Crashed short, Alaska Airlines, Inc., Boeing 727, N2969G, Near Juneau, Alaska, September 4, 1971

Micro-summary: **This Boeing 727 crashed while executing a non-precision approach to Juneau.**

Event Date: **1971-09-04 at 1215 PDT**

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

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

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AIRCRAFT ACCIDENT REPORT

ALASKA AIRLINES, INC.

BOEING 727, N2969G,

NEAR JUNEAU, ALASKA

SEPTEMBER 4, 1971

ADOPTED: OCTOBER 13, 1972

NATIONAL TRANSPORTATION SAFETY BOARD
Washington, D. C. 20591
REPORT NUMBER: NTSB-AAR-72-28

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NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D. C. 20591
AIRCRAFT ACCIDENT REPORT

Adopted: October 11, 1972

ALASKA AIRLINES, INC.
BOEING 727, N2969G,
NEAR JUNEAU, ALASKA
SEPTEMBER 4, 1971

SYNOPSIS

Alaska Airlines Flight 1866, a Boeing 727, N2969G, crashed during an instrument approach to Juneau Municipal Airport, Juneau, Alaska, at approximately 1215 P.d.t., on September 4, 1971.

The flight had been cleared for a Localizer Directional Aid (LDA) approach tc Runway 8 and had reported passing the final approach fix (Barlow Intersection). This intersection is located 10.2 nautical miles west of the airport. No further communications were heard frcm the flight.

The aircraft struck a slope in the Chilkat Mountain range at about the 2,500-foct level, 18.5 miles west of the airport, and approximately on the inbound localizer course. All 104 passengers and the seven crewmembers were injured fatally. The aircraft was destroyed by impact and isolated postcrash fires.

The National Transportation Safety Board determines that the probable cause of this accident was a display of misleading navigational information concerning the flight's progress along the localizer course which resulted in a premature descent below cbstacle clearance altitude. The origin or nature of the misleading navigational information could not be determined. The Board further concludes that the crew did not use all available navigaticnal aids to check the flight's progress along the localizer nor were these aids required to be used. The crew also did not perform the required audic identification of the pertinent navigational facilities.

Following this accident, the Board recommended (NTSB Safety Recommendation A-72-14) to the Federal Aviation Administration (FAA) that the public instrument approach procedure for the LDA approach to Juneau, Alaska, Airport be amended to reflect the addition of Distance Measuring Equipment (DME) as a source of determining the location of fixes on the final approach course of the localizer.

The Administrator has concurred with this recommendation and the appropriate approach charts for the Juneau Airport have been amended to reflect these changes.

The Board further recommends that the FAA continue tests and research into the effects of possible extraneous harmonics generated by a Doppler VOR transmitter on airborne navigational receivers and associated instrument displays.

1. INVESTIGATION

1.1 History of the Flight

Alaska Airlines, Flight 1866 (AS66) of September 4, 1971, a Boeing 727, N2969G, was a regularly scheduled passenger flight from Anchorage, Alaska, to Seattle, Washington, with intermediate stops at Cordova, Yakutat, Juneau, and Sitka, Alaska. The flight, operating under instrument flight rules (IFR), departed Anchorage at 0913 1/ and landed at Cordova at 0942. AS66 departed Cordova at 1034 after a delay, part of which was attributable to difficulty in securing a cargo compartment door. The flight landed at Yakutat at 1107.

While on the ground, AS66 received an air traffic control clearance to the Juneau Airport via Jet Route 507 to the Pleasant Intersection, direct to Juneau, to maintain 9,000 feet or below until 15 miles southeast of Yakutat on course, thence to climb to and maintain flight level (FL) 230. (See Appendix D.) The flight departed Yakutat at 1135, with 104 passengers and seven crewmembers on board.

At 1146, AS66 contacted the Anchorage Air Route Traffic Control Center (ARTCC) and reported level at FL 230, 65 miles east of Yukutat. The flight was then cleared to descend at the pilot's discretion to maintain 10,000 feet so as to cross the Pleasant Intersection at 10,000 feet and was issued a clearance limit to the Howard Intersection. (See Appendix E.) The clearance was acknowledged correctly by the captain 2/ and the controller provided the Juneau altimeter setting of 29.46 inches and requested AS66 to report leaving 11,000 feet.

At 1151, AS66 reported leaving FL 230. Following this report, the flight's clearance limit was changed to the Pleasant Intersection. At 1154, the controller instructed AS66 to maintain 12,000 feet. Approximately 1 minute later, the flight reported level at 12,000 feet.

The changes to the flight's original clearance to the Howard Intersection were explained to AS66 by the controller as follows: "I've got an airplane that's not following his clearance. I've got to find out where he is." The controller was referring to N799Y, a Piper Apache which had departed Juneau at 1144 on an IFR clearance, destination Whitehorse, Canada. The clearance issued to this aircraft made reference to Airway Blue Seventy-Nine; the designation

of this airway had been changed to Amber Fifteen, and was depicted as such on then current charts. On two separate occasions, AS66 acted as communications relay between the controller and N799Y regarding this clearance.

At 1158, AS66 reported that they were at the Pleasant Intersection, entering the holding pattern, whereupon the controller recleared the flight to Howard Intersection via the Juneau localizer. In response to the controller's query as to whether the flight was "on top" at 12,000 feet, the captain stated that the flight was "on instruments." At 1200, the controller repeated the flight's clearance to hold at Howard Intersection and issued an expected approach time of 1210. At 1201, AS66 reported that they were at Howard, holding 12,000 feet.

At 1207, AS66 was queried with respect to the flight's direction of holding and its position in the holding pattern. When the controller was advised that the flight had just completed its inbound turn and was on the localizer, inbound to Howard, he cleared AS66 for a straight-in LDA 3/ approach, to cross Howard at or below 9,000 feet inbound.

The captain acknowledged the clearance and reported leaving 12,000 feet. At 1208, in response to the controller's query, relative to the aircraft's altitude, the captain replied, " . . . leaving five thousand five . . . four thousand five hundred," whereupon the controller instructed AS66 to contact Juneau Tower. Contact with the tower was established shortly thereafter when the captain reported, "Alaska sixty-six Barlow inbound." (Barlow Intersection is located about 10 nautical miles (NM) west of the Juneau Airport.) The Juneau Tower Controller responded, "Alaska 66, understand, ah, I didn't, ah, copy the intersection, landing Runway 8, the wind 080° at 22 occasional gusts to 28, the altimeter now 29.47, time is 09 1/2, call us by Barlow."

No further communication was heard from the flight.

Search and rescue facilities were alerted at approximately 1223. Several hours later, the aircraft's wreckage was located 18.5 NM west of the airport at about the 2,500-foot level in the Chilkat Mountain Range.

There were three witnesses located in the vicinity of the accident site who heard the aircraft fly overhead just prior to the crash.

Two of these witnesses, who were located about 1-1/2 miles west of the accident site and at the approximate 2,500-foot elevation of the Chilkat Range, heard a low-flying jet aircraft pass approximately overhead proceeding in an easterly direction. They stated that they were unable to see the aircraft because of the restricted visibility, which was estimated at 60 to 70 yards in fog and light rain. They further stated that the engines sounded normal and that there was no change in the engine sounds from the time they first heard the aircraft until the sound of explosions was heard approximately 1 minute later. They estimated the time of the accident as approximately 1215. The wreckage site coordinates were 58° 21' 42" N. and 135° 10' 12" W.

The third witness, located about one-half southwest of accident site, heard and saw the aircraft pass overhead. He stated that shortly thereafter he ceased to hear the engine noise and assumed the aircraft was cut of hearing range. He did not hear the aircraft crash nor did he hear any explosions.

1.2 Injuries to Persons

Injuries	Crew	Passengers	Others
Fatal	7	104	0
Nonfatal	0	0	0
Other	0	0	0

Post-mortem examination of the flightcrew members revealed no evidence of any condition which could have adversely affected performance of duty.

1.3 Damage to Aircraft

The aircraft was destroyed by impact and isolated postcrash fires.

1.4 Other Damage

None

1.5 Crew Information

All crewmembers were certificated and qualified to conduct this flight. (For detailed information, see Appendix B.)

1.6 Aircraft Information

The aircraft, a Boeing 727-193, N2969G, Serial Number 19304, was owned by Hughes Air Corporation and was subleased, via Air West Incorporated, to Alaska Airlines, Inc., on September 25, 1970. The aircraft was certificated and maintained in accordance with all applicable company and Federal Aviation Administration (FAA) procedures and regulations. (See Appendix C For detailed information.)

1.7 Meteorological Information

The 1156 surface weather observation at Juneau Municipal Airport was reported as: 1,500 feet scattered, measured 3,500 feet broken, 7,500 feet overcast, visibility 15 miles, light rainshowers, temperature 51° F., dew point 46° F., wind 110° at 13 knots, altimeter setting 29.46 inches, sky coverage 1/10 stratocumulus, 7/10 stratocumulus, 7/10 altocumulus, breaks in overcast.

There were no pilot reports (PIREPS) available via weather teletype which were pertinent to the immediate Juneau area near the time of the accident. However, a PIREP filed at 1310, contained the following:

> Sitka pilot report Juneau - Sitka 1115 Tenakee Springs Pass/Inlet closed, ceiling 1,000 feet overcast, moderate rain. Chatham ceiling 3,000 feet overcast, visibility 10 miles.

There were no radar weather observations available pertinent to the area concerned with the accident.

1.8 Aids to Navigation

The Juneau Airport was provided with two public instrument approach procedures (IAP), one entitled NDB-A (nondirectional beacon) Runway 8, and the other, LDA (localizer directional aid)/NDB-1 Runway 8. On this approach only localizer course information is provided; no glidepath is associated with this procedure. The Sisters Island VOR 4/ (SSR) is used in conjunction with the Juneau localizer to provide intersection fixes in determining the appropriate descent altitudes along the inbound course.

Alaska Airlines, Western Airlines, and Wien Consolidated Airlines have special instrument approach procedures, approved by the FAA, which utilize the Juneau localizer.

This approach procedure was depicted on Jeppesen Approach Chart 11-9, dated January 15, 1971, (See Approach Chart in Appendix E.)

As noted on the approach chart, the minima applicable to Alaska Airlines B-727 daylight operations for a straight-in landing on Runway 8 utilizing this procedure were: minimum descent altitude (MDA) 1,000 feet and visibility 2 miles. The approach is conducted on a localizer, transmitting on a frequency of 109.9 MHz. The inbound course is 062°. After departing from Howard Intersection (where the localizer intersects the 353° radial of Sisters Island VOR), the initial approach fix, the flight is continued via the 062° inbound localizer course, with a minimum altitude of 5,000 feet for 3.2 NM to the Rockledge Intersection (006° radial of the Sisters Island VOR). At this point, descent to the MDA of 1,000 feet m.s.l. is authorized. The flight is continued inbound on the localizer course, past the Barlow Intersection (015° radial of Sisters Island VOR), to the Coghlan Island NDB which is the missed-approach point (MAP) for this procedure.

The Coghlan Island NDB is located 3.2 NM west of the approach end of Runway 8. The procedure requires that this radio aid be monitored by the flight during the approach. Visual flight must be conducted between the MAP and the airport. The localizer antenna is located about 1.5 NM west of the runway threshold, and its course orientation (062°) is displaced about 20° from the runway heading. There are lead-in lights installed to provide the pilot visual guidance from the MAP to the airport. Should the lights not be operative, the visibility minimum is increased from 2 to 3 miles.

Colocated with the Sisters Island VOR is the Sisters Island NDB. Although the Alaska Airlines approach chart in effect at the time of the accident refers to "Sisters I. VOR/NDB", the NDB frequency (391 kc.) is not mentioned on the chart, nor are the magnetic bearings listed that delineate the Howard, Rockledge, and Barlow Intersections.

Also depicted on the Alaska Airlines approach chart was the Point Retreat NDB, located 3.2 NM northwest of the Barlow Intersection.

During the National Transportation Safety Board's public hearing concerning this accident, the FAA Principal Operations Inspector assigned to Alaska Airlines testified that he considered it adequate to use only the Sisters

Island VOR to check progress along the localizer and that the use of what he termed redundant facilities would be a discretionary item for the particular captain flying the LDA approach.

The details of an instrument approach procedure, once formulated, are delineated on specified FAA forms. These tabular and textual data are transformed by the cartographic agency (or company) to a pictorial display of the procedure, and are the sole basis for preparation of an IAP chart of a procedure under FAA cognizance.

A special IAP requires the amendment of the carrier's Operations Specifications and is validated upon receipt thereof by a representative of the carrier and approval by a representative of the Administrator of the FAA, along with his selection of an effective date. On June 10, 1971, an amended special IAP, No. 15, was approved by the Chief, Airspace and Procedures Section, Flight Standards Division, Alaska Region of the FAA. On July 9, 1971, the amended Operations Specification was received by the carrier and approved by the FAA Principal Operations Inspector assigned to Alaska Airlines. This revised IAP is essentially the same as the IAP dated January 15, 1971, except that it raises the minimum crossing altitude at Barlow Intersection to 3,900 feet and lists the Sisters Island NDB Frequency. MDA and visibility data remain the same. The revised special IAP Chart 11-9, dated July 16, 1971, was disseminated to Alaska Airlines flightcrews subsequent to the accident. (See Appendix E.)

On the day of the accident, all navigational radio aid (NAVAID) facilities and system components serving the Juneau area were flight checked by the FAA Flight Inspection District Office (FIDO). The reports of this flight check showed that all facilities and components were operating within their prescribed tolerances.

