

NATIONAL TRANSPORTATION SAFETY BOARD

REPORT NUMBER

NTSB-AAR-76-13

AIRCRAFT ACCIDENT REPORT

CESSNA 310N, N41110

NEAR UPLAND, CALIFORNIA

APRIL 12, 1969



NATIONAL TRANSPORTATION SAFETY BOARD
 Bureau of Aviation Safety
 Washington, D. C. 20591

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Adopted: June 25, 1970

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NATIONAL TRANSPORTATION SAFETY BOARD
DEPARTMENT OF TRANSPORTATION
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SYNOPSIS

Cessna 310N, N4111Q, a privately owned aircraft, crashed near Upland, California, at approximately 1255 P.s.t., on April 12, 1969. All five occupants were fatally injured, and the aircraft was destroyed by impact and ground fire.

N4111Q was being vectored for an instrument approach to the Riverside Municipal Airport by the March AFB Approach Control facility at the time of the accident. When the radar controller noted that the target he was observing failed to follow the headings he assigned and the crew reported, he instructed them to climb to 4,000 feet, the upper limit of his airspace, and to proceed to the Riverside VOR and execute a VOR approach. The last transmission from the pilot was an acknowledgment to report over the VOR. The wreckage was found the day after the accident at 4,500 feet on the south slope of Cucamonga Canyon, approximately 16 miles north-northwest of the Riverside Airport. The weather in the Riverside area was: partial obscuration, estimated ceiling 2,000 feet, visibility 1-1/2 miles, haze and smoke.

The Board determines that the probable cause of this accident was the radar vectoring of the aircraft below terrain clearance level following target misidentification by the FAA controller.

The Board recommends that the FAA conduct a continuing program of analysis to detect and eliminate critical procedures in the air traffic control system.

1. INVESTIGATION

1.1 History of the Flight

The flight, N4111Q, a privately owned Cessna 310N, was the return portion of a round trip from Riverside, California, to Albuquerque, New Mexico. An Instrument Flight Rules (IFR) flight plan was filed at the Albuquerque Flight Service Station (FSS) indicating that the transponder-equipped aircraft would be flown at 180 knots true airspeed, with an initial cruising altitude of 10,000 feet. The specialist receiving the flight plan at the FSS briefed the pilot on pertinent weather and then forwarded the proposed flight plan to the Albuquerque Air Route Traffic Control Center (ARTCC). The flight was cleared via Victor Airway 12 (V-12), flight-planned route, to maintain 12,000 feet, with a climb on course approved. Communication with Albuquerque ARTCC was established at 0936:30 P.s.t. 1/ and a transponder code of 1100 was assigned. Radar contact was established by means of the "ident" feature of the transponder. At 0940:25, the pilot of N4111Q reported level at 12,000 feet. During the next 1-1/2 hours, the pilot twice requested descent clearance to 10,000 feet and was finally cleared to that altitude at 1116. The pilot reported level at 10,000 feet at 1119:50, and the flight continued routinely. At approximately 1138, Los Angeles ARTCC instructed the pilot to "ident" and radar contact was established 50 miles northeast of Parker, California. When the flight was cleared to cross Palm Springs at 13,000 feet, the pilot initially acknowledged, but then at 1209, he advised Los Angeles ARTCC that he would proceed in accordance with Visual Flight Rules (VFR) at 10,500 feet until Banning Intersection, 21 miles west-southwest of Palm Springs. (See Attachment A.)

At 1233, a radar handoff to March Approach Control (RAPCON) was effected and a beacon code of 0200 was assigned. The R-4 controller, 2/ who was the first of two controllers at March RAPCON to assume control of the flight, stated that N4111Q was pointed out to him as a code 1100 transponder target. After it had passed the Banning Intersection, he issued descent clearances to 9,000 and then 7,000 feet. At approximately 1238, he requested the altitude of N4111Q, and was advised it was descending through 8,800 feet. He then instructed the aircraft to turn to a 170° heading in order to effect proper spacing between N4111Q and a Cessna 150 (N652CF), which was approximately 5 miles west of N4111Q. He continued with additional vectors and descent clearances until 1241:25, at which time he transmitted, "Twin Cessna one one Quebec is 5 miles south-east of the Edgemont Intersection, upon intercepting zero niner three radial cleared for straight in VOR zero niner three radial approach to

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

2/ The R-4 controller is assigned airspace encompassing V-16 from the Banning Intersection to the eastern edge of Riverside Municipal Airport, from the surface to 6,000 feet.

