At **Nome** (and to some extent *system* wide), Ryan's **approved** maintenance manual and the procedures **outlined** therein were not being used by maintenance personnel. **Waltnanct personnel at Nome were tartructtd by the Director of Maintenance to discontinue using the "approved" annual and to use another "unapproved" manual instead.** The unapproved manual was submitted to the **local FSDO** for approval several times but was returned for revision. Some confusion on **the** part of Ryan's management personnel was evident during the team's inspection and at the out briefing. **Certain Ryan personnel were** not aware that the maintenance manual **had to be approved by the FAA prior to** implementation.

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2.4 MEL PROCEDURES/USAGE

EIR 88AL630010: Beechcraft Hodel 1900C, Registration No. N6778R; date occurred: 01/15/88; FARs believed violated: 135.179(b)(2).

Ryan Air, Inc. operated an aircraft with the avionics cooling fan inoperative, i.e., the circuit breaker was open and collared. The item is not deferrable under the provisions of their approved HEL. This act was contrary to FAR 135.179(b)(2) that restricts the operator from operating the aircraft with inoperative equipment except in accordance with their approved MEL. This discrepancy was discovered during an FAA enroute inspection of Ryan Flight 4945, ANL-ANC.


THEODORE CAVOORIS
TEAM LEADER

February 12, 1988

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DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
FLIGHT STANDARDS
NATIONAL AVIATION **SAFETY** INSPECTION **PROGRAM**
SPECIAL INVESTIGATION
FINAL REPORT
RYAN AVIATION
JANUARY 1988

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The inspection commenced on January 5, 1988, at the Alaska Regional Office with an inbriefing with Tom Westphal, AAL-200, and Lee Edwards, AAL-7. This was followed by a meeting with Dick Andrews, Acting Manager, AAL-FSDO-63 and his staff.

On January 6, 1988, the team reviewed Ryan Air's records located at FSDO-63.

On January 7, 1988, the team conducted an Inbriefing with Ryan Air's management team. Following this inbriefing, the team began its Inspection of Ryan Air's operations and maintenance.

An inspection of the pilot records Indicated that Ryan Air apparently reviewed these records in anticipation of the team's arrival. The records were "impeccable" and were found to be in agreement with the pertinent aircraft records or aircraft used for training.

During an inspection of Ryan Air's maintenance facility at Nome, the team learned that Ryan's aircraft were not being maintained in accordance with an approved maintenance manual during the previous three to six months. (The same discovery was later made by the team at Ryan Air's Bethel maintenance facility.) This finding prompted the team's decision to desist from conducting enroute inspections on Ryan Air's aircraft as Ryan was unable to demonstrate that their aircraft were airworthy.

The Ryan Air Inspection Team would like to express their sincere gratitude to all the FAA personnel in AAL-200 and AAL-FSDO-63 who assisted the team in carrying out their investigation. It is doubtful that the Ryan Air Inspection Team could have carried out their responsibilities without their valued assistance. The Ryan Air Inspection Team would also like to express their gratitude to the Ryan Air employees who cooperated with the team. They were polite and helpful regardless of their work schedule or the hour of day or night.

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CHANGE ONE
SPECIAL INSPECTION
RYAN AVIATION

1. Remove and replace the cover **page**, page **1**, and page 4 of the original *with* the attached replacement pages. Retain originals in attachment 1 at the back of the report.
2. Make the **following** pen and ink changes to **the** original:
 - Page **6**. line 5. Change 'situatd' to 'situated.'
 - Page 8, **para.** 1, line 1. Change "**traing**" to 'training.'
 - Page 8, **para.** 1, line 2. Change "**requird**" to 'required.'
 - Page 13, line 5. Change 'preceding' to "**preceeding.**"
 - Page 15, **para** 7, line 3. Change "**accorance**" to 'accordance.'

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APPENDIX F
ADDENDUM #1

28

1 MEMBER BURNETT: We' ll come back to that
2 when we discuss probable cause. I'm really
3 uncomfortable with the concept of inaccuracy here when
4 it looks as though the process was not exercised, and
5 it's awful hard to call that an inaccuracy.

6 MR. GORNEY: It wasn't an inaccuracy, it was
7 just a blatant violation. The First Officer was well
8 aware that that airplane was only legal for 1100 pounds
9 of total cargo weight. When he asked for 1500, he knew
10 very well that was 400 pounds beyond what that airplane
11 was legal for. There was no question about that.

12 MR. HAUETER: That's the structural load
13 limitation.

14 MEMBER BURNETT: Do I detect there might
15 be some disagreement with that position?

16 MR. STRAUCH: I don't know if it's fair to
17 ascribe attention to the First Officers I think the
18 staff can feel uncomfortable using words like "blatant",
19 so on and so forth.

20 MEMBER LAUEER: What would you call it if you
21 knew the structural limitation was 1100 and he loaded for
22 1500? Ignorance or what?

23 MR. ERENNER: This is directly on the point,
24 there was testimony after the aircraft was loaded, the
25 co-pilot was back in the terminal and was trying to

1 calculate weight and balance, spent several minutes
2 trying to workout the figures.