Two separate reports of navigation difficulties in the Juneau area were received by the Safety Board following the accident. The first, a Canadian Military flight which traversed the Juneau Airspace on September 4, 1971, at approximately 1205, reported a VOR bearing pointer error of between 50° and 70° to the left of the actual position of the Sisters Island VOR. Similar errors were noted by the pilot when passing the Level Island, Annette, Malcolm, and Vancouver VOR stations. Subsequent examination of the VOR receiver from this aircraft revealed an internal malfunction which caused the reported bearing pointer errors. The other

incident involved a U. S. Coast Guard helicopter which experienced a navigational discrepancy in connection with the Sisters Island VOR on September 21, 1971. Similarly, subsequent examination of the aircraft's VOR receivers revealed an internal failure as the cause of the problem.

A Canadian aircraft (CF-LOO), which had departed Whitehorse at 1106 on the day of the accident, reported to Anchorage ARTCC at 1147 that the flight had passed Sisters Island at 1146 and was estimating Level Island at 1216. The crew noted no faulty operations or abnormalities of the Sisters or Level Island VOR's. The copilot specifically stated: " I do not remember anything abnormal when switching from the Sisters VOR radial to the Level Island VOR radial, such as having to change course in order to pick up the new radial."

1.9 Communications

There were no reported difficulties with air/ground communications between AS66 and either the Anchorage ARTCC or the Juneau Tower. However, a review of the transcription of recorded communications from the Anchorage ARTCC indicates that the center controller did have difficulty in receiving transmissions from Apache N799Y which prompted the controller to utilize AS66 as a relay station with that aircraft. (The transcript of AS66 communication relays between N799Y and the Center are included in Appendix G, Transcription of Cockpit Recorder.)

1.10 Aerodrome and Ground Facilities Information

Juneau Municipal Airport, published elevation of 18 feet m.s.l., is surrounded on three sides by mountainous terrain and opens to a bay on the southwest. It has one runway, 8/26, which is 8,456 feet long and 150 feet wide. The magnetic variation in the Juneau area is 29.5° East.

Because of the unusual terrain features surrounding the Juneau Airport, the approach area leading to Runway 8 is equipped with sequential flashers leading from the MAP to the runway threshold (3.2 NM).

1.11 Flight Recorders

N2969G was equipped with a United Control Data Division (Sundstrand), Model F-542B flight data recorder (FDR), serial No. 1941.

The recorder had been subjected to mechanical damage only, with moderate crushing evident in both sides of the rear half of the unit. The foil medium was removed from the magazine and was found to be undamaged. All recorded parameter had been active and were clearly readable up to the end of the traces. The flight was examined back to the last departure point, Yakutat, and no evidence was found to suggest abnormal recorder operation.

The altitude trace showed that the final descent commenced about 2 minutes and 12 seconds prior to impact, from an altitude of 12,250 feet m.s.l. A descent rate, exceeding 6,000 ft./min. at times, but averaging 5,220 ft./min., was maintained to an altitude of about 6,500 feet m.s.l. The descent rate decreased at this point to approximately 1,000 ft./min. for 12 seconds and then again increased to an average of 4,300 ft./min. for the remaining 54 seconds to impact. The impact elevation, as shown on the readout, was 2,475 feet m.s.l. During the final descent, a shallow right turn from 060° to 070° was completed. The impact heading was approximately 070°. Beginning with the final descent, the airspeed ranged from 216 knots indicated airspeed (KIAS) to 245 KIAS and decreased erratically to about 200 KIAS at impact. Only minor fluctuation of the vertical acceleration trace was noted throughout the entire period of the readout.

A Collins Radio Company Model 642-C-1 cockpit voice recorder (CVR) was installed in N2969G. The CVR unit had sustained extreme impact damage to all surfaces; however, except for a break between the erase and record heads, the tape was found to be in good condition. The entire tape, beginning with the ground conversation at Yakutat, to impact, was reviewed and a transcription of all relevant communication and sounds appearing on the CVR tape was made. (See Appendix G, which contains the transcript of the last 20 minutes of cockpit voice recording.)

Voice identification was made by persons who were familiar with the voices of the flight crewmembers. Timing for the transcript was accomplished by correlating air-ground communications with the recording thereof from the Anchorage ARTCC and by subsequently timing from these known points to other points on the cockpit area microphone channel where speech or other sounds occur.

No evidence was noted on the CVR that the crew used audio identification procedures when tuning the different navigational facilities.

Appendix F shows the approximate flightpath during the final 15 minutes of Flight 66 as derived from computer calculations using the indicated airspeed and magnetic heading data from the FDR. Since this flightpath presentation depends on the accuracy of the available data, including the meteorological inputs, the plot presents only a reasonable estimation of the flightpath with respect to the ground. Certain voice transmissions obtained from the CVR were superimposed on the flightpath.

According to this presentation, AS66 was cleared to the Howard Intersection while about 3.5 NM east of the Pleasant Intersection and while crossing the Juneau localizer beam on a southerly course. The subsequent right-hand holding pattern was confined between a point about 4.5 NM east of Pleasant and a point about 7 NM west of Howard. The captain's Howard identification at 1201 occurred on the 308° radial of the Sisters Island VOR instead of the 353° radial. When the flight was completing its inbound turn toward the centerline of the localizer, at approximately 2 NM west of the 308° radial, it was cleared for an approach and to cross Howard at or below 9,000 feet. Based on cockpit conversation, Rockledge Intersection occurred on approximately the 323° radial, and the captain reported "Barlow inbound" on the 340° radial.

1.12 Aircraft Wreckage

The aircraft crashed on the easterly slope of a canyon in the Chilkat Range of the Tongass National Forest. The impact occurred at the 2,475-foot level, in near-alignment with the Juneau localizer course, and at a distance of approximately 18.5 nautical miles from the airport. The aircraft disintegrated on impact, and the wreckage covered an area approximately 800 feet long and 600 feet wide. The major portion of the wreckage came to rest on the slope of the canyon. The cockpit and various portions of the forward fuselage were found on the ridge of the canyon and farther along the projected flightpath.

All extremities of the aircraft were accounted for. No evidence of in-flight structural failure, fire or explosion was found. The nature of the breakup of the aircraft precluded any determination of the preimpact integrity of the control system or deflection of primary flight controls. The landing gear was found in the extended position, the wing flaps and spoilers were retracted. Portions of the leading edge slats were extended. The flap handle was found in the 2° detent.

All three engines separated from the aircraft and came to rest 75 yards apart, in a snow-covered gully below the main impact site. Each engine showed evidence of bending or breakage of the fan, compressor, or turbine blades in the direction opposite to rotation. No evidence of any operational distress was noted.

Several electrical control panels were found in the cockpit wreckage. All were damaged by fire and impact, and no switch or circuit breaker positions could be determined. Two constant speed drive units and two generators were recovered, and all showed evidence of rotation at impact.

All three hydraulic fluid reservoirs were found in the wreckage. The "A" system and standby reservoirs still contained hydraulic fluid. One-half of the "B" system reservoir was found, and it was wet with hydraulic fluid.

Neither the captain's nor the first officer's barometric altimeter was recovered from the wreckage.

Components of the communication and airborne navigational systems were recovered in the cockpit wreckage area. All of these units showed extensive impact damage; however, only the VHF communication/navigation frequency selector panels had been damaged by the postimpact fire. All of these components were inspected and documented at the accident site and then shipped to the United Air Lines Maintenance Facility at San Francisco International Airport for detailed examination. (See Section 1.15, Tests and Research.) The VHF navigation antenna and the captain's DME unit were recovered on October 3, 1971.

1.13 Fire

All fuel-containing structures disintegrated at impact. There was evidence of scattered, independent fires throughout the wreckage area. A fuel spill on the ridge below the main impact point did not burn.

1.14 Survival Aspects

This was a nonsurvivable accident.

1.15 Tests and Research

Examination of the recovered airborne navigation and communication equipment components disclosed the following:

VHF Navigation/Communication Frequency Selector Panels. Both selector panels were damaged extensively by fire and impact. Control head shaft alignment and shaft mechanisms were examined and compared with similar units and with engineering drawings of the unit. It was determined that both the captain's and first officer's VHF navigation frequency control heads were set on 109.9 MHz. (Juneau localizer frequency is 109.9 MHz.) One of the VHF communication control heads was set on an approximate frequency of 118.3 MHz (Juneau Tower frequency is 118.3 MHz) and the other was at an approximate frequency of 119.9 MHz.

Captain's ADF Receiver. The frequency setting was determined to be 216 kHz. (The frequency of the Coglan Island NDB is 212 kHz) There is no navigational aid near the Juneau area with a frequency of 216 kHz.

First Officer's ADF Receiver. The frequency setting was determined to be in the range between 321 and 359 kHz. The damage to the unit prevented a closer determination. (The frequency of the Mendenhall NDB is 332 kHz.)

Captain's Gyrosyn Indicator (RMI). Both the single needle and double needle pointers were missing from the instrument. Examination under ultraviolet lighting revealed no impact marks from either pointer on the face of the instrument. The single pointer selector switch was in the VOR position. The double pointer selector switch was in the ADF position. Because of internal damage to the synchros, the position of the pointers at impact could not be determined by electrical measurements of the synchro position.

First Officer's Gyrosyn Indicator (RMI). Both pointers were missing from the instrument. The single pointer selector switch was in the VOR position. The double pointer selector switch was in the ADF position. Examination of the single pointer's position synchro showed its position to be at a relative angle of 093°.

Captain's Course Director Indicator (CDI)
(Collins 331 A-6A)

Selected Course Display - 014°
Selected Course Arrow - missing

Heading Marker	- 068 ±5°
Deviation Bar	- mechanism destroyed
VOR/LOC Flag	- retracted
Azimuth Card	- heading 068 ± 2°

The mechanical drive integrity between the course control knob and its associated components was determined to be intact.

First Officer's Course Director Indicator (CDI)
(Collins 331 A-6A)

Selected Course Display	- 062°
Selected Course Arrow	- 062 ± 3°
Heading Marker	- 077 ± 3°
Deviation Bar	- missing
VOR/LOC Flag	- retracted
Azimuth Card	- intact

Both the captain's and first officer's horizon bars on their respective flight director indicators (Collins FD-108 flight director system) showed an attitude at impact of 2-1/2° noseup.

Three VHF navigation receivers (Collins 51RV-1) were examined with the other navigation/communications equipment at the IIAI maintenance facility. The units had been distorted by impact but had not been subjected to heat or fire.

Examination of the bearing mechanism of the captain's receiver disclosed an RMI pointer position of approximately 157° magnetic which corresponded to the approximate "parked" 5/ position of the pointer.

Because of the damage to the bearing mechanism module in the first officer's receiver, no bearing determination could be made by this means.

It became apparent during the investigation that bearing information relative to the flight's progress along the localizer course in conformance with the prescribed approach procedures was being derived from the captain's VHF navigation receiver. To determine its preimpact operational capability, this receiver was disassembled and examined further and tested at the manufacturer's facility.

The Collins 51RV-1 receiver contains several subcomponents which include:

51V-4B Glideslope receiver
51X-4 VOR/LOC receiver
344-2 Manual VOR/LOC unit
344F-1 Automatic VOR unit

In the as-found condition of the captain's receiver, there were broken resistors and condensers, dislodged and missing transistors, and a punctured transformer (T-3).

The three crystals that comprise the 114.0 MHz frequency (Sisters Island VOR) were removed and examined. One of the crystals (Y-21) was found broken off its mount in the containing unit, and when tested it did not display any crystal activity. Upon X-ray examination it was found that the quartz wafer was fractured. The other crystals were tested and were found to be capable of normal operation.

The damaged components of the captain's receivers were replaced and a test VOR signal (113.962 MHz) was applied to the receiver. Signal outputs of the receiver and instrumentation were found to be within specified tolerances. Because the bearing mechanism module had been damaged beyond repair, the three VOR/LOC subcomponents were placed in another 51RV-1 chassis and tested for bearing accuracy. Under the test conditions, the induced bearings were found to be within allowable tolerances throughout the entire 360° spectrum.

Although no Distance Measuring Equipment (DME) was operational in the Juneau area at the time of the accident, the captain's DME transceiver was examined in order to determine the DME channel position at impact.

Selection of a VOR or localizer frequency at the pilot's control panel signals the DME unit to begin searching for the DME channel number associated with that particular frequency. There are a total of 126 channels and corresponding frequencies. Channeling always occurs from the lower to the higher numbers. Channeling from any channel to the next lower takes about 10 seconds -- in this case, the mechanism sequences from the old channel to 126 and then from 1 to the new channel.

The captain's DME electro-mechanical channeling mechanism was found "frozen" and in transit between Channels 24 and 25. A listing of some of the channel correlations follows:

Channel	VHF Frequency	
24	108.7	
25	108.8	
36	109.9	(JNU Localizer)
87	114.0	(SSF VOR)

According to the manufacturer, the channeling sequence from Channel 87 to 36 would take about 4 seconds.

The captain's DME distance unit showed 1 NM; this corresponds to the "erase" position.

A teardown inspection of the aircraft's VHF navigation antenna revealed some corrosion on the surfaces mating with the aircraft structure. The mating surfaces of the No. 1 coupler installation were clean. The No. 2 coupler surfaces showed some corrosion; the No. 2 antenna and cavity were distorted by impact.

It was also noted that all five of the B-727 aircraft operated by Alaska Airlines were equipped with dual Collins FD-108 flight directors. Two of these aircraft, N2969G and N2979G, were equipped with Collins 51RV1 VHF navigation receivers. The other three B-727's were equipped with Bendix RA-21A and NAV-22A VHF navigation receivers.