Riverside Airport." 3/ At 1243:10, the R-4 controller advised, ". . . you are a half mile east of Edgemont Intersection cleared for a straight in approach." Approximately 1 minute later, he observed the flight overshooting the 093° radial, and ascertained that it was still 200 feet above the previously assigned altitude of 4,500 feet. At this time, 1244:45, the R-4 controller transmitted, "Cessna one one Quebec continue in a left turn heading one eight zero, this will be a vector back to the zero nine three radial and I'll set you up on it again for a straight in approach."

During the intrafacility coordination to commence another approach, the R-4 controller and the R-6 controller 4/ communicated as follows:

1245:00 R-4 This guy blew it I don't know if he knows what he is doing. I've got him in a left turn ah (unintelligible) southbound east of Riverside there. I'll go back for another setup on him. I'll call you back.

R-6 Ah okay.

R-4 It's a funny transponder.

1245:10 R-6 I'll drive him straight across and run him for a VCR nine if you want me to.

1245:15 R-4 OK He's on a one eighty heading now. I'll just turn him uh two seventy, forty-five hundred.

1245:20 R-6 Two seventy and send him over to me if you want to.

The R-4 controller then instructed the pilot of N4111Q to turn right to a heading of 270° for a vector to the VOR 9 approach, and to switch frequencies. The R-6 controller, who was now responsible for the flight, confirmed the assigned heading of 270° and altitude of 4,500 feet. At 1247:35, he cleared N4111Q to descend to 3,000 feet and assigned a new heading of 280°. Approximately 3 minutes later, he instructed the flight to turn right to 350°, and, at 1252:35, requested that it turn further right to 020°. The pilot of N4111Q reported steady on 020° approximately 30 seconds later. Shortly thereafter, the pilot and controller engaged in the following communication:

1253:19.7 R-6 November one one Quebec, March, climb and maintain four thousand and are you receiving Riverside?

3/ See Section 1.8 for description of the approved instrument approach procedures to Riverside Municipal Airport.

4/ The R-6 controller is assigned airspace encompassing the eastbound approach to Riverside Municipal Airport and the airport itself. The altitude assignment at the time of the accident was from the surface to 4,000 feet.

1253:25.5 11-Q Roger, ah, we're climbing to four thousand.

1253:31.3 R-6 All right one one Quebec, ah, disregard, make a right three hundred and sixty degree turn, please.

1253:41.5 11-Q You'll have me in the hills here making a right turn.

1253:45.2 R-6 One one Quebec, March, I, ah, I'm not getting any response on the turns. I say again, climb and maintain four thousand, return to the Riverside VOR, execute the VOR approach from over the Riverside VOR.

1253:56.0 11-Q Roger, one one Quebec.

1254:19.0 R-6 One one Quebec, roger, and, ah I, evidently your compass is erratic. Continue inbound to the Riverside VOR, report over the Riverside VOR.

1254:26.5 11-Q Roger, one one Quebec.

This was the last transmission from the aircraft. After receiving no response to several transmissions, the R-6 controller advised at 1255:33, "Twin Cessna one one Quebec, March, if you hear, radar contact lost, last observed position six miles west of the Ontario VORTAC."

The R-6 controller stated, "The R-4 controller advised that N4111Q was in a left turn southbound east of Riverside and would execute another 093R approach. At this time I observed a target, at the location described by R-4 which was approximately 2 miles east of the Riverside VOR . . . R-4 advised that the aircraft was on a 180° heading and that he would turn him right to a 270° heading which I accepted. I observed the target track a heading of 180° and turn right to a heading of approximately 270°." The watch supervisor stated that N4111Q was approximately 4 to 5 miles east of the Riverside VOR at that time.

The R-6 controller stated that he observed the target respond to each heading assigned, but that instead of maintaining 020°, the aircraft continued the turn to a southwesterly heading and eventually disappeared from the radarscope, 6 miles west of the Ontario VORTAC.

The CI-3 coordinator, who was responsible for supervision of the R-6 position, came on duty at 1247. In familiarizing himself with the current traffic situation, he asked the R-6 controller where N4111Q was located. The coordinator stated that "In response he pointed out a primary target on the scope which appeared to be two miles east of

the Ontario VORTAC . . . I followed the target to a point approximately four miles west of the Ontario VORTAC. During my observation, the target appeared to be tracking approximately two seven zero degrees." He stated that he had been informed that N4111Q was not responding to vectors, but he could not recall whether or not he had been shown the target at the time. He did not see a beacon return emanating from the target identified as N4111Q at any time, and he was not aware of any overflights in the vicinity of N4111Q.