3 *MEMBER* BURNETT: After he gave these
4 instructions?

5 *MR. BRENNER*: Yes. **I was involved closely in**
6 **interviewing** the people at the **station**. The **co-pilot**
7 **gave the instruction** of **1500 pounds**, they **loaded 1500**
8 **pounds**. The agent who **did the loading** had been **keeping**
9 **mental notes on the weights**, and through the **hearing**,
10 **sincerely believed** that he had loaded 1500 pounds as
11 **instructed, that** he'd been **following the weights**.

12 One of our questions was, where **did the extra**
13 **weight** come from, and I'm not sure we **ever resolved that**
14 **totally to our satisfaction**. There ~~were~~ some
15 inaccuracies **in the** procedure where nothing **was really**
16 written **down**, so there may have been some errors on that
17 **part**.

18 *MEMBER* BURNETT: Was there any **suspicion**
19 or any **concern** that the statement by the ground
20 personnel as to what the First **Officer told** them was a
21 **CYA type of situation** where **in fact**, it's easy to **say** a
22 dead man said something and you then can get yourself
23 out of a bind? Was there any sense of that? **Is that an**
24 **issue or concern** here **or are you accepting** what they
25 **said as being** accurate?

30

MR. EFFNER: I'm accepting that under the
company policy, the co-pilot was responsible for
determining weight and balance. When he arrived, they
asked how much **should he load on and they** were prepared,
depending **what the eventualities were. They agent had**
loaded the materials in his mind, it was not written
down. It was not a carefully documented procedure. He
knew the **different weights in the** back room and
depending on what was asked **for, he planned, as**
reported, to load whatever he was told. As far as I can
tell, he sincerely believed that 1500 pounds was on. He
went down item by item as he took them out. In fact, we
found some errors in arithmetic that **at least** by his
report, he **was loading 1500** pounds --

MEMBER LAUBER: There's an **interesting point**
raised by Mr. **Gorney's** comment **regardless** of whether you
buy **into his characterization of the situation or** not.
Is **it true, first of all,** that there **is** an 1100 pound
structural **limit on cargo in the airplane? Is** that a
statement of fact?

MR. GORNEY: That's not true.

MEMBER LAUBER: **You just said** that.

MR. GORNEY: **No,** there was an 1100 pound
limit. I didn't say it was a structural **limit, it's a**
balance limit.

1 MEMBER LAUPER: You said **limit** and somebody
2 else said **structural**.

3 MEMBER NALL: **I think it's more likely a**
4 **structural limitation** because --

5 MR. TROTTER : Excuse me. **On page ten, it gives**
6 **the structural limitations** and you have 1910 pounds
7 **total weight** that **it's possible to** put on the aircraft.
8 That's **everything**.

9 MEMBER LAUPER: **So the limit you were talking**
10 **about** --

11 MR. GORNEY: The total cargo **limit would have**
12 **been** 1100 pounds. That **would give** them the --

13 MEMBER LAUEER : **Given** the other **loading** on the
14 **airplane, is** that what you're **raying**?

15 MR. GORNEY: That **would dictate** that you would
16 take that **1100** pounds and distribute **it with** 250 pounds
17 **in the** nose part of the forward compartment and then
18 **place** the rest **in** the rear cargo compartment because you
19 **would obviously want** to put as much **as possible in** the
20 forward cargo compartment. That compartment had a **250**
21 pound **weight limit** on **it**. Then you **take** the rest **and**
22 start putting it in the rear, **very** rapidly the **CC will**
23 start **shifting aft**. The **forward portion of the rear**
24 cargo compartment has an 880 pound structural **limit**. **So**
25 if you take **1100** pounds and put 250 of **it in** the front

32

1 in the forward cargo compartment, you can just about put
2 the remainder of it in the forward portion of the rear
3 cargo compartment. That **would** be how you would take
4 care of that **1100** pounds.

5 **If you started adding more weight, it can**
6 **structurally handle it.** You can Put **it in a** rear cargo
7 compartment but the **plane would 90 out of CG**, so the
8 **plane will 90 out of CG --**

9 MEMBER BURNETT: **In** other words, there
10 **is** no way to load that plane **without -- by Putting more**
11 **than 1100** pounds **in there?**

12 MR. GORNEY: That's correct.

13 MR. TROTTER: **With full passenger limit.**

14 MEMBER NALL: **You could do it.** You could put
15 **all the passengers in the front seats, if you** did not
16 **have a full load, so you could put this amount in** the
17 **rear compartment and still be within limits?**

18 MR. GORNEY: **With that passenger load --**

19 MEMBER BURNETT: **Is** that something the
20 crew members knew?

21 MR. GORNEY: The **co-pilot was the Director** of
22 **-- he had taught --**

23 MEMBER BURNETT: Let's assume he was
24 **Director of Training.**

1 MR. GORNEY: **He had taught weight and balance**
2 **and in speaking to the officers of the company, they are**
3 **aware of when this airplane has a full passenger load,**
4 **what then you were left with as far as the maximum cargo**
5 load. They were **all** aware and stated that the co-pilot
6 was **aware that** they **all** knew 1100 pounds was -- when you
7 had 19 passengers.