The cockpit presentation relative to the presentation of the glide slope pointers and warning flags varies with the navigation equipment installed. With the Collins receiver, the glide slope pointers and warning flags are biased out of view at all times when other than a localizer/glide slope frequency is selected. With the Bendix receivers, the glide slope pointers and warning flags are in view when other than a localizer/glide slope frequency is selected.

Sisters Island VOR

The Sisters Island (SSR) single sideband Doppler VOR was commissioned in June 1965, and has been in operation since that date. The Doppler-type VOR was developed by the FAA for use in mountainous areas where the standard VOR installation has experienced problems caused by signal reflection off the surrounding terrain. There are about 25 Doppler VOR installations operational in this country.

Sisters Island is located in the Icy Strait, approximately 4 miles from the southern tip of the Chilkat

Peninsula, and about 23 NM southwest of Juneau Municipal Airport.

On September 4, 1971, following the accident, FAA electronics specialists inspected the facility to determine its operational capabilities. It was found that the station had been operating under normal power at the time of the accident and that no automatic switchover to emergency power or to the alternate transmitter had occurred in the interim period since the last routine inspection (September 2, 1971). The station power output and radial monitoring systems were checked and found within tolerances.

Navigational signals transmitted by the VOR are checked continually by a monitoring system to insure accuracy of the radiated signal and positive continuous operation of the station. The monitoring system employed at SSR checks the following six parameters:

1. The omni course signal at 090° magnetic

   - Tolerance: ± 1°

2. Amplitude of the AM modulation

   - Tolerance: 13 percent reduction

3. Amplitude of the FM modulation

   - Tolerance: 13 percent reduction

4. The 1,020 Hz identification signal

   - Detects loss of signal

5. The frequency difference between the carrier and sideband transmitters

   - Tolerance: ± 95 Hz

6. The RF sideband energy radiated from sideband antennas

   - Detects loss of one or more sideband antennas

When the VOR is operating within prescribed tolerances, a continuous green light indicating normal operation is shown at the Juneau Flight Service Station

(FSS). If the monitor system detects an out-of-tolerance condition for any of the above parameters, a buzzer warning will sound and a red warning light will illuminate at the FSS indicating that the station is not functioning properly and that it has been shut down automatically (off-the-air).

It should be noted that prior to complete shut down of the station, an intermediate step is accomplished when the monitor initially alarms. At that time, the alternate transmitter and/or emergency generator is activated and, if the fault is corrected, the alarm will be cleared and the station will remain on the air. In this case, the FSS will have only a momentary alarm, followed by a reillumination of the green light indicating normal operation. However, if the fault persists after the changeover occurs, the monitor will shut down the station and the alarm will appear in the FSS as previously described.

The entire alarm system can be bypassed, only at the facility, by placing the appropriate switch to the "by-pass" position. This is generally done by a maintenance technician at the station when minor maintenance or testing etc., is to be accomplished on the facility wherein it is desirable to leave the station on the air, yet not have the alarm activate. When the alarm system is bypassed, the monitor will continue to operate; however, it will not transfer or shut down the VOR equipment, even if a fault condition is present. Additionally, the green, normal operation light will be illuminated in the FSS, whether or not a fault is detected. When the switch is returned to the normal position the alarm system will then function and respond in the prescribed manner. Unless the maintenance technician informs the FSS personnel about his actions, the FSS will not be aware of the bypassing of the alarm systems.

The monitor alarm system was operating under the control of the Juneau FSS during this period, and no alarms or interruptions of service were recorded.

A DME facility was in the process of being installed on Sisters Island at this time. However, on the day of the accident, no work was being conducted on this installation and it was not on the air.

Following the inspection on September 4th, and the FIDO flight test, the facility was certified operational by the FAA.

The Safety Board investigation team inspected the Sisters Island VOR facility on September 9, 1971. The transmitter and building antenna site were examined visually and no discrepancies were observed. The station monitoring system was tested and was found to be operating within specified tolerances.

The facility log sheets pertaining to the operations and maintenance of the VOR for the previous 6 months were examined in detail. No failures or discrepancies were found that would point to a significant problem area with any of the facility components. Similarly, a review of the FSS facility records did not reveal any recurrent failures or interruptions of service of the SSR facility which would indicate a problem applicable to this accident.

The only item of nonroutine nature found in these log sheets pertained to a flood in the distributor pit on February 20, 1971, which caused the station to alarm and go off the air. It was found that because of a blocked (frozen) drain system, approximately 12 inches of water had accumulated on the floor of the pit. It was noted by the FAA maintenance technicians that the water level did not reach the level of the motor, goniometer or distributor head, but it had covered the electrical power cables and inlet to the electrical distributor.

After the water was drained, the complete distributor unit was removed from the pit, and after it had been inspected and cleaned it was returned to service. No discrepancies were found with the distributor or other components associated with this unit. Flight and ground checks conducted on the facility after it had been returned to service showed normal operation.

Although the postaccident FAA flight test of the Sisters Island Doppler VOR (DVOR) showed the station was functioning normally, several additional flight tests were conducted when information concerning the flightpath of N2969G became known. Signal reception of the SSR VOR at various specified radials and altitudes was measured. During these tests a descent from 12,000 feet m.s.l. was commenced approximately 11 NM west of the crash site inbound on the Juneau localizer course. A descent rate of approximately 4,100 ft./min. was maintained to an altitude of 2,500 feet m.s.l. At a distance of 3 NM west of the crash site, loss of warning flag current was recorded, and CDI cross pointer fluctuation was followed by a centering of the course indicator (CDI).

Test flights were conducted inbound on the localizer course to the accident site at altitudes of 5,000 feet m.s.l. and 4,000 feet, m.s.l., respectively. At 5,000 feet, the inbound run was started at 7 NM west of the site. Warning flag "pops" were recorded all along the run, and sweeping action of the CDI occurred at 1.3 NM west of the site. At 4,000 feet m.s.l., the run was started from a distance of 17 NM west of the crash site. Warning flag "pops" began at 10 NM west, and sweeping action of the CDI occurred at 1.9 NM west of the site.

Additional flight testing of the SSR DVOR was conducted on September 27, 28, and 29, 1971, to duplicate as closly as possible the tidal conditions at the time of the accident. The modulation level of the transmitter was set to correspond with the output at the time of the accident. Additionally, the FIDO Saberliner aircraft used in these tests was equipped with a Collins (Model 51RV1) VOR receiver similar to the one installed in N2969G.

All of the tests performed showed a normal operation of the station and, although there were areas of marked course roughness, no out-of-tolerance conditions were noted.

Spurious Radio Signals

Inquiries were made of the military authorities concerning possible electronic or electronic counter measure (ECM) activity in the Juneau area at the time of the accident. It was reported that no such activity was in progress near Juneau at the time.

To determine if there might have been interfering radio signals affecting the SSR VOR signals, special radio frequency and interference measuring examinations were conducted. Five different locations around Sisters Island were used for monitoring signals. The frequency range from 10 MHz to 40,880 MHz was covered with particular emphasis on the portion of the band around 114 MHz. No interference to the VOR signal was detected at any of the locations.

Consideration was also given to the possibility of passenger operational electronic devices causing interference with the aircraft's navigation system. Tests were conducted by Alaska Airlines in which a number of different models of transistor receivers (radios) were operated in flight at various locations in the passenger cabin, cockpit, and cargo compartments. No effect was noted on the aircraft's navigation instruments during the tests.

The possibility of a solar flare occurrence affecting the accuracy of radio navigation bearings was considered. Our investigation disclosed that solar flare activity had occurred prior to the date of the accident but that electromagnetic effects due to the activity had lessened to a below normal level at the time of the accident. Additionally, the normal performance of several radio communication and navigation facilities was verified by several aircraft users at the time and on the day of the accident. While the Board concludes that solar flare activity was not a factor in this accident, nevertheless, the Board believes that further research concerning the relationship of solar flare activity to electromagnetic disruptions in connection with the transmission of radio, navigational and landing aids is needed and encourages such research.

2. ANALYSIS AND CONCLUSIONS

2.1 Analysis

Based on all available evidence, it appears that Alaska Airlines Flight 1866 was operating routinely as it progressed over its route of flight from Yakutat to the Pleasant Intersection in the Juneau area. The aircraft was airworthy, maintained properly, and capable of normal operation in the existing weather conditions with regard to powerplants, flight controls, altimetry system, and communications equipment. The crew was certificated and qualified for the operation involved. There was no crew incapacitation, nor were there any other factors that might have interfered with the crew's physical ability to perform their tasks. The CVR readout revealed no evidence of crew suspicion or concern about aircraft performance.

Correlation between the CVR readout and the approximate flightpath derived from the flight data recorder traces shows that the first, unmistakable abnormality in the flight's progress occurred at 1201:03 when the captain told the first officer; " 'kay, you're Howard," although the aircraft was actually about 9 NM west of Howard. Since prior cockpit conversation indicates that the captain had set the 353° radial (Howard Intersection) into his CDI, it appears that the crew depended on a display of navigational information that seemed to be correct, but was in error by about 45°. Similar erroneous indications of progress along the localizer course are evident in subsequent intracockpit conversation dealing with the passing of Rockledge and

Barlow Intersections, although the aircraft, in fact, never progressed as far as Howard.

Following the clearance to make a localizer approach into Juneau, the aircraft's descent from holding pattern altitude was predicated on the crew's recognition of the appropriate intersections, as displayed on the navigational instruments in the cockpit, and the minimum altitudes associated with these intersections.

The weather in the vicinity of the accident site was characterized by multilayered cloud coverage with the bases between 1,000 and 1,500 feet m.s.l. These conditions would have obscured the terrain below the aircraft's flightpath, as well as the mountain peaks above the lower cloud layer, thereby preventing any visual discovery of the misleading navigational display which resulted in the premature descent below obstacle-clearance altitude. Neither the CVR nor the FDR showed any evidence of a last-second awareness on the part of the crew that a mishap was imminent.

It was established that the first officer was flying the aircraft from the right seat and that he was using his VHF navigational equipment and instrumentation to keep the aircraft aligned with the centerline of the localizer course; the fact that he had no apparent problem in remaining on or near the centerline indicates that all of his (first officer's) VOR/ILS related equipment was operating properly while tuned to the localizer.

According to the cockpit conversation, the captain used his VHF navigational equipment in conjunction with the SSR VOR to check the flight's progress along the localizer by setting the appropriate intersection radials. Therefore, the determination of the causal mechanism in this accident must include a resolution of the question: How could erroneous navigational signals, malfunctioning aircraft equipment, or misuse of the equipment involved, have given the captain a false indication of the aircraft's position along the localizer flightpath?

In the absence of reasons to favor any one area as the most promising avenue of investigation, five hypotheses were developed, encompassing possible failure modes in which this type of bearing error or navigational instrumentation presentation could be compatible with the findings of this case. These five hypotheses can be summarized as follows:

1. Malfunctioning DVOR.

2. Malfunctioning aircraft navigational equipment.

3. Signal interference (spurious signals).

4. Non-compatibility between Doppler VOR and aircraft navigational receivers.

5. Operational factors.

The following results were obtained from analytical evaluation of the factual evidence and tests and research concerning these various possibilities.

1. Malfunctioning DVOR

Flight testing of all ground navigational aid facilities in the Juneau area, including the SSR VOR, showed that all facilities were operating normally.

Routine flight inspections prior to the accident and special flight tests subsequent to the mishap revealed no malfunctions, faults, or discrepancies concerning the SSR VOR that can be related to the large bearing error which would have been necessary to produce the conditions of the accident.

The degree of error as defined by the CVR/FDR correlation is not a constant error. The amplitude or size of the error decreases slightly in value for each intersection identified by the captain. A comparison of the map positions of the intersection and the plotted intersections position called out by the captain shows the errors as follows:

The crew's identification of Howard Intersection occurs on the 306° radial of SSR. This position is actually 47° counterclockwise from the actual radial position of Howard as viewed from the SSR VOR.

Rockledge is identified on the 323° radial of SSR which is in error by 43° counterclockwise from the VOR relative to the actual location of the intersection.

Barlow is identified on the 340° radial of SSR which is in error by 35° counterclockwise from the VOR relative to the intersection. These intersections as identified by the captain are approximately 9 miles west of their actual positions.

The three positions where the crew incorrectly identified these intersections can be called error points. Considering the amplitude and angle of these error points, then, they can be plotted in polar coordinate form, i.e., plotted from the center point in the compass direction of the error and on a scale representing the magnitude of the error.

When these error points are so depicted, it is interesting to note, that a line connecting these points forms an arc which, when extended to a full circle, passes through the center point of the plot which, in turn, represents the geographic position of SSR VOR. The axis of this circle coincides with the 300° radial of the polar plot, which in this case would be the 300° radial of SSR. This resultant analytical curve (circle) is comparable in shape to the normal "duantal error" curve associated with DVOR stations.

The duantal error, or counterpoise 6/ effect course error, is present in all single sideband DVOR facilities and is caused by a variation in amplitude of the sideband signal. This variation is caused by the signal reflection which moves into and off the counterpoise surface at the programmed 300 c.p.s. The resultant course error is maximum negative at bearing positions of 360° magnetic and maximum positive at bearing positions of 180° magnetic. These errors decrease to zero at bearing positions of 90° and 270° magnetic. The resultant duantal error curve, when plotted, forms two full circles oriented on a north-south axis and extending through the VOR position.

Data were obtained from FAA test reports which detailed system error measurements between a standard Doppler VOR facility and a Collins model 51RV1 VHF navigation receiver. The maximum system error shown (including duantal error) was ± 1.2°.