The pilot of N652CF, a Cessna 150, was flying at 6,000 feet along V-16 at approximately the same time as N4111Q. This aircraft was also on an IFR flight plan, under control of the March RAPCON. The pilot stated that he passed the Moreno Intersection at 1235 and the Ontario VORTAC at 1250, giving him a computed ground speed of 84 knots. His heading was generally 258° and no vectors were given him by March RAPCON. He reported that visibility was "perfect" at his altitude, but poor below the clouds which he entered between 2,500 to 3,000 feet during descent to Los Angeles. He encountered no turbulence. He estimated that the clouds in the Riverside area covered 0.6 to 0.7 of the sky, with the tops 2,000 to 3,000 feet below his altitude. There was no transponder installed on his aircraft.

There were two persons located near the crash site who had knowledge of N4111Q. The first, a corporate pilot, observed that the aircraft was in a very slow cruise condition, with less than cruise power and the landing gear and flaps retracted. He estimated that the cloud base in the area was 3,200 feet, and the aircraft was flying just below the clouds. He stated, "I observed the aircraft begin a right turn for approximately 10° then make a normal 90° turn to the left and level off directly toward the mountains. I saw the aircraft disappear into Cucamonga Canyon, into the clouds and fog and it appeared to be climbing slightly." When the aircraft did not reappear within a few minutes, he notified the Ontario Tower of his observations.

The second witness did not see the aircraft but heard it passing in an easterly direction, north of his position on Cucamonga Mountain. He reported, "When approximately northeast of us, the engines revved (first one, the second a half second later), the increased noise lasting about 3 seconds. About 5 seconds after the end of the engine noise, a faint scuffing noise was heard. We immediately headed on motorcycle toward the direction of the last noise." At an elevation of 4,560 feet, he broke out of the dense clouds into very clear weather. He noted that the cloud cover completely filled Cucamonga Canyon.

The aircraft crashed at an elevation of 4,500 feet during hours of daylight. The geographic coordinates were latitude 34°11'30"N. and longitude 117°36'10"W.

1.2 Injuries to Persons

<u>Injuries</u>	<u>Crew</u>	<u>Passengers</u>	<u>Others</u>
Fatal	2	3	0
Nonfatal	0	0	0
None	0	0	

1.3 Damage to Aircraft

The aircraft was destroyed by impact and ground fire.

1.4 Other Damage

None.

1.5 Crew Information

The pilot-owner had been practicing for his instrument rating, and the other pilot, a flight instructor, had been practicing for his instrument flight instructor certificate. Entries in the pilot-owner's logbook indicate that they had flown together frequently, and on at least one occasion, in the appropriate capacities in preparation for their respective qualifications. (See Appendix B for details.)

1.6 Aircraft Information

The aircraft, N4111Q, a Cessna 310N, was privately owned by Robert A. McMillan. A review of available records indicates that the aircraft had been maintained in accordance with FAA regulations. The last annual inspection was completed on December 4, 1968, at which time the total aircraft time was 93.7 flight hours. The aircraft was fueled in Albuquerque with 92.4 gallons of 100-octane fuel. No information was available regarding the center of gravity or gross weight at takeoff.

1.7 Meteorological Information

The Weather Bureau pertinent forecast was issued by the Los Angeles office for a period from 0500 to 1700. It stated in part:

Southern California coastal waters inland to coastal slopes mountains 1,500-2,500 feet overcast, visibility 7 miles, top clouds, 3,000-4,000 feet. Visibilities Los Angeles basin and nearby coastal and intermediate valleys 2-6 miles, haze, smoke.

The 1300 surface weather observation at Riverside was: partial obscuration, estimated 2,000 feet overcast, visibility 1-1/2 miles, haze, smoke, temperature 68° F., dew point 55° F., wind calm, altimeter setting 30.10 inches, 3/10 of the sky obscured by haze and smoke. The 1215 Los Angeles pilot weather report summary contained the following:

Los Angeles basin top of the overcast 4,200 feet. Palm Springs to San Bernardino top of the overcast 5,000 feet. Cajon Pass area top of the overcast 8,000 feet. Palm Springs to Palmdale. Palm Springs to San Bernardino top of the overcast 5,000 feet. Cajon Pass top of broken clouds 5,000 feet.

The pilot was provided with all pertinent weather for his route of flight by a specialist at the Albuquerque Flight Service Station.

1.8 Aids to Navigation

The Riverside Municipal Airport is served by the Riverside VOR (111.4 MHz) which is located at the northwest corner of the airport. There are two approved instrument approaches utilizing this facility.