8 DR. LOEB: Where **is** the 1100 pounds? **I'm** not
9 sure -- they **could** have loaded the **1500** pounds onto **this**
10 **airplane** and not been overgrossed or **in a structural**
11 **problem.** They would have been out of CC.

12 MR. GORNEY: **I'm saying** --

13 MEMBER BURNETT: **That's** exactly what
14 he's **saying.**

15 MR. GORNEY: **I'm saying** that you can go
16 **structurally much higher, there's no structural problem;**
17 **it's the center of gravity limitation.**

18 MEMBER DICKINSON: Did we **talk about the 1100**
19 pounds **in here?**

20 MEMBER BURNETT: I don't **think so.**
21 **I see the Point** he's making. There's **no way with a full**
22 passenger **load,** you can't **load** over **1100 pounds and**
23 **still stay within CC.**

24 MR. GORNEY: Actually, **it's about 1,050 if YOU**
25 **want to be exact.**

1 MEMBER DICKINSON: Yes, but I think that's a
2 relevant point that I don't see in the report.

3 MEMBER BURNETT: It's also relevant
4 that he knew that. I don't think that's in the report.

5 MEMBER LAUBER: It's also relevant, it seems to
6 me, that the ground people ought to have known that.

7 MR. GORNEY : No, the --

8 MEMBER LAUBER: Why not?

9 MR. GORNEY: The ground people are not aware
10 of the CG limitations and so on. That's something
11 strictly --

12 MEMBER LAUBER : But we are not talking CG,
13 we're talking a limitation based on full passenger load
14 and you're saying that the number is fixed and well
15 known.

16 MR. GORNEY : They might be able to know a
17 structural limit because there might be a placard back
18 there in the forward portion of the rear cargo
19 compartment that says the structural limit is 880
20 pounds. They might know that, but the structural limits
21 never come into it. It's the center of gravity and they
22 do not -- because they don't fly that airplane -- they
23 are not going to be aware of when that CG goes out.

24 MEMBER BURNETT: Is it established in
25 the record that this First Officer or this Captain or

1 the crews in **general** knew **that 1100** pounds of cargo was
2 **all** that **you** could put **in** there with **a full** passenger
3 **load** without **going** out of CC?

4 MR. GORNEY: The Chief **Pilot stated** that
5 Hr. **Stohlphys (ph)** was aware that **with a** full passenger
6 load, that **was the limit**.

7 *MEMBER* BURNETT: **I think we** need to
8 have that **in** the report.

9 MR. GORNEY: Of course had he bothered to 90
10 ahead **and** complete the **weight and balance**, he **would have**
11 found that out because with **1500** pounds, **if** you do take
12 the **1500** pounds and distribute it in an optimum manner,
13 that **is**, put 250 **in** the forward cargo compartment, 880
14 in the forward portion of the rear cargo compartment,
15 more **in the rear**, then **would find out** that the **airplane**
16 **was** about **3-1/2** inches -- the CC would be about **3-1/2**
17 inches **beyond** the aft **limit**, we made that **calculation**.
18 Had they **bothered** to take **1500** pounds --

19 HR. TROTTER: We address that portion of it **in**
20 the **report**, distributing the **1500** pounds, **completing his**
21 **weight** and balance with his numbers.

ERRATA

**THESE CORRECTIONS SHOULD BE MADE
TO THE PREVIOUSLY PUBLISHED REPORT
IDENTIFIED AS FOLLOWS**

AIRCRAFT ACCIDENT REPORT

CONTINENTAL AIRLINES, INC., FLIGHT 1713
McDONNELL DOUGLAS DC-9-14, N626TX
STAPLETON INTERNATIONAL AIRPORT
DENVER, COLORADO
NOVEMBER 15, 1987

NTSB/AAR-88/09 (PB88-910411)

1. On page 29, delete the first four lines and replace with the following lines:

evidence indicates that the tailcone/empennage departed the fuselage and was thrown to a point about 850 feet beyond initial impact. The fuselage and intact right wing then slid to a point about 1,000 feet beyond initial impact and slewed around to point in a southerly direction.

2. On page 31, reference to figure 6 in the last two paragraphs should be changed to figure 7.

3. On page 41, replace the second paragraph in section 2.16, Crash/Fire/Rescue Activity, with the following paragraph:

In the area of the aft tailcone exit, impact damage and debris delayed passenger evacuation 7 to 10 minutes. Contributing to the delay was the fact that outside rescuers were hampered by limited visibility around the hatch area. The only instruction printed on the outside of the hatch was the word "Pull" on a placard near the hatch release handle. The hatch was then upside down because the fuselage was inverted. To assist future rescue attempts, the Safety Board believes that the FAA should issue an airworthiness directive to require more complete operating instructions on the exterior side of the tailcone exit hatch of DC-9 airplanes. The instructions should include both actions that are required to unlock and open the hatch: (1) Pull the release handle and (2) Push the hatch into the cabin. A precautionary instruction also should be included to advise rescuers that inward movement of the hatch may be blocked by occupants of the aft jumpseat.