Although the bearing errors noted in this case were grossly in excess of the expected duantal error and oriented on a bearing of 300° rather than 360°, the unique mathmatical relationship of the error points and the coincidental similarities in the shape of the error curves would serve to reinforce the postulation that the bearing errors originated at the DVOR facility.

It was theorized that perhaps the changing sea level conditions around the SSR facility could influence the

effective size of the counterpoise or signal reflective area and thereby produce a transitive duantal-type error of the magnitude shown in this case.

A flight test was conducted under the same tidal conditions (high tide) which existed at the time of the accident and using the same type Collins VHF navigational receiver installed in N2969G and obtained from the shelf stock of Alaska Airlines. The flightpath of AS66 was simulated and no bearing errors were detected. It appears that no measurable duantal error exists and that tidal action has no effect on signal reflectivity.

It was also noted that the bearing error experienced by AS66 reached a maximum near the 300° radial of SSR. This would have caused an error of 24° at the 90I monitor located at the facility and, accordingly, should have triggered an alarm since the tolerance of plus or minus 1° was exceeded. The monitor did not alarm at the time of the accident.

In addition to all of the flight tests that were conducted on the DVOR, the entire facility was inspected by the investigating team following the accident. No discrepancies or unusual conditions were found that could be related to a possible problem with the DVOR. Functional testing of the monitor alarm system showed it to be operating properly.

A review of the SSR facility logs revealed no failures or chronic malfunctions that would suggest any problem areas that could be related to this accident. Although a flooding of the DVOR distributor pit occurred on February 21, 1971, no reasons were found to associate this occurrence with a possible station malfunction on September 4, 1971.

Of the different flights on September 4th, which used the SSR DVOR without problems related to the ground equipment, none is probably more significant than the Canadian flight (CF-L00) which crossed SSR, southeast-bound at 1146, or 23 minutes before the accident. Since this flight was estimated to arrive at the Level Island VOR 30 minutes later, it seems reasonable to assume that at least one of the aircraft's two VOR receivers would still be tuned to SSR DVOR at 1201, or 14 minutes after passing SSR. The fact that the crew of CF-L00 observed no abnormalities while using SSR, and that no

significant course deviations were required when switching from the SSR outbound course radial to the Level Island inbound course, tends to verify a normal operation of the SSR facility at the time that the captain of AS66 was apparently observing the "false" Howard Intersection. This would imply that the Canadian flight was using SSR with no apparent problems at the time that the captain of AS66 was apparently observing the "false" Howard Intersection.

Subsequent to the accident, there were two reported cases of navigational difficulties involving the SSR DVOR, one on the day of the accident and the other 1 week later. However, investigation of these reported occurrences revealed that both were due to faulty airborne receiver equipment.

Several months after the accident, an approximate 45° navigational error at Annette Island VOR was reported. Attempts to duplicate the error, using the equipment involved, have been unsuccessful. This incident is still under investigation.

Thus, despite extensive flight tests, frequency spectrum analysis, and close observation of the SSR facility since the day of the accident, it has been impossible to substantiate the occurrence of a temporary and self-correcting malfunction of such a magnitude as to cause the bearing errors in question without triggering any alarm system on the ground or in the air. However, it is well known that transient faults have occurred in most types of electronic devices and installations, so that the possibility of a similar fault in the SSR DVOR cannot be ruled out summarily.

2. Malfunctioning Aircraft Navigational Equipment

Examination of the airborne navigational components installed in N2969G showed that both the captain's and the first officer's VHF navigation receivers were tuned to the Juneau localizer frequency (109.0 MHz) at impact. Through examination and evaluation of the recovered ADF components, it was determined that the No. 2 ADF receiver was tuned to the Mendenhall NDB (332 kHz), and that the No. 1 ADF receiver was at a frequency setting of 216 kHz which does not correspond to any of the navigational aid facilities in the Juneau area. However, allowing for a possible slight inaccuracy in the test method used (4 kHz deviation) it can reasonably

be concluded that the No. 1 ADF receiver was tuned to the Coghlan Island NDB (212 kHz).

Although it was established that the captain's VHF navigation receiver control head was selected to 109.9 MHz, examination of the No. 1 DME added some insight to this observation. The frequency control unit of this DME showed that the electromechanical channeling mechanism was in the process of channeling when impact occurred. Considering that the maximum time required for a complete channelization cycle after the control head is moved is only 10 seconds, it would indicate that the localizer frequency had been selected just moments before the crash. This finding would tend to fit in with the operational circumstances, inasmuch as the crew, believing that they had passed the last approach fix, would no longer need SSR for position checks and would then want both receivers tuned to the ILS localizer frequency.

All of the navigational radio components received extensive damage at impact; however, all of these units were recovered and examined. No gross discrepancies were noted, and all information derived from the examination appeared to coincide with the operational circumstances of the flight.

Because the determinations of intersections along the localizer course were being conducted by the captain on the No. 1 VHF navigation receiver, a detailed disassembly and examination was performed on this unit. By replacing broken or damaged parts it was possible to restore this unit to operating condition. The receiver was plugged into a 51RV-1 stock chassis for functional testing. Under these conditions the 51X-4 VOR/LOC receiver the 344A-2 manual VOR/LOC instrumentation, and the 344F-1 automatic VOR instrumentation all performed normally. It was noted that the number of components required to replace the damaged or missing items and return it to an operational condition, represented only a small percentage of the total parts content of the equipment. X-ray and visual analysis of the damaged parts, including crystal Y-21, indicated that the damage was incurred by crash impact.

Another theory concerning the receiver and its related CDI presentation was that possible corrosion in the VOR antennas (located in the vertical stabilizer

pin) could have caused the bearing errors. Examination of this antenna indicated that there was insufficient corrosion present to cause discrepancies.

One other consideration for a possible source of the bearing error was the wiring in the aircraft from the receiver to the CDI circuit. Wiring for this circuit passed from the receiver to a transfer unit and then to the CDI component. Through analytical fault studies it was shown that a short circuit in this wiring to the aircraft ground could result in a two-cycle (quadrantal) error curve that crosses the zero error line at 20°, 120°, and 300° bearings. A peak error of 45° is manifested when the load resistance is 40 ohms, and 33° when the load resistance is 100 ohms.

The total destruction of the aircraft precluded any examination of the internal wiring, and, therefore, this possibility could not be assessed. The records of the Collins Radio Company and The Boeing Company were reviewed to see if a fault of this type in similar equipment had ever occurred previously. No information was found relating to this type of fault.

In view of the fact that the aircraft had been navigated safely and correctly to the Pleasant Intersection, it can be assumed that if a short circuit of this type had occurred, it would have had to happen after the aircraft arrived at this point. Moreover, a wiring short circuit of this type would most probably result in a variable value (resistance) and, therefore, the resulting bearing errors would tend to be inconsistent and erratic in consonance with changing resistance levels. The nature of the bearing error manifested in this case, therefore, would tend to discount this type of fault as the source of the problem.

In summation, no evidence was found or analysis developed which would substantiate that malfunctioning navigation equipment aboard N2969G caused the bearing errors. However, the Board recognizes the fact that destruction of the aircraft at impact might have destroyed evidence that otherwise could have pointed to a finding in this area.

3. Signal Interference (Spurious Signals)

Monitoring of signals in the frequency range from 10 MHz to 40,880 MHz failed to detect the presence of any spurious signals in and around Sisters Island that would have affected the DVOR signal. Further, it was reported by the military authorities that no electronics activity was being carried cut in the Juneau area which could have affected the SSR signal.

Based on this information it is concluded that the possibility of interfering radio signals of unknown origin was not responsible for the bearing errors experienced by AS66.

4. Non-Compatibility between Doppler VOR and aircraft navigation receivers

Since the SSR facility was a single sideband Doppler VOR, the question arose as to the general compatibility between the standard VHF navigation receiver and the signal generated by a Doppler transmitter. Compatibility in this respect applies to the factors involved in the transmission of VOR signals and the receiver interface in processing these signals.

A comparsion between the conventional and Doppler VOR's shows that the conventional stations transmit a single carrier frequency with two sideband frequencies. The sideband frequencies should be 10 kHz above and 10 kHz below the carrier signal, thus providing a full bandwidth of 20 kHz. Testing of certain conventional VOR stations has shown that additional sidebands can be developed inadvertently by the transmitter and generally extend above and below the carriers in 10 kHz increments and can increase the bandwidth to upwards of 60 kHz. Thus, with the allotted bandwidth spacing of 50 kHz, 7/ a frequency overlap into an adjacent channel is possible and the internal processing within the receiver may produce erroneous navigation information.

The Doppler VOR transmits a carrier signal with a single sideband frequency either 10 kHz above or 10 kHz below the carrier. As in the case of the conventional VOR, it is possible for extraneous modulations to be produced in the Doppler transmitter. However, testing in this area has shown that these emissions are far less complex and not as extensive as those generated in the conventional VOR stations. Thus, frequency band overlap does not appear to be a significant problem with the Doppler VOR.

Similarly, it would appear that the emission of extraneous signals from the VOR station might cause problems within a particular receiver, depending on the sensitivity and/or filtering process of that receiver and the definition of the modulation being produced by the transmitter.

It should be noted that while the official testing and spectrum analysis performed on the SSR signal did not reveal the presence of any extraneous modulation, data made available to the Board subsequent to these tests indicated that an additional harmonic may well exist. In this light, ongoing testing of the SSR signal as well as research into the effects of extraneous modulations in the UHF navigation receiver is continuing as of the date of this report. Although it is anticipated that the useful information will be gained so as to further improve the accuracy and reliability of these components, it is doubtful that any forthcoming data can resolve, with any degree of certainty, the cause of this accident.

Extensive testing and spectrum analysis of the SSR signal did not reveal the presence of any extraneous sidebands or complex modulations emanating from that station. Flight testing of the facility using an identical model Collins 51RV1 VHF navigation receiver under conditions similar to those which existed on the day of the accident revealed no problems of this nature.

An additional flight test was conducted in which a Bendix VHF navigation receiver was deliberately off-tuned by 50 kHz using SSR VOR. Under these conditions, both glide slope and localizer warning flags were visible and the CDI pointers were centered and became stationary.

Thus, if there is any compatibility problem between the Doppler VOR and the Collins 51RV1 receiver, it has not manifested itself in the tests and research conducted to this date. While it is possible that a transient or intermittent condition relating to these possibilities could have occurred, that fact cannot be substantiated on the basis of the evidence available to the Board.

5. Operational Factors

It has already been established that the crew was competent and qualified for operation of AS66. With the exception of some overtones of irritation about the manner in which another aircraft, N799Y, affected the flight's progress into the Juneau area, the recorded cockpit conversation, in general, reflects a relaxed but businesslike atmosphere. The only apparent deviation in the crew's routine performance is the absence of any indication on the CVR that aural identification procedures were used when tuning-in the different navigational facilities. Audio identification of a navigational facility is accomplished by increasing the volume gain at the receiver or at the junction box volume control until the NAVAID code signal can be identified by the crewmember performing this function. All of the radio signals are routed through the radio junction boxes in the cockpit from which all radio signals can be selected by the crewmember and thus picked-up on the CVR. Any incoming radio signal which comes through the junction box at sufficient volume to be audible to the pilot will similarly be recorded on the CVR. It is actually this absence of positive identification of signals which makes it impossible to state categorically that navigational tuning errors did not occur. This uncertainty, in conjunction with the fact that the captain's CDI was the primary instrument to determine the flight's progress along the localizer, necessitates a thorough analysis of procedures involving the tuning of the captain's VOR receiver.

At about 1149, while the aircraft was approaching the Berg Intersection, the captain instructed the first officer to go to the 093° radial of the Sisters VOR. The captain kept his VOR receiver tuned to Yakutat to check passage of Berg, using the DME distance (120 NM) from Yakutat. Shortly thereafter, the flight reported leaving 23,000 feet and was cleared to the Pleasant Intersection at 10,000 feet with the remark: "Present time no delay expected." The reception of the Yakutat VOR usually becomes marginal southeast of the Berg Intersection at altitudes below 20,000 feet. Since the first officer was tuned to the Sisters VOR, it is possible that the captain tuned in the Juneau localizer after passing Berg, in readiness for a holding pattern at Pleasant. His remark, "I'm set up," at 1154:40, might have been intended to convey this readiness. The distance from Berg to Pleasant is 18 NM.

Shortly thereafter, the captain became involved, for about 2 minutes, in his first relay of communications between Anchorage ARTCC and N799Y. Just before this three-way communication ended, the first officer asked the captain: "You put yours back on Sisters, please Dick . . . zero nine three." The captain did not make an audible response. The foregoing suggests that the first officer, while the captain was occupied with N799Y's activities, tuned in the Juneau localizer on his own receiver.

Fifty seconds after his first request to the captain to change frequency, the first officer repeated it partially: "Crank zero nine three in on yours." (1158:03) This time the captain answered "Yeah." There is no indication, direct or indirect, on the cockpit voice recorder that the captain did tune in the Sister VOR prior to or after setting the 093° radial. This uncertainty raises two important questions in the overall analytical process: (1) What was the likelihood of an oversight in the cockpit? and (2) To what extent could an oversight, in the form of a failure to change frequency, explain the apparent sequence of events?

With regard to the first question, there are indications that the activities surrounding N799Y imposed at least an additional workload on the crew of AS66 and could have affected their coordination.