The VOR-Radial 093 approach is made from the east by executing a procedure turn south of the 093° radial, within 10 miles of the Edgemont Intersection (8.7 miles east of the VOR), at 4,400 feet. Further descent westbound is approved to 3,700 feet at Edgemont, 2,200 feet at Overlook (3.1 miles east of the VOR), and thence to authorized minimums.

The VOR-Runway 9 approach is made from the west by commencing a procedure turn south of the 277° radial, within 10 miles of the Norco Intersection (4.0 miles west of the VOR), at 3,200 feet. Further descent eastbound is approved to 2,000 feet at Norco, and thence to authorized minimums.

Radar transitions to the final approach course for both approaches are authorized.

The Riverside VOR was inspected both in flight and on the ground. No discrepancies were noted and, in addition, the pilot of N4111Q twice acknowledged satisfactory reception of the VOR.

N4111Q was under the positive radar control of the March RAPCON. This facility is equipped with an ASR-5 radar and GPX-9 transponder interrogator. The radar antenna site is physically located at the Ontario International Airport. Flight inspection and ground maintenance checks of this equipment revealed no discrepancies.

1.9 Communications

No problems were reported with communications; however, the transmissions from N4111Q were slightly garbled. A friend of both pilots stated that the pilot-owner was making the transmissions from the aircraft with a boom-type microphone.

1.10 Aerodrome and Ground Facilities

The Riverside Municipal Airport is located on the western edge of the city at an elevation of 816 feet. There are two runways, 9-27 and

16-34, both of asphalt construction. Runway 9-27 is 4,600 feet long by 100 feet wide, and is the primary landing runway. Runway 16-34 is 2,191 feet long by 75 feet wide, but only 1,607 feet are available for landing on Runway 34. Runway 16 is not used for landings. Except for the relatively level Los Angeles Basin which opens to the west, the airport is virtually surrounded in all quadrants by mountainous terrain.

1.11 Flight Recorders

No flight recorders were installed and none were required by regulation.

1.12 Wreckage

The aircraft crashed on the south slope of Cucamonga Canyon at an elevation of 4,500 feet. Investigation at the scene revealed that the aircraft struck the ground in a near vertical dive, slightly inverted. Most of the wreckage was located within 40 to 50 feet of the main impact site. The fuselage was consumed by fire. The left wing was still attached to the fuselage, but the right wing was separated and located approximately 40 feet downhill. All cables recovered had failed in gross overload. Inspection of the engines revealed no indication of preimpact malfunction.

1.13 Fire

An intense ground fire occurred at impact.

1.14 Survival Aspects

This was a nonsurvivable accident.

1.15 Tests and Research

None.

1.16 Other

The R-4 and R-6 controllers, who were directly involved in the control of N4111Q during the approach to Riverside, refused to testify at the public hearing held in connection with the accident. They were advised by the counsel for their organization, the Professional Air Traffic Controllers Organization, that they should claim the protection against self-incrimination as provided in the Fifth Amendment to the Constitution. The Safety Board has the power to compel such testimony if it is deemed necessary to the investigation; however, such action would automatically grant immunity to the controllers as provided in section 1004(i) of the Federal Aviation Act of 1958 (49 U.S.C. 1484(i)), which states in part: ". . . no individual shall be prosecuted or subjected to any penalty or forfeiture for or on account of any transaction,

matter, or thing concerning which he is compelled, after having claimed his privilege against self-incrimination, to testify or produce evidence, documentary or otherwise, except that any individual so testifying shall not be exempt from prosecution and punishment for perjury committed in so testifying."

In this instance, a review of the record revealed that while detailed testimony of the controllers would probably have provided a more complete record, their written statements with corresponding interviews, the transcription of communications, the testimony of others, and other available data were sufficient to determine probable cause. Consequently, sworn testimony was not taken, and will not be taken.

The R-6 controller was interviewed on May 13, 1969, for the purpose of augmenting his statement dated April 23, 1969. H. stated that he was not under any form of medical treatment or medication on April 12, 1969, and had not been on sick leave for other than minor illnesses, such as a cold, during the past 12-month period. He reported that he had been on duty from 1400 to 2200 on April 11, and from 0700 to 1500 on April 12. During the off-duty 9 hours, he had slept 5-1/2 hours. He stated that he felt better than usual, and was not preoccupied or worried about anything, despite this quick turnaround. He did not remember whether N4111Q was a transponder target, or if the transponder was mentioned during the transfer of control. Additionally, he did not advise the pilot of N4111Q that he was in radar contact. In response to a question about his conclusions as to the cause of the accident, he indicated that he might have shifted his attention, or he might have had the wrong aircraft initially.

The R-6 controller was removed from operational duties following the accident and, except for manning control positions under direct supervision, he remained in a nonoperational status until September 23, 1969. On that date he was returned to full operational status, based on the recommendation of the Psychiatric Assistant to the Federal Air Surgeon who evaluated several psychological examinations and personal interviews. The R-6 controller was again removed from operational duty status on January 26, 1970, and, following another interview by the Psychiatric Assistant, was found medically unqualified to serve as an air traffic controller.

During the public hearing, several persons testified about the internal quality control procedures of the FAA. The chief of the March RAPCON stated that "over the shoulder" observation of a controller's activity is conducted for a minimum of 2 hours per quarter by the crew chief. His evaluation is then summarized in a report. Additionally, tape recordings of a controller's communication are periodically made and then reviewed jointly with the crew chief. However, there is no specific program designed to elicit incidents of misidentification from the controllers, which would document the details for use in a training or corrective program.

The Chief, Air Traffic Control Operations and Procedures Division of FAA's Air Traffic Service, stated that the primary source of checks and balances within the air traffic control system is the first line supervisor. His surveillance of a controller's operation is expected to detect deviations from established procedures and to correct such discrepancies to the extent possible. He reported that with respect to a procedure requiring mandatory confirmation of the identity of an aircraft following transfer of control, whether transponder-equipped or not:

"We considered that in some depth, the feasibility of requiring a confirmation of handoff within a terminal facility in the same manner it's required in a center, and we decided against it. . . . The workload involved in the terminal facility, we felt, would be such as to make the procedure unacceptable. . . . In the terminal environment the aircraft are generally changing heading much more frequently than in the en route environment, therefore, it was felt that the chances of a misidentification in a terminal area working with aircraft constantly changing heading and being vectored is less than a center area where the aircraft frequently maintain the same heading for long distances of time. Prior to making this decision we made a proposal to our field offices throughout the country to require a mandatory confirmation procedure in terminals . . . the opinions that came back from the field were such that we did not adopt the procedure, and they are substantially as I've outlined to you."

The System Error Reporting Program which is conducted by the FAA is designed to provide for regional and Washington-level review of system errors which result in less-than-standard separation of aircraft from other aircraft or terrain. Recommendations for corrective action are then implemented as appropriate. However, there is no defined procedure analysis or method of evaluating the man-machine air traffic system to identify the critical areas where single faults may bring catastrophic results.

2. ANALYSIS AND CONCLUSIONS

2.1 Analysis

The flight plan for N4111Q revealed two items of significance to this analysis. The pilot-owner initially listed himself as pilot of the aircraft, but his name was lined out and the other pilot's name inserted. This suggests that the pilot-owner intended to fly the aircraft to Riverside, but because he lacked the necessary qualifications to file the required IFR flight plan, the other pilot's name was substituted. The pilot-owner was identified as making the transmissions from the aircraft with the boom microphone and, accordingly, must have been seated in the left seat where that microphone was installed. Based on this information and the relationship which existed between the two pilots, it is presumed that the pilot-owner was flying the aircraft from

the left seat to gain instrument experience, and that the pilot was gaining experience as an instrument flight instructor in the right seat. Although the basic flight instruments in the aircraft would have been in front of the pilot-owner with this seating arrangement, the pilot was a qualified flight instructor and it is reasonable to assume that he was capable of operating the aircraft from the right seat under instrument flight conditions. Although the preceding analysis of piloting duties cannot be proven, in any case it is presumed that during the final seconds, one or both pilots reacted to the sudden appearance of trees and terrain by attempting to climb sharply. Control was probably lost in a very nose-high attitude, and the aircraft either knifed, wing down, through the air or in some other stalled condition, crashing in a nearly vertical attitude at impact. It is not known whether such a zoom maneuver carried the aircraft into clear sky, but if it did, the pilots were obviously unable to cope with the unusual attitude.

The second item of significance on the flight plan is the indication that the aircraft was transponder equipped. This information was reflected on each written record in the four controlling agencies responsible for processing the data for the flight. This includes the flight progress strips prepared in both the FSS and ARTCC at Albuquerque, the ARTCC at Los Angeles, and the March RAPCON. However, this very meaningful intelligence, which was faithfully transmitted from facility to facility on succeeding handoffs, was lost in the final transfer of control between the R-4 and R-6 controllers within the March RAPCON. The R-6 controller accepted a primary target as N4111Q, apparently oblivious to the transponder indication on the flight strip, and unaware of the off-hand comment by the R-4 controller that the flight had ". . . a funny transponder," which was made just 5 seconds prior to his volunteering to accept responsibility for control of the aircraft.