The confusion following N799Y's departure at 1144 from the Juneau airport was the result of the issuance and acceptance of an improper clearance, compounded by communication difficulties. The air traffic control system is designed to cope with such contingencies; after-the-fact evidence in this case suggests that N799Y was processed out of the Juneau area with considerable difficulty, but without violating the airspace assigned to other air traffic. Nevertheless, N799Y's activities had an immediate effect on AS66 by delaying its approach into Juneau. This in itself did not present an unusual problem to the crew, although it would have been annoying for a flight concerned with on-schedule arrival. It is more important to consider what distractive impact the uncertainty about N799Y's whereabouts might have had on the AS66 crew.

The crew became aware of N799Y's problems at about 1153 (shortly after passing the Berg Intersection) when they heard the Anchorage Center controller tell N799Y:

"That was not your clearance." The captain reacted by remarking: "There's trouble." Immediately thereafter the flight was told to maintain 12,000 feet to the Pleasant Intersection, instead of 10,000 feet.

At 1154:33, the captain showed that his concern about N799Y involved more than a possible delay when he remarked: "(Wonder) what the # altitude he's at." This concern was strengthened by the Center controller's subsequent message to AS66: "I've got an airplane that's not following his clearance. I've got to find out where he is." This statement introduced the earlier-mentioned, 2-minute conversation between N799Y and the controller, in which AS66 participated. It was also at this time that the controller's uncertainty about N799Y's position, route of flight, and intentions, became evident. The knowledge that N799Y was climbing somewhere in their approach corridor near Coghlan Island and that communciations with Center were marginal, might have been sufficient reason for the captain to assume that the safety of his flight demanded that he monitor the development of the N799Y situation.

Just before N799Y made its last response in this three-way conversation, the first officer asked the captain to tune in the Sisters VOR and to set the 093° radial. In light of the foregoing, it seems not surprising that the recorder does not show an audible response to this request, contrary to the promptness of the captain's response and teamwork displayed at other times. It should also be noted that the second officer had a conversation with a cabin attendant during this same time period, thereby possibly detracting from his monitoring capability.

The strongest indication of the captain's involvement with N799Y occurred at 1157:50, when he stated emphatically, and without reference to previous cockpit conversation: "##, he'd be over Coghlan Island? ##." The captain's associates indicated that it was not characteristic of him to use strong language. A few seconds later he added, as if to himself: "Blue seventy-nine, Blue seventy-nine ain't right." The captain was probably studying the Juneau area chart at this time and realized that part of N799Y's original problem was the confusion created by the use of an airway designation that no longer existed; this realization could only add to his concern. Shortly thereafter he acknowledged the

first officer's second request to "crank in" zero nine three.

It is apparent that the 50-second period, marked by the first officer's two requests to monitor the Sisters VOR 093° radial, was critical with regard to crew coordination and the proper tuning of the captain's VOR receiver. The captain's strongest expression of displeasure with N799Y also falls within the same time-span. His tone of voice, as well as the language used, suggests that his awareness level might have narrowed down to the extent that a momentary error potential existed. This could have led to an oversight on his part in the form of setting the 093° Sisters radial without changing the frequency of his receiver from the localizer to the Sisters VOR. Although it would appear quite unlikely that this type of oversight could occur, even under the most adverse circumstances, this would be the point of the original error if, in fact, the SSR frequency was not selected on the captain's receiver.

Before discussing how such an oversight on the part of the captain, or the assumption of one, could have had a bearing on the apparent accident sequence, it may be well to mention that the cockpit conversation of all three crewmembers reflects some degree of irritation about the N799Y situation. The last pertinent comment is made by the first officer, less than 2 minutes before impact.

To simplify the analysis of the operational error hypothesis which could be called "the dual localizer theory," the factors that would have confirmed or contradicted the captain's belief that he was tuned to the Sisters VOR will be listed in chronological order, starting in the vicinity of Pleasant.

(a) Following the setting of the captain's CDI to the 093° radial, the position and direction of flight of the aircraft were such that his CDI lateral deviation bar would have been moving from the right to the left side of the course cursor as the aircraft traversed the localizer beam. This movement of the deviation bar would have been identical to its movement had the aircraft been crossing the 093° radial near the Pleasant Intersection, while tuned to SSR.

(b) Coincidental with the events in (a), the captain's CDI should also have shown two inconsistencies, had he been tuned to the localizer: the absence of the TO/FROM flag and the presence of the glide slope flag. With regard to the TO/FROM flag it can be asserted that it served no direct navigational purpose in this type of approach procedure. The alerting function of the glide slope flag becomes debatable when crewmembers are conditioned to see the glide slope flag when tuned to a VOR in conjunction with one type of receiver, but not with another.

(c) If the No. 1 RMI needle selector switches of both pilots were set to the VOR function throughout the approach, the No. 1 needles would have been in the "parked" position, if the captain was tuned to the localizer. If the crew observed these needles they would have noted a distinct inconsistency, except for those times when the Sisters VOR was physically located off the aircraft's right wing.

(d) When the captain set the 353° radial (Howard) in his course indicator, at 1159:03, the aircraft was south of the localizer and the captain's deviation bar should have pegged to the left of the course cursor, if tuned to the localizer. When the aircraft entered the localizer beam there would have been a relatively slow but steady movement of the deviation bar from the left of the cursor to the center. If tuned to the VOR, the deviation bar should have pegged to the right of the cursor when the captain set the 353° radial and it's subsequent motion would have been from the right toward the center.

(e) Between 1204:45 and 1205:35, when the aircraft crossed the localizer beam during its inbound turn, a complete reversal of the captain's deviation bar should have occurred, had he been tuned to the localizer. However, if tuned to SSR, the deviation bar should have remained pegged.

(f) At 1205:55 the captain stated: "Coming back in," at the point where the aircraft began to intersect the northern boundary of the localizer. If he were tuned to the localizer, his deviation bar would have started moving from the right of the cursor toward the center, just as he would expect to

see within about 10° from the Howard radial. Actually, the point where he made his observation was about 16° west of the originally called-out "false" Howard.

(g) Flight tests indicated that at the location where the aircraft descended through 5,000 feet, the line of sight to Sisters Island is interrupted by mountainous terrain and that below 5,000 feet the VOR/localizer warning flag begins to come into view on the CDI. There are no indications on the CVR during the last 32 seconds of the flight, when the aircraft descended from 4,500 to about 2,500 feet, that the crew observed this warning flag.

(h) The only distinct intersection callout was made by the captain at 1201:03, when he told the first officer "'Kay, you're Howard." The second passage of Howard, following completion of the procedure turn, was not discussed by the crew. The subsequent passage of Rockledge and Barlow cannot be defined clearly in the crew's conversation. The first officer's questions in that regard suggest a certain vagueness in the related instrument displays. It should also be noted that the aircraft was north of the centerline of the localizer at this time and that its flightpath converged toward the centerline at an angle of about 4.5°. Considering aircraft speed and width of localizer at this point, the convergence after passing Rockledge resolves into a CDI deviation bar displacement rate of one-half-dot width in 57 seconds (from right to left). Although this movement of the bar would have been in the same direction as if the aircraft were approaching the Barlow Intersection, the convergence rate of the bar would have been considerably slower than what would have been expected normally if the receiver were tuned to SSR VOR.

It should also be noted, that if tuned to the localizer frequency there would have been no movement of deviation bar in proportion to the manipulation of the course control knob at the times when the various intersection radials were selected. Conversely, if tuned to the SSR VOR, normal movement of the course control knob should have caused a rapid displacement of the deviation bar in the direction of the selected radials.

(i) Although the captain's VHF navigation receiver was tuned to the localizer at the time of the crash, it was evidenced that the frequency selector had been manipulated just a few seconds before impact. Although this fact itself does not disprove the dual localizer theory, it strongly suggests that the captain had made a change from another frequency to the localizer frequency shortly after passing Barlow, inbound. This would be in accordance with the standard operating procedures wherein the captain, if properly tuned to the SSR VOR to determine the approach fixes, would then change his receiver to the localizer frequency after passing Barlow Intersection in order to monitor final approach course guidance. Although unlikely, but in support of the theory, it is possible that after passing Barlow, the captain might have begun selection of the localizer frequency in a perfunctory manner while preoccupied with communicating with the Juneau Tower and without looking at the frequency selector control head. Once the selector had been moved from its original setting, it is debatable whether or not there would have been sufficient time for the captain to detect the fact that the localizer frequency had been set on his receiver throughout the approach or to realize the full implication of this error.

The foregoing discussion of some of the factors that could have confirmed or contradicted the captain's belief that he was tuned to the VOR, while inadvertently tuned to the localizer, should make it apparent that most of the inconsistencies in the captain's CDI display would have been transient in nature; they could have been observed only at certain times, which would make their observation dependent on the activities in the cockpit. It should also be noted that the captain made the Howard callout when the aircraft and his CDI display (azimuth card) - had been constantly turning for about 4 minutes. To what extent such a dynamic display can create a tendency to concentrate on the centering of the deviation bar, rather than its direction of motion, is difficult to say.

Although it is a well-known fact that the intensity of the stimulus required to alert a crew to discrepancies in a cockpit display increases as a flight's apparently normal progress reinforces the crew's trust in their instruments, it can hardly be expected that all three crewmembers would overlook obvious inconsistencies in favor of what they

expected to see on their instruments. Such inccnsistencies, in this case, would include basic incongruities in the normally expected CDI presentation as well as a complete derogation of the visual mechanical function cf selecting the proper frequency on the VHF navigation receiver. In view of the proficiency standards required cf qualified airline pilots it is difficult to believe that all of these hypothetical circumstances could go by unrecognized. For these reasons, as well as the overall ambiguity of all related evidence, the Board concludes that there is insufficient evidence upon which tc base a finding that the dual localizer theory is a ccntributing factor.

Another operational factor deals with the delay in the issuance of the revised Juneau approach chart to Alaska Airlines pilots. This prompts a speculation on the possible effect the 2,900-foot increase in minimum altitude at Barlow might have had on the outcome of the flight's premature descent. The aircraft crossed what the captain believed was the Barlow Intersection at about 3,700 feet, which is very close to the 3,900 feet required by the new approach plate. The rate of descent of the aircraft at this time was about 4,000 feet per minute, changing to about 3,000 feet per minute in the next, and final, 20 seconds. Impact occurred at the 2,475-foot level. There seems to be nc reason to assume that the new approach plate would have made a marked change in the flight's descent profile near Barlow, since the minimum altitude after passing Barlow is 1,000 feet on the old as well as the new plate.

This accident caused considerable discussion about the lack of navigational facilities in the Juneau area. The Board is of the cpinion that operaticnal procedures should be scrutinized before condemning the approach facilities as they existed on September 4, 1971. The crew had available two additional aids which could have been used to doublecheck progress along the localizer course: the Sisters Island NDB and the Point Retreat NDB. Neither was used, apparently because it was not part of the prescribed procedure. Since the Juneau approach has long been considered cne of the most hazardous with regard to terrain and the missed-approach point, the FAA should have required the use of additional position checks along the localizer course rather than leaving it tc the discretion of individual carriers and pilots.

In the course of this investigation it also came to the Board's attention, as it has in previous investigations, that the reporting of incidents involving irregularities

noted in the use of navigational facilities leaves much to be desired. Although there is no proven connection between operational irregularities of the Sisters Island VOR and the subject accident, the Board wants to stress the fact that the proper and thorough reporting of observed irregularities by daily users of navigational facilities is the best way to assure their continued reliability.

In reviewing the different hypotheses, the Board concludes that the presently available evidence does not support the selection of any of them as the most probable explanation for the sequence of events leading to the accident. Despite this uncertainty about the causal mechanism, the Board reiterates the hindsight lesson learned in so many accident investigations: that seemingly minor compromises may negate the effectiveness of the only safeguards which can interrupt an otherwise catastrophic sequence of events.

2.2 Conclusions

(a) Findings

1. The aircraft was certificated, maintained, and loaded properly and there was no failure or malfunction of the aircraft, powerplants, or control systems.

2. The crew was certificated and qualified for the operation.

3. Air traffic control handling of AS66 was appropriate and in accordance with prescribed procedures and standards.

4. The issuance of an incorrect clearance to N799Y caused this aircraft to stray into airspace where its presence caused an additional traffic control workload from a separation as well as communications standpoint.

5. Involvement in the N799Y activities and awareness of the uncertainty about that aircraft's whereabouts and intentions might have created a distraction for crew of AS66.

6. The crew did not use audio identifications procedures when tuning in the pertinent navigational facilities.

7. It could not be established that effective crew coordination took place when the first officer changed his VHF navigational frequency from the VOR to the localizer and requested the captain to tune in the VOR.

8. The crew was subjected to seemingly correct but erroneous navigational information which led to a premature descent into obstructing terrain.

9. There was no altimetry system malfunction.

10. The display of the intersections that delineate the Juneau localizer approach were displaced about 35°-40° counterclockwise, based on the recorded callouts by the crew.

11. The captain's VOR receiver was tuned to the Juneau localizer at impact, and the associated frequency selector had been manipulated just prior to impact.

12. There was no evidence indicating that the crew used all available navigational facilities to check the flight's progress along the localizer.

13. Flight tests and other research failed to disclose a Sisters Island VOR malfunction which would have accounted for a large bearing error on the day of the accident.

14. Examinations and tests of the recovered aircraft's avionics equipment revealed no evidence of other than normal operation.

15. Research into the compatibility of Doppler VOR transmitters and the existing aircraft navigational receivers revealed no information that would indicate any discrepancy in this area.

(b) Probable Cause

The National Transportation Safety Board determines that the probable cause of this accident was a display of misleading navigational information concerning the flight's progress along the localizer course which resulted in a premature descent below obstacle clearance altitude. The origin or nature of the misleading navigational information could not be determined. The Board further concludes that the crew did not use all available navigational aids to check the flight's progress along the localizer nor were these aids required to be used. The crew also did not perform the required audio identification of the pertinent navigational facilities.