The air traffic control handling of N4111Q was routine until approximately 1238 when a vector of 170° was assigned. The R-4 controller issued this instruction to enable the flight to continue descent below 6,000 feet, the assigned altitude for N652CF. At the time, the two aircraft were about 5 miles apart. N4111Q maintained the southerly heading for approximately 1 minute and then was requested to turn westbound again. Shortly thereafter, they were cleared for a straight-in, VOR-Radial 093 approach. During the time interval that N4111Q was attempting to intercept and track inbound on the 093° radial, the flightpath was converging with N652CF; however, adequate vertical separation existed.

Insufficient data are available to reconstruct the relative flightpaths of the two aircraft precisely, but it is obvious from an analysis of the testimony of the pilot of N652CF, and the progress of N4111Q as reflected in the communications with various controllers, that both aircraft would have been approximately 4 to 5 miles east of the Riverside VOR at 1245:20. At this time, the targets of the two aircraft were presumably merged into one, even as control was being transferred from R-4 to R-6.

With the possible exception that there was no reference to the transponder code assigned, or to the overflight of N652CF, the intra-facility transfer of control conformed to both the letter and spirit of the air traffic control procedures. However, the transfer was ineffective because the R-6 controller failed to identify the proper target as the two aircraft targets separated and continued along what were then divergent courses. Although this was a rather unorthodox transfer of control, and the Board believes that the misidentification was basically an individual error, involvement of the system itself must also be considered. The information and indications available to the R-6 controller were sufficient to dramatize the mistake he had made. N652CF was a non-transponder target, tracking in a southwesterly direction 20° to 30° off the assigned headings, at about half the speed of N4111Q. Once the assigned heading of N4111Q was changed to 350°, approximately 5 minutes after control was transferred, the deviation of the observed target from the assigned and reported headings was even greater. The Board believes that during the 2-minute period in which the target was supposed to be proceeding in a northerly direction, the R-6 controller finally realized that he was in fact observing the wrong target. Presumably, his subsequent instructions to N4111Q to turn to 020°, and then to make a 360° turn were intended to assist him in identifying the proper target on his radarscope. The pilot, though unaware that radar contact was obviously lost, demonstrated his awareness and concern for the critical position in which he had been placed when he commented, "You'll have me in the hills here, making a right turn." The instruction to ". . . climb and maintain 4,000, return to the Riverside VOR, execute the VOR approach . . ." was tantamount to the controller's abdicating further responsibility for navigation of the flight except for blocking the airspace from use by other aircraft, and he still failed to advise N4111Q that radar contact was lost. Had such a warning been issued in a timely manner, in view of the crew's already expressed apprehension, it might have prompted them to initiate a request for a southerly heading away from the mountainous terrain.

The aircraft industry, for years, has conducted analytical studies in the design of aircraft to assess not only the effect of a failure or combination of failures on the system involved, but also the effect on other subsystems including the "human components" or operator. Such analyses identify critical areas. Redundant parts or specific warnings are then designed into the aircraft, which eliminate or minimize the probability of catastrophic failures. This systematic method of analysis, applied to the operating procedures and equipment of the air traffic control system might, well have been most effective in the prevention of this specific accident.

It is significant that during the 2-minute period while N4111Q was on a northerly direction, it was heading toward the radar antenna site. It is impossible to correlate accurately this time element and flight-path with the reception of the target while the R-6 controller was presumably searching, but certainly the target would disappear while

the aircraft was in the vicinity of the antenna site. In any case, there was no possibility that the R-6 controller would locate the target of N4111Q as long as he was looking for a non-transponder target.

The Board considered the possibility that workload may have caused the R-6 controller to miss the remark by the R-4 controller about the transponder and the indication on the flight progress strip. However, it must be remembered that the R-5 controller volunteered to accept responsibility for control of the aircraft. Since the discussion between the controllers relating to N4111Q was intended for coordination only, the self-initiated action of the R-6 controller clearly indicates that he did not consider his workload excessive. At the time he accepted responsibility for N4111Q, he was controlling two aircraft which he handed off approximately 1 minute later. Throughout the period that he was issuing vectors to N4111Q, he never had more than one other aircraft under his control. It is therefore concluded that his workload was indeed light.

Another possible explanation for the misidentification is that the controller was fatigued by the quick turnaround, with only 9 hours duty-free. He stated during an interview that he had slept about 5-1/2 hours of that time, and although he also added that he felt better than usual on the day of the accident, the involvement of fatigue cannot be discounted.