3. RECOMMENDATIONS

Shortly after this accident, the FAA installed Distance Measuring Equipment (DME) at the Juneau Airport. Following the commissioning of this equipment, the Board recommended that the FAA:

> "Amend the public instrument approach procedure for the LDA approach to Juneau,Alaska,Airport to reflect the addition of DME as a means of determining the location of fixes on the final approach course of the localizer."

This action has been approved by the Administrator and the appropriate charts now incorporate data concerning the DME distances associated with the localizer.

During this investigation the Board became aware of the possible existence of undesirable harmonics on the Sisters Island Doppler VOR signal and the signals of other similar DVOR installations. It is possible that this type of hormonic may have an adverse effect on VEF navigation receivers presently in use and in a manner not visualized in the original design. While the Board realizes that the tests conducted to date concerning extraneous harmonics are, by far, not conclusive, it is believed that the entire spectrum of receiver compatibility with the Doppler VOR signal warrants more study and research.

The Board, therefore, recommends that:

> The FAA continue the tests now in process concerning extraneous harmonics on the Doppler signal and initiate research into their possible hazardous effects on navigation receives and associated instrument displays. (A-72-205)

FOOTNOTES

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

2/ All communications from AS66 to Air Traffic Control were made by a voice identified as that of the captain.

3/ Localizer-type directional aid.

4/ Visual Omni Range.

5/ The RMI pointer will automatically "park" (or position) at an angle 90° clockwise relative to the nose of the aircraft when the pointer function switch is placed in the "VOR" position and when an ILS frequency has been selected on the VHF navigation receiver.

6/ The DVOR counterpoise is a round, flat reflective surface around which the 500 antennas are mounted. The counterpoise area is used to develop the signal radiation pattern.

7/ At the present time, VOR station frequencies are set at 100 kHz intervals. The older VHF navigation receivers were designed and built to select these stations at these intervals. However, as a result of advancements in electronic navigational technology, the FAA is planning to increase the number of VOR navigation stations through more efficient use of the frequency spectrum. This plan proposes to space VOR frequencies 50 kHz apart. In view of the forthcoming system modifications, receivers, such as those installed in N2969G, have been designed and built to tune at 50 kHz intervals. Thus, under existing system conditions it would be possible to "mistune" some receivers to the next adjacent channel which has no station frequency assignment, yet be within 50 kHz of an operating station.

BY THE NATIONAL TRANSPORTATION SAFETY BOARD:

/s/ JOHN H. REED
Chairman

/s/ FRANCIS H. McADAMS
Member

/s/ ISABEL A. BURGESS
Member

/s/ WILLIAM R. HALEY
Member

Louis M. Thayer, Member, was absent, not voting.

October 11, 1972.

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APPENDIX A

INVESTIGATION AND HEARING

1. Investigation

The Board received notification of the accident at approximately 1330 on September 4, 1971, from the Federal Aviation Administration. An investigating team was immediately dispatched to the scene of the accident. Working groups were established for Operations, Air Traffic Control, Weather, Human Factors, Structures, Powerplant, Systems, Maintenance Records, and Cockpit Voice Recorder. Parties to the investigation included Alaska Airlines, Inc., the Federal Aviation Administration, The Boeing Company, and the Airline Pilots Association.

2. Hearing

A public hearing was held at Juneau, Alaska, on October 20-21, 1971. Depositions were taken at Seattle, Washington, on January 27, 1972, and at Washington, D. C., on June 1, 1972.

3. Preliminary Reports

A preliminary aircraft accident report summarizing the facts disclosed by the investigation was released by the Safety Board on October 12, 1971.

APPENDIX B

CREW INFORMATION

Captain Richard C. Adams, aged 41, was employed by Alaska Airlines on June 4, 1955. He held Airlines Transport Pilot Certificate No. 1281390, with type ratings in the Boeing 727, Douglas DC-4/6/7, Convair 240/340/40, Lockheed-C-130, and C-46 aircraft. His last first-class medical certificate was dated March 17, 1971, and was issued with no waivers.

Captain Adams had a tctal of 13,870 flying hours of which 2,688 hours were in B-727 aircraft. He had flown 179 hours in the previous 90 days and 60 hours in the last 30 days. His last proficiency check was conducted on May 28, 1971. He completed recurrent ground training in May 1971.

First Officer Lecnard D. Beach, aged 32, was employed by Alaska Airlines on February 28, 1966. He held Airline Transport Pilot Certificate No. 1552371 with a type rating in the Lockheed C-130 aircraft. His last first-class medical certificate was dated March 17, 1971, and was issued with no waivers.

First Officer Beach had a total of 5,000 flying hours of which 2,100 hours were in B-727 aircraft. He had 140 hours in the previous 90 days and 51 hours in the last 30 days. His last proficiency check was conducted cn October 30, 1970, and he completed recurrent ground training in May 21, 1971.

Second Officer James J. Carson, aged 30, was employed by Alaska Airlines on June 6, 1966. He held Commercial Pilot Certificate No. 1569825, with AMEL and instrument ratings, and Flight Engineers Certificate No. 1569825 with a turbojet rating. His last first-class medical certificate was dated July 29, 1971, and was issued with no waivers.

Second Officer Carson had a total of 2,850 flying hours of which 2,600 hours were in B-727 aircraft. He had flown 173 hours during the previous 90 days and 51 hours in the last 30 days. His last proficiency check was conducted on March 27, 1971, and he completed recurrent grcund training on May 8, 1971.

All three flight crewmembers had a total of 18 hours and 42 minutes crew rest time prior to reporting for duty for this flight. They had been on duty for 4 hours and 9 minutes at the time of the accident, of which 1 hour and 59 minutes was flight time.

APPENDIX C

AIRCRAFT INFORMATION

Aircraft N2969G, a Boeing 727-193, Serial No. 19304, was manufactured July 1, 1966. The aircraft was leased to a number of airlines between that date and April 8, 1970, at which time a certificate of registration was issued in the name of Hughes Air Corporation, San Francisco International Airport, San Francisco, California. The aircraft was subleased by Hughes Air Corp., d.b.a Air West, to Alaska Airlines, Inc., on September 25, 1970, with an accumulated total time of 8,848 hours. The total accumulated time at the time of the accident was 11,344 hours.

A review of all aircraft and component maintenance records showed that all inspection and overhauls had been performed within the prescribed time limits and that the aircraft had been maintained in accordance with all company procedures and Federal Aviation Administration directives. There were no aircraft discrepancies reported prior to the flight's departure from Anchorage, Alaska.

A comprehensive review was made of the maintenance records of the Collins FD-108 Flight Director System components installed in this aircraft. The history of each component was documented from the point where it was last removed for a time unit change and zero timed, or where the unit was removed for a discrepancy writeup. There were no instances of uncorrected discrepancies or chronic malfunctions noted.

The last removals and subsequent installation for the captain's (Position No. 1) and first officer's (Position No. 2) CDI's and VHF navigation receivers were as fcllows:

COMPONENT	POSITION NO.	SERIAL NO.
Course Deviation Indicator	1	318

1. Removed from the No. 2 position on aircraft N798AS on June 24, 1971, for complaint -"No.2 CDI to/from indicator intermittent on all stations course bar OK and neg VOR/LOC flag."

2. The component was overhauled by the Ccllins Radio Company on July 13, 1971, and zero timed.

3. The component was installed in the No. 1 position on aircraft N2969G on August 27, 1971.

There were no further discrepancies noted for this unit. The time since overhaul (TSO) at the time of the accident was 45 hours. The scheduled time between overhauls (TSO) was 1,800 hours.

COMPONENT	POSITION NO.	SERIAL NO
VHF Navigation Receiver	1	7838

1. Removed from the No. 2 position on aircraft N2969G on June 30, 1971, for complaint - "VOR inop on 116.70 freq.-." OK other freq." TSO was 1,638 hours

2. The receiver was repaired by Collins Radio Company on July 16, 1971.

3. The receiver was installed in the No. 1 position on aircraft N2969G on August 27, 1971.

There were nc further discrepancies noted for this unit. TSO at the time of the accident was 1,688 hours. TBO for the componet was 2,400 hours.

COMPONENT	POSITION NO.	SERIAL NO.
Course Deviation Indicator	2	754

1. The unit was overhauled by Del Tech Instruments on January 6, 1971, and zero timed.

2. The unit was installed in aircraft N2969G in the No. 2 position on January 10, 1971.

There were no discrepancies noted for this component. TSO at the time of the accident was 1,649 hours. TBO for the componet was 1,800 hours.

COMPONENT	POSITION NO.	SERIAL NO.
VHF Navigation Receiver	2	1970

1. The unit was removed from aircraft N979AS on December 26, 1970, for complaint - "Flight Director give unreliable info in VOR/LOC and G. S. Auto-."

2. The component was repaired by Collins Radio Company on December 30, 1970.

3. The component was installed in aircraft N2969G in the No. 2 position cn January 6, 1971. TSO was 647 hours.

There was no further discrepancies noted for this unit. TSO at the time of the accident was 2,330 hours. TBO for the component was 2,400 hours.

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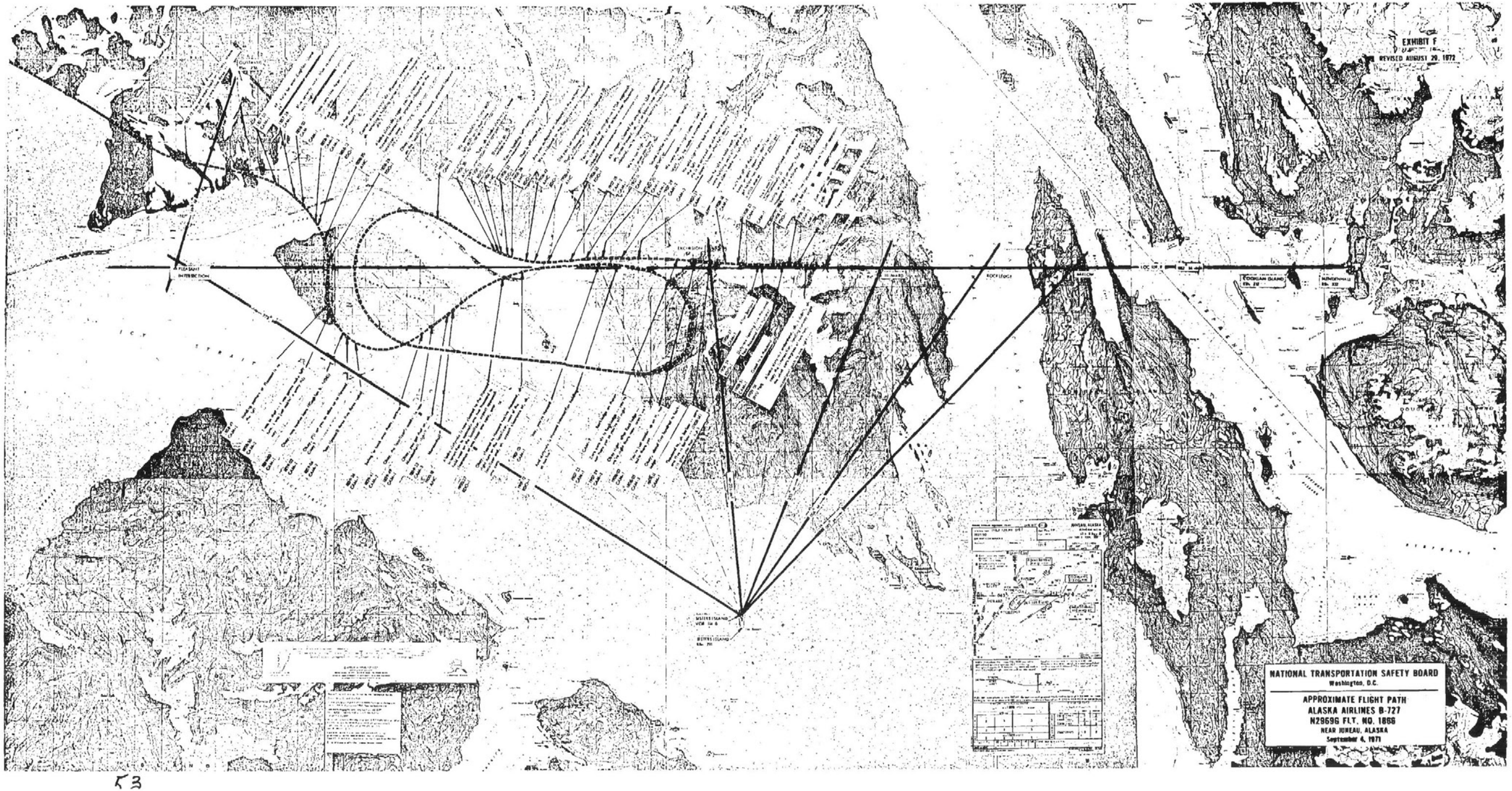
EXHIBIT F
REVISED AUGUST 20, 1972
NATIONAL TRANSPORTATION SAFETY BOARD
Washington, D.C.
APPROXIMATE FLIGHT PATH
ALASKA AIRLINES B-727
N2969G FLT. NO. 1866
NEAR JUNEAU, ALASKA
September 4, 1971

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LEGEND

CAM	Cockpit area microphone sound or voice source	WA602	Western Airlines Flight 602
RDO	Radio transmission from N2969G	AS403	Alaska Airlines Flight 403
-1	Voice identified as captain	AS JNU	Alaska Airlines Agent, Juneau
-2	Voice identified as first officer	AS 92	Alaska Airlines Flight 1892
-3	Voice identified as second officer	CAM8603	Canadian Military Aircraft, Registry 8603
-4	Voice of a stewardess	JNU TWR	Juneau Control Tower
-?	Voice unidentified	*	Unintelligible word
N799Y	Piper Apache N799Y	#	Nonpertinent word
WA720	Western Airlines Flight 720	( )	Questionable text
ANC	Anchorage ATC Center, Sector D8	(( ))	Editorial insertion
CF-LOO	Canadian Civil Gulfstream G-159, Registry CF-LOO		

NOTE: Times are Greenwich Mean Time

SOURCE	CONTENT	TIME & SOURCE	CONTENT
		1846:15	
		RDO	Anchorage Center, Alaska sixty-six two three zero
		ANC	Alaska sixty-six, Anchorage Center, how do you hear me?
		RDO-1	Roger loud and clear now we're level at two three zero sixty five DME east of Yakutat
		ANC D8	Sixty-six, roger, you're cleared to descend and maintain, ah, one zero thousand at your discretion, descend so as to cross Pleasant at ten thousand, and you are cleared to the Howard Intersection at ten thousand, over
CAM-1	What intersection?		
CAM-2	Cleared to Howard		
		RDO-1	Roger, cleared to Howard Intersection, descend to and maintain ten thousand pilots discretion, and cross Pleasant Intersection at ten thousand

SOURCE	CONTENT
CAM-1	((Whistling))

TIME & SOURCE	CONTENT
ANC	That is correct, the Juneau altimeter is two niner four six, report leaving eleven thousand over
RDO-1	Okay two nine four six, report out of one one thousand
1847:25 CF-LOO	Anchorage, L oh oh
ANC	Oh oh, Anchorage, go ahead
LOO	Roger, Sisters at forty six, Level ah sixteen, we're flight level one nine zero requesting flight level two one zero
ANC	Roger, and ah what's your Level Island estimate over?
CF-LOO	One six
ANC	L oh oh stand by
ANC	Apache seven niner niner Yankee, Anchorage Center go ahead
ANC	Niner niner Yankee, roger, and you're on a Coghlan Island one departure is that correct?
ANC D8	Roger, ah, report ah Coghlan Island northbound, over
ANC	Niner niner Yankee report leaving, ah, eight thousand, over
ANC	Roger
ANC	Niner niner Yankee, Anchorage Center

SOURCE	CONTENT
CAM-?	What
CAM-1	Put yours on, ah, Sisters
CAM-2	'kay
CAM-1	Ninety-three, and, ah, ---

TIME & SOURCE	CONTENT
ANC	Roger, on your Coghlan Island one departure cross Coghlan outbound, ah, at your discretion, however on your swing around on the localizer to go northbound from over Coghlan cross Coghlan northbound at or below ten thousand, over
ANC	Ten thousand, one zero thousand, over
ANC	Western seven twenty, Anchorage Center -- Western seven twenty, Center
AS403	Zero three, we're level ah one zero thousand ah, request clr, ah, cruise clearance
ANC	Aircraft requesting cruise say again
AS403	That's Alaska four oh three level one zero thousand
ANC	Four zero three roger stand by
AS403	Four oh three
1850:10 WA720	Anchorage Center, Western seven twenty
ANC	Western seven twenty how do you hear me, over?
WA720	Loud and clear, we're level two niner zero
ANC	Twenty, roger have you passed Level Island yet?

SOURCE	CONTENT
CAM-2	I'd better start 'er on down
CAM-1	Berg's what? Ninety-eight miles?
CAM-2	Berg's a hundred and twenty miles
CAM-2	I (usually) start down (at Berg to cross) Pleasant about (sixteen) or so -- fourteen
CAM-1	'kay

TIME & SOURCE	CONTENT
WA720	Oh, we'll be there in about ah two minutes
ANC	Seven twenty roger
1850:55	
ANC	Canadian L oh oh, Anchorage Center
CF-LOO	Anchorage, L oh oh
ANC	Oh oh, you're cleared to climb and maintain flight level two one zero report level
CF-LOO	Oh oh is cleared to climb and maintain flight level two one zero, we'll report level
ANC	Roger
1851:10	
RDO-1	Anchorage Center, Alaska sixty-six is leaving two three zero
ANC	Six--Alaska sixty-six roger

SOURCE	CONTENT
CAM-3	* * ((checklist it ms))
CAM-1	Two nine four six
CAM-2	Set
CAM-?	* * for forty
CAM-1	The M E A though to Berg is nineteen thousand, though, isn't it?
CAM-2	Beg pardon?
CAM-1	The M E A to Berg?
CAM-2	You're not to Berg yet
CAM-?	*
CAM-1	I'll get it

TIME & SOURCE	CONTENT
1851:20	
CAM8603	Anchorage, Military Canadian Military eight six zero three requesting Sisters altimeter
ANC	Six zero three, roger, the Juneau altimeter is two niner four six, over
CAM8603	Four six roger
1851:45	
ANC	Alaska sixty-six, Anchorage Center
RDO-1	'laska sixty-six go ahead
ANC	Roger, now cleared to the Pleasant Intersection present time no dely expected
RDO-1	Roger now cleared to Pleasant at ten thousand, thank you
ANC	Roger
1852:35	
ANC	'ska four zero three, correction Alaska four zero three, Center
AS403	Ah go ahead

SOURCE	CONTENT
CAM-1	'kay you're past Berg now
CAM-2	Past Berg anyway
CAM-1	There's trouble

TIME & SOURCE	CONTENT
ANC	'ska four zero three you're cleared for an approach to the Sitka airport to cross the one five mile DME fix inbound at or below eight thousand report ah leaving eight thousand go ahead
AS403	Ah, roger, four oh three is cleared for an approach to the Sitka airport, ah, and is cleared to cross the fifteen mile DME fix ah inbound at or below eight thousand and, ah, report ah leaving eight
ANC	'ska four zero three, roger, the altimeter two niner four zero and there is nine thousand over traffic
1853:25 ANC	Aztec nine nine Yankee say your position ah correction Aztec nine nine Yankee say your position on your departure now
ANC	Roger which VOR are you going to over?
ANC	What is your altitude now?
ANC	Roger maintain niner thousand, that was not your clearance over
ANC	Nine Yankee maintain one zero thousand ten thousand over
1854:20 ANC	Alaska sixty-six maintain one two thousand over
RDO-1	Roger sixty-six ah maintain twelve

SOURCE	CONTENT	TIME & SOURCE	CONTENT
		ANC	Roger -- Aztec nine nine Yankee how do you here me now?
		ANC	Change to one one eight point five
CAM-1	Sounds like he's got some problems down there		

INTRA - COCKPIT		AIR - GROUND	
SOURCE & TIME	CONTENT	SOURCE & TIME	CONTENT
1854:40 CAM-1	I'm set up		
CAM-2	Okay	1854:45 N799Y	One one eight point five, Apache seven niner niner Yankee
1854:53 CAM-3	That's gonna shake him		
CAM-1	(Wonder) what the # altitude he's at?	1854:55 WA720	Anchorage, ah, Western seven twenty is by Level Island at five five
		1854:59 ANC	Western seven -- Western seven twenty, roger, and you're cleared to descend and maintain one two thousand, over
CAM-?	*	1855:12 WA720	Seven twenty cleared to one two thousand
		1855:15 RDO-1	Sixty-six level at twelve
		1855:18 ANC	'ska sixty-six roger, I've got, ah, an airplane that's not following his clearance (*) Alaska sixty-six, roger, I've got an airplane that's not following his clearance, I've got to find out where he is. Nine nine Yankee, Anchorage Center

INTRA - COCKPIT

SOURCE & TIME	CONTENT

AIR - GROUND

SOURCE & TIME	CONTENT
1855:30 N799Y	Center, Apache seven niner niner Yankee
1855:31 ANC	Roger, maintain one zero thousand and are you en route to Sisters Island VOR, over?
1855:37 N799Y	That's affirm but I have not climbed to one zero thousand as yet. I am climbing
1855:46 ANC	Alaska sixty-six did you read him okay?
1855:49 RDO-1	Roger, he's, ah, not to one zero thousand yet, he's climbing, he's en route to ten thousand
1855:55 ANC	Roger -- nine nine Yankee maintain one zero thousand and, ah, your clearance was for a Coghlan Island One departure and Blue seventy-nine, not to go to Sisters Island, over

INTRA - COCKPIT

SOURCE & TIME	CONTENT
CAM-1	What's he on?
CAM-3	He said he was (on), ah, Blue seventy-nine
CAM-3	He was, he was giving his position related to
CAM-3	He was just * * *
CAM-3	* * * *
CAM-4	* * * *

AIR - GROUND

SOURCE & TIME	CONTENT
1856:07 N799Y	I am on Victor seventy-nine but I was identifying myself as regards my position to Sisters Island and I'm now at seven thousand five hundred climbing and in the clear
1856:22 ANC	Sixty-six I can't copy him. Did you copy him?
1856:28 RDO-1	Roger, he says he's on Blue seventy-nine in the clear at seven thousand five hundred -- he was giving you his position in relation to Coghlan Island, he said
1856:50 ANC	I understood him to say he was in the vicinity of Sisters Island, over
1856:55 RDO-1	No, he said he's climbing on Blue seventy-nine through seven thousand five hundred, climbing to ten in the clear
1857:03 ANC	Okay, ah, thank you, ah -- Aztec nine nine Yankee report Coghlan Island northbound on, ah, old Blue seventy-nine now Amber fifteen,

INTRA - COCKPIT

SOURCE & TIME	CONTENT
1857:13	
CAM	You put yours back on Sisters, please Dick --- zero nine three * *
1857:26	
CAM-1	Comin' up on, ah,
CAM-3	I better give you somethin' a little different. I'm gonna give you the (truth) for a while here
CAM-1	Okay
1857:29	
CAM-2	We're gonna gave to hold, we're, ah, Pleasant
1857:31	
CAM-1	I think you're gonna have to hold

AIR - GROUND

SOURCE & TIME	CONTENT
1857:16	
N799Y	Roger nine yank, wilco
1857:18	
WA720	Anchorage, Western seven twenty, leaving two niner zero
1857:23	
ANC	Western seven twenty roger
1857:25	
CF-LOO	L oh oh is level two one zero
1857:27	
ANC	Oh oh roger
1857:36	
ANC	Western seven twenty what time were you by Level Island?
1857:40	
WA720	Five five
1857:43	
ANC	Seven twenty, roger, report leaving one five thousand, over
1857:46	
WA720	Roger, check out of one five thousand

INTRA - COCKPIT		AIR - GROUND	
SOURCE & TIME	CONTENT	SOURCE & TIME	CONTENT
1857:50 CAM-1	# #, he'd be over Coghlan Island? # #		
1857:58 CAM-1	Blue seventy-nine, Blue seventy-nine ain't right		
1858:03 CAM	Crank zero nine three in on yours, if it's okay		
CAM-1	Yeah		
1858:11 CAM-1	Is that Pleasant Intersection?		
CAM-2	Pleasant	1858:13 RDO-1	Center, Alaska sixty-six, Pleasant Intersection ah, entering a holding pattern at twelve thousand
		1858:20 ANC	Alaska sixty-six, roger, you're cleared to the Howard Intersection, proceed inbound on the localizer, over
		1858:28 RDO-1	Okay, now cleared to Howard, proceed inbound on the localizer
1858:30 CAM-1	You can (whipt) her right back		
1858:31 CAM-2	Yeah, I can cut 'er left		

INTRA - COCKPIT		AIR - GROUND	
SOURCE & TIME	CONTENT	SOURCE & TIME	CONTENT
		1858:32 ANC	Are you on top at twelve?
		1858:33 RDO-1	Negative, we're, ah, on instruments, ah, at twelve
		1858:38 ANC	Roger -- Aztec nine nine Yankee, Anchorage Center
		1858:44 ANC	Aztec nine nine Yankee, Anchorage Center
		1858:46 N799Y	Nine Yank
1858:47 CAM-1	Holding pattern at Pleasant is to the left	1858:47 ANC	Roger, you're a lot better now. Have you - - what is your altitude now?
CAM-2	Yeah ((whistle))		
1858:50 CAM-2	I was in that -- I was gonna make left turn, I was just makin' a entry this way	1858:51 N799Y	Nine Yank, ah, coming up on niner and climbing
		1858:56 ANC	Roger, have you passed Coghlan Island northbound as yet?
		1858:59 N799Y	Negative
1859:00 CAM-1	Okay, two twelve here ((Coghlan Is. NDB))		

INTRA - COCKPIT		AIR - GROUND	
SOURCE & TIME	CONTENT	SOURCE & TIME	CONTENT
		1859:01 ANC	Roger -- nine nine Yankee maintain one zero thousand to the Yankee Intersection, over
1859:03 CAM-1	Okay, I'll set you on mine up to Howard, Okay?		
1859:06 CAM-2	'kay ((pause)) three five three radial		
1859:13 CAM-1	Three fifty three	1859:13 N799Y	Roger, maintain ah one zero thousand to the Yankee Intersection
		1859:17 ANC	Roger and, ah, are you inbound on the localizer now or where?
1859:22 CAM-1	Howard's right turns into *		
		1859:23 N799Y	Inbound on the localizer to Coghlan Island and, ah, right at nine thousand climbing
		1859:30 ANC	Nine Yankee, roger
1859:32 CAM-3	That Yankee's inbound on the localizer		
1859:36 CAM-1	Swing 'er back over there, partner		
		1859:37 WA602	Western Six zero two progess
		1859:39 ANC	Western six zero two go ahead
1859:41 CAM-2	Okay, the localizer's comin' in now		