The R-6 controller's conclusion as to what might have caused the accident is that he might have shifted his attention, or that he might have had the wrong aircraft initially. Inasmuch as he did not realize that he was controlling a transponder-equipped aircraft, the Board concludes that the latter is true. Additionally, since various other possibilities such as proficiency, and workload, were not involved in the misidentification, the reasons for this error are presumably of an individual nature involving the controller. For example, the proposition that confirmation of radar identification is more critical in the en route environment than in the terminal area because of the frequency of turns, may overlook the possibility that a greater potential for misidentification exists in the terminal area due to the denser traffic conditions. Misidentification did occur in this instance despite the fact that the aircraft was transponder-equipped and made several turns. A mandatory requirement for controllers to request and observe the "ident" feature during transfer of control, whether intrafacility or interfacility, should preclude the recurrence of this type of misidentification. In another case, the period of time during which a controller may safely ponder whether or not radar contact has been lost is quite variable, and perhaps the increased safety from the establishment of certain local instructions to accommodate such variations would offset any dangers from lack of procedural standardization. These are but two rather obvious critical circumstances of this accident for which the air traffic control

system provides little or no backup. The Board believes that there are many more which could be detected by a systematic survey and either eliminated or reduced through appropriate corrective action.

2.2 Conclusions

(a) Findings

1. The aircraft and pilot were properly certificated.
2. N4111Q was originally cleared for a VOR-Radial 093 approach to the Riverside Municipal Airport, but when the flight missed the final approach course, additional radar vectoring was given for a VOR-Runway 9 approach and an intrafacility transfer of control was effected.
3. The transponder was operating during the transfer of control from the R-4 controller to the R-6 controller.
4. The R-6 controller should have been aware that he was controlling a transponder-equipped aircraft.
5. The targets of N4111Q and N652CF were probably merged into one when the R-6 controller assumed control.
6. The R-6 controller was not formally notified of the over-flying traffic.
7. The R-6 controller should have realized he was observing the wrong target when there was no response to the heading changes, but there was no possibility of his finding N4111Q as long as he was looking for a non-transponder target.
8. The R-6 controller was delinquent in not notifying N4111Q sooner that radar contact was lost, which action might have triggered the crew into requesting a southerly heading.
9. The crew of N4111Q was apprehensive of the mountainous terrain, but unaware of their exact position in relation to the mountains.
10. The crew of N4111Q was complying with the instructions issued throughout the approach.

(b) Probable Cause

The Board determines that the probable cause of this accident was the radar vectoring of the aircraft below terrain clearance level following target misidentification by the FAA controller.

3. RECOMMENDATIONS

It is recommended that the FAA conduct an analysis of the air traffic control system to identify critical procedures, particularly in geographic areas where little or no margin for safety exists. These hazardous situations should then be eliminated by implementing suitable corrective action, or at least the potential danger could be reduced by establishment of vigorous programs to educate controllers and pilots alike to the problem. Obviously, the constantly changing environment of the system dictates that periodic updating of the analysis would be required. The Board acknowledges that such an analysis of the air traffic system represents a major challenge, and if a lack of methodology exists on how to conduct such a study, then research and development on the subject should begin immediately.

BY THE NATIONAL TRANSPORTATION SAFETY BOARD:

/s/ JOHN H. REED
Chairman

/s/ OSCAR M. LAUREY
Member

/s/ FRANCIS H. McADAMS
Member

/s/ LOUIS M. THAYER
Member

/s/ ISABEL A. BURGESS
Member

June 25, 1970.

INVESTIGATION AND HEARING1. Investigation

The Board received notification of the accident at approximately 1300 on April 13, 1969, from the Federal Aviation Administration. An investigating team was immediately dispatched to the scene of the accident. Working groups were established for Operations-airworthiness, Air Traffic Control, Weather, and Human Factors. The Federal Aviation Administration participated as an interested party. The on-scene investigation was completed on April 16, 1969.

2. Hearing

A public hearing was held at Riverside, California, on June 25-26, 1969. Parties to the Investigation included the Federal Aviation Administration, Aircraft Owners and Pilots Association, Cessna Aircraft Company, Professional Air Traffic Controllers Organization, and the Air Traffic Control Association.