INTRA - COCKPIT

SOURCE & TIME	CONTENT
1859:49	
CAM-1	Okay, you got that on, ah, Mendenhall, right? --
1859:52	
CAM-2	Mendenhall
CAM-1	---, okay
1859:54	
CAM-1	Ditto, ditto, ditto
1859:58	
CAM-3	Ah, Dick?
CAM-1	What?
CAM-3	Did you happen to hear where the * (too tight)?
1900:02	
CAM-1	He's inbound on the localizer, he said. It's not Coghlan Island to me
1900:06	
CAM-3	Inbound to the localizer goin' to Coghlan Island ten thousand --- climbing to ten thousand feet, he's at nine thousand somethin' now
CAM-1	Yeah
1900:14	
CAM-1	Well, in other words, he's right out in front of us, underneath us

AIR - GROUND

SOURCE & TIME	CONTENT

INTRA - COCKPIT		AIR - GROUND	
SOURCE & TIME	CONTENT	SOURCE & TIME	CONTENT
1900:18		1900:18	
CAM-3	That's what I understand	ANC	Alaska sixty-six is now cleared to the Howard Intersection to maintain one two thousand to hold west on the localizer, expect approach clearance at one niner one zero, over
		1900:27	
		RDO-1	Okay, cleared to Howard twelve thousand, ah, right turn on the localizer, west of the localizer and, ah, expect clearance at, ah, one zero
		1900:37	
		ANC	Roger
1900:45			
CAM-1	You better -- oh, you got some on there? Okay.		
		1900:46	
		ANC	Aztec nine nine Yankee say your altitude now
		1900:48	
		N799Y	Roger, ah, right at one zero thousand now, level at one zero thousand and, ah, inbound to, ah, the localizer
1900:59			
CAM-2	Inbound to Coghlan Island		
		1901:01	
CAM-3	Coghlan Island	ANC	Roger, report Coghlan Island northbound
1901:03			
CAM-1	'kay, you're Howard		

INTRA - COCKPIT

SOURCE & TIME	CONTENT
CAM-2	Okay
CAM-3	(He thinks) he's rough and tough

AIR - GROUND

SOURCE & TIME	CONTENT
1901:05 N799Y	Roger, will report Coghlan Island northbound
1901:12 RDO-1	And sixty-six is Howard Intersection holding at twelve
1901:15 ANC	Sixty-six, roger
1901:17 WA602	Anchorage, this is Western six zero two standing by
1901:23 WA602	Okay, we were by Douglas at five five and three five zero, estimating Annette at zero eight and, ah, ah, looking for Kingfish after that an, ah, we'd like to have a step climb to three niner zero at Annette
1901:37 RDO-3	Juneau, Alaska sixty-six
1901:40 AS JNU	Alaska sixty-six, Juneau
1901:42 RDO-3	Roger, ah, we're holding here at, ah, Howard Intersection, ah, so we'll be on probably around one five and, ah, requesting thirty thousand pounds
1901:53 AS JNU	Okay, estimating on at one five and thirty thousand will be okay weight-wise, ah, I think Sitka is pretty full. I haven't talked to them and I notice the minimum out of there is twenty-three. Ah, do you think you'll burn off that much goin' across?

INTRA - COCKPIT

SOURCE & TIME	CONTENT
1902:25 CAM-3	Did you hear that, Dick?

AIR - GROUND

SOURCE & TIME	CONTENT
1902:10 RDO-3	Ah, negative, we'll burn about forty-five hundred
1902:12 WA720	Seven twenty, ah, fifteen point five
1902:13 AS JNU	Yeah, I wonder if we ought to maybe hold it down a little for Sitka's benefit. Possibly you could talk to them this frequency from your position
1902:20 WA720	And cleared for an approach and two niner five seven, changing over
1902:20 RDO-3	Ah, usually we can't account of the hills. We'll give them a try, though, if you want

INTRA - COCKPIT		AIR - GROUND	
SOURCE & TIME	CONTENT	SOURCE & TIME	CONTENT
CAM-1	What was that?		
1902:27			
CAM-3	They want to hold us down to our minimum fuel out of Sitka 'cause Sitka's full, that's twenty-three thousand pounds which we'll need there and with turning we'll only burn about forty-five hundred, we'll be a little over		
		1902:29	
		ANC	Alaska four zero three say your altitude
		AS403	Ah, four oh three now level eight thousand
		ANC	Four oh three, roger
1902:39			
CAM-3	Ah, so, six forty-five * is eight * *		
		ANC	Zero three, you plan on holding eight to the VOR, over?
		1902:50	
		AS403	Ah, we'll hold eight till fifteen DME
		1902:52	
		RDO-3	Alaska Sitka, sisty-six
		ANC	Four zero three, roger, contact Sitka Radio now for current winds, over
		AS403	Roger, four oh three

INTRA - COCKPIT		AIR - GROUND	
SOURCE & TIME	CONTENT	SOURCE & TIME	CONTENT
		1903:04 N799Y	Nine Yank over Coghlan Island at zero three and turning for Berners Intersection, out of one zero thousand for one two thousand
		1903:16 ANC	Aztec nine nine Yankee, did you call?
		1903:19 N799Y	Roger, Apache seven niner niner Yankee over Coghlan Island at zero three, left ---
		1903:46 ANC	Alaska sixty-six did you copy nine nine Yankee okay?
1903:49 CAM-2	He cut out in the middle, he said he was over Coghlan	1903:50 RDO-1	Ah, sixty-six ah he, ah, cut off in the middle, he said he was over Coghlan Island at ten thousand feet climbing to twelve heading for some intersection, I didn't get the intersection
		1904:02 ANC	Okay, his clearance was to maintain one zero thousand to the Yankee Intersection -- nine nine Yankee maintain one zero thousand to the Yankee Intersection
		1904:13 N799Y	--- over Coghlan Island at zero three
		1904:18 RDO-1	He's over Coghlan Island at zero three -- nine nine ah, Yankee, Center says to maintain ten thousand till the Yankee Intersection, you copy that?

INTRA - COCKPIT

SOURCE & TIME	CONTENT
1905:00 CAM-3	It's a bag of worms
CAM-1	Yeah

AIR - GROUND

SOURCE & TIME	CONTENT
N799Y	Ah, roger, Yankee Intersection ten thousand
1904:32 RDO-1	Roger, Yankee Intersection ten thousand. He got that okay, Center
1904:36 ANC	Okay, I can hear you and talk to you okay although I can't understand why I can't talk to him. I can sometimes and other times it isn't worth a toot
1904:43 AS92	Anchorage Center, Alaska ninety-two, Annette, eighteen five
1904:50 AS92	Alaska ninety-two Annette at zero two, level three seven zero, estimating Douglas at two five, Malcolm
1905:02 AS92	Alaska ninety-two changing, good day
1905:16 AS JNU	Alaska six six, Juneau
1905:20 RDO-3	Ah, sixty-six, go ahead
1905:22 AS JNU	Yeah, Sitka indicates there's no problem on weight so we'll go at thirty thousand out of here

INTRA - COCKPIT

SOURCE & TIME	CONTENT
1905:31 CAM-3	'kay, Sitka says there's no problem with weight, Dick, so they're gonna have to * * * (to it)
1905:55 CAM-1	Coming back in
1905:58 CAM-2	You got a south wind up here
CAM-1	Yeah
1906:05 CAM-2	We were holdin' a little drift, left drift on it that time
CAM-1	Yeah
1906:15 CAM-1	Be about two two zero or something goin' out, huh?
CAM-2	Yeah

AIR - GROUND

SOURCE & TIME	CONTENT
1905:26 RDO-3	Okay, fine, thank you
	((Interspersed transmissions heard from Juneau Tower and N49K and N53J))
1906:06 ANC	* * eight six zero three Anchorage Center
1906:11 CAM8603	Eight six zero three, Anchorage, we were by Sisters at zero three, one one thousand, one one thousand, Level Island at four zero, Prescott
1906:21 ANC	That's Level Island at four zero, is that correct?

INTRA - COCKPIT

SOURCE & TIME	CONTENT

AIR - GROUND

SOURCE & TIME	CONTENT
1906:24 CAM8603	Affirmative
1906:26 ANC	Camforce eight six zero three roger
1906:30 ANC	'kay, ah Alaska sixty-six, Center
1906:32 RDO-1	Sixty-six go
1906:33 ANC	You're holding left turns, is that correct?
1906:35 RDO-1	That is affirmative
1906:36 ANC	Are you outbound or inbound in the pattern?
1906:38 RDO-1	We're inbound on the localizer now to Howard
1906:42 ANC	Did you just complete your turn inbound?
1906:45 RDO-1	That's affirmative
1906:47 ANC	You're cleared for straight-in LTDA approach, ah, cross Howard, at or below niner thousand inbound

INTRA - COCKPIT

SOURCE & TIME	CONTENT
1907:05 CAM-2	We're too high
CAM-1	Come on, Dad (lemme * *)
1907:08 CAM-2	Can't
1907:10 CAM-1	I'll show you how
1907:11 CAM	Sound similar to landing gear handle actuation
1907:12 CAM-1	Go down
1907:12 CAM	Sound of landing gear in transit
1907:14 CAM-?	(Put 'em on)
CAM-2	Okay

AIR - GROUND

SOURCE & TIME	CONTENT
1906:55 RDO-1	Ah, roger, cleared for straight-in LDA approach, ah, cross Howard, ah, at or blow niner thousand inbound, we're inbound now leaving twelve thousand
1907:04 ANC	Roger
1907:07 N799Y	Ah, Center, this is Apache seven niner niner Yankee
1907:17 CAM8603	Anchorage Center this is military eight six zero three, nine nine Yankee is trying to contact you

SOURCE & TIME	CONTENT
1907:20	
CAM-1	We were makin right turns -- (no)
CAM-2	Well, he, he made a mistake there
1907:25	
CAM-2	* that's the way we were supposed to be doing it.
CAM-3	He told us, he told your right turns
1907:29	
CAM-2	He said right turns when he gave us the clearance
CAM-3	Left
CAM-2	He is so screwed up with that Apache he doesn't know what he's doing
1907:37	
CAM-1	Now he told us hold west, but, ah, we were holding west all right but we sure didn't make the left turns
1907:42	
CAM-1	You're all right
1907:44	
CAM-3	Five releases, smoking, down gear
1907:46	
CAM-1	Cleared for an approach, you're (lemme) get, ah --

SOURCE & TIME	CONTENT
1907:22	
ANC	Nine nine Yankee, Anchorage Center, go ahead
1907:25	
N799Y	Roger, nine nine Yankee is getting a little icing here, ah, we're * * get me a changed, ah, clearance allow me to head west where it is clear and allow me to climb to one six thousand and then take up Victor, or rather Blue three eight for Whitehorse, over

INTRA-cockpit

SOURCE & TIME	CONTENT
CAM-3	(You want a * and a flight idle)
1907:51	
CAM-?	* *
CAM-?	Yeah
CAM-?	Rockledge on there
1907:55	
CAM-1	Zero zero six is Rockledge -- you're not there yet so you're all right
1907:59	
CAM-2	Okay right, after Rockledge -- we're right there now, aren't we?
1908:03	
CAM-1	You're just comin' up on it, not quite there yet
1908:05	
CAM-2	Okay, about five hundred to Rockledge
19 08.07	
CAM-1	A thousand after

Air Ground

SOURCE & TIME	CONTENT
1907:52	
ANC	Nine nine Yankee, you're very, very difficult to read, you're cleared to climb and maintain one six thousand report reaching, over
1908:00	
N799Y	Roger, cleared for one six thousand and report reaching, thank you
1908:06	
ANC	Nine nine Yankee roger

INTRA - COCKPIT		AIR - GROUND	
SOURCE & TIME	CONTENT	SOURCE & TIME	CONTENT
1908:11			
CAM-1	Thousand to, ah Barlow -- zero one five is Barlow -- (1908:14) I'll give you that, huh?		
CAM-2	Okay		
1908:18			
CAM-1	Ain't far off of that, either -- keep 'er goin' down -- don't let it get below two hundred or you'll get a stick shaker	1908:19	
		ANC	Navy Papa Golf zero one, Anchorage, go ahead
1908:25			
CAM-2	No I won't ((underlined words spoken simultaneously))		
1908:27			
CAM-1	Swing 'er right on down, four thousand feet a minute		
CAM-2	Okay		
		1908:35	
		ANC	Zero one, roger
1908:37		1908:37	
CAM-2	After Barlow?	ANC	Alaska sixty-six say your altitude
		1908:39	
		RDO-1	Sixty-six leaving five thousand five, four thousand five hundred
1908:43		1908:43	
CAM-1	Okay	ANC	Sixty-six contact the tower now
		1908:45	
		RDO-1	Okay, fine ((pause)) and we're just approaching Barlow

INTRA - COCKPIT

SOURCE & TIME	CONTENT
1908:51	
CAM-1	Good to a thousand
1908:53	
CAM-2	Detent flaps
1908:54	
CAM-2	Just comin' up on Barlow, right?
CAM-1	Yeah
1908:55	
CAM-2	Okay

AIR - GROUND

SOURCE & TIME	CONTENT
1908:58	
RDO-1	Tower, Alaska sixty-six Barlow inbound
1909:04	
JNU TWR	Alaska sixty-six understand, ah, I didn't, ah, copy the intersection, landing runway eight, the wind zero eight zero degrees at two two, occasional gusts to two eight - - -
1909:15	END OF RECORDING