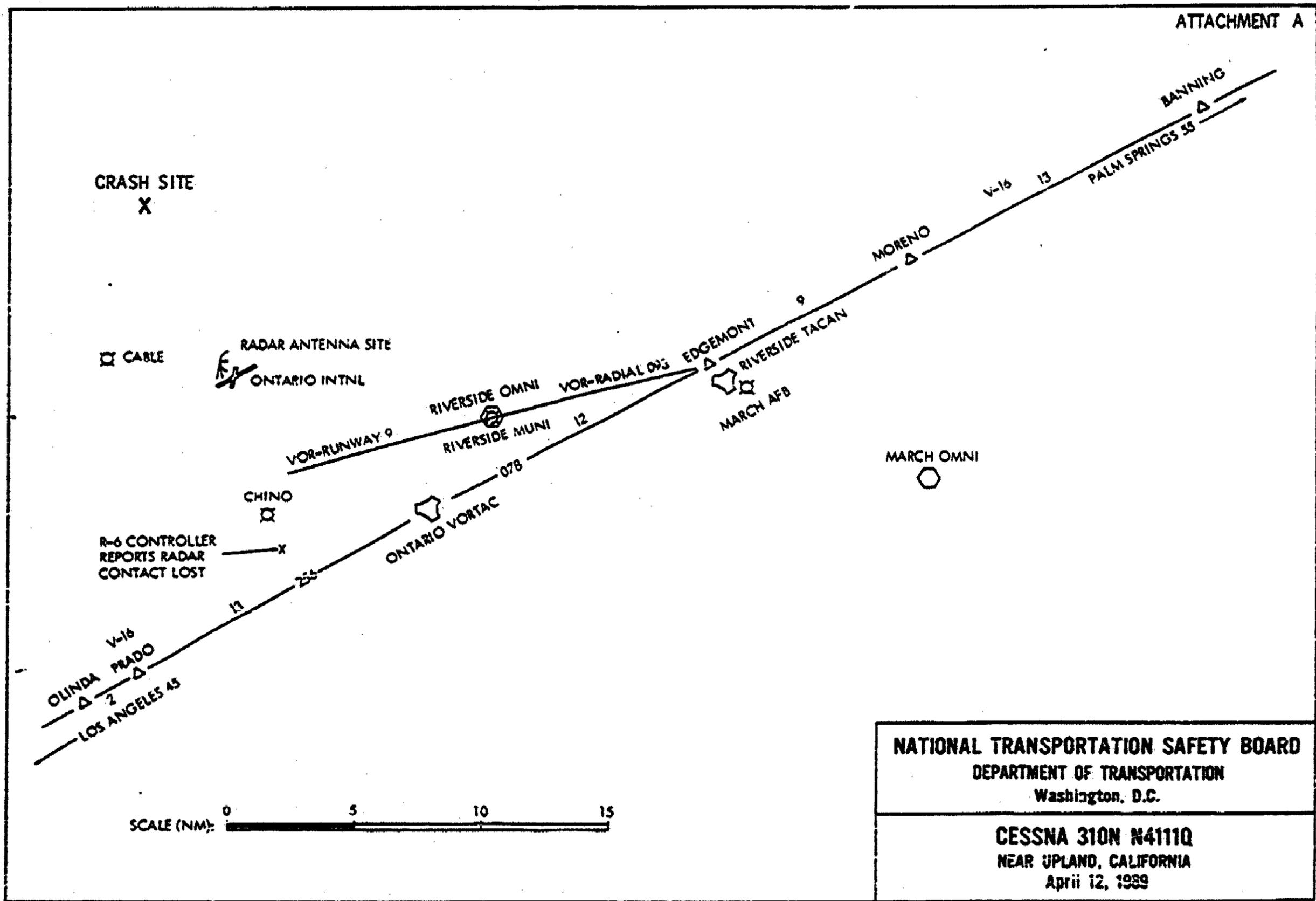
3. Preliminary Reports

A summary of the testimony which was taken at the public hearing was published by the Board on July 30, 1969.

CREW INFORMATION

Allen H. Kropfenstein, aged 58, held commercial pilot certificate No. 30144, with airplane single- and multiengine land, instrument and flight instructor ratings. He had accumulated approximately 8,881 total flying hours, of which over 100 were in the Cessna 310. His last instrument proficiency check was completed on November 13, 1968. He had also successfully renewed his flight instructor rating on December 13, 1968. His FAA second-class medical certificate was issued May 24, 1968, with the limitation that the holder must wear glasses for near vision.

Robert A. McMillan, aged 54, held private pilot certificate No. 1580275, with airplane single- and multiengine land ratings. He had accumulated approximately 2,600 total flying hours and had been flying Cessna 310 aircraft since 1964.



NATIONAL TRANSPORTATION SAFETY BOARD
 DEPARTMENT OF TRANSPORTATION
 Washington, D.C.

CESSNA 310N N4111Q
 NEAR UPLAND, CALIFORNIA
 April 12, 1989

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