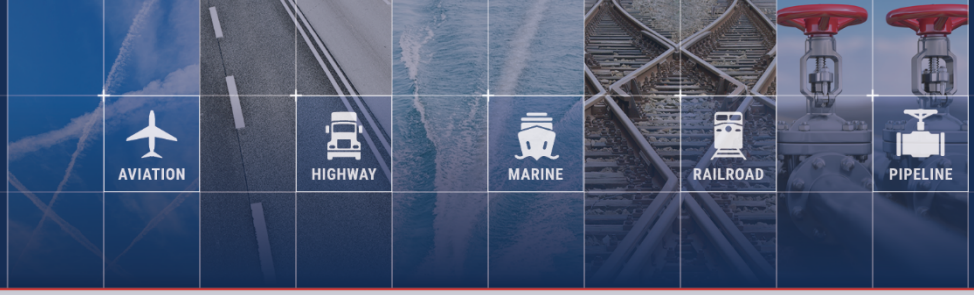

Aviation Investigation Final Report

Location:	VAN NUYS, California	**Accident Number:**	LAX01FA018
Date & Time:	October 17, 2000, 15:51 Local	**Registration:**	N1801B
Aircraft:	Beech C90	**Aircraft Damage:**	Substantial
Defining Event:		**Injuries:**	3 None
Flight Conducted Under:	Part 135: Air taxi & commuter - Non-scheduled		

Analysis

The Gulfstream descended from above and behind the Beech C90 and collided with it while both aircraft were on 2.5-mile final approach to the same runway. Visual meteorological conditions prevailed. The Gulfstream was on an ILS instrument approach and the Beech was on a VFR approach. Both airplanes subsequently landed without additional damage or injury to the occupants. Upon initial contact with the air traffic control tower, the Beech C90 was instructed to make a straight-in approach to the runway and was given a transponder code. The pilot miss-set the assigned code, which, due to an air traffic control computer software anomaly, caused the Beech's identifying data block to be suppressed and not available to the radar approach controller. The approach controller attempted to provide traffic advisories to the overtaking Gulfstream pilot but could not determine the Beech's type, destination, or altitude. (Altitude data became available to the controller 1 minute 14 seconds before the collision via a conflict alert message.) The controller did not issue a traffic alert to the Gulfstream crew when the Beech's altitude became known. Additionally, for unrelated reasons, the approach controller experienced frequent failures of his communication radio transmitter and was required to repeat transmissions to the Gulfstream and other aircraft. Despite the traffic point-out, in front of them 1 mile, altitude unknown, and later at short distance at a known altitude near theirs, the Gulfstream flight crew did not visually identify and avoid the Beech nor did they request radar separation services. On initial contact with the tower, the Gulfstream crew was cleared to land on the same runway the tower had previously cleared the Beech to make a straight-in approach to. When asked by the Gulfstream if there was any traffic in their vicinity, the tower replied, "nothing reported." The tower controller realized his mistake approximately 16 seconds later, however, the collision had already occurred. The Gulfstream pilot reported there were no TCAS 2 traffic advisories within 3 miles and there were no resolution advisories. The Gulfstream first officer recalled a TCAS "traffic" advisory close by at near their altitude, but no annunciation in the minute or two before the collision. With the model TCAS aboard the Gulfstream, when the aircraft's landing gear is extended, the lower TCAS antenna goes into an omni-directional mode wherein targets

detected on the lower antenna only are displayed to the flight crew on the cockpit TCAS display with a text message of range and delta altitude but no bearing information. The Beech's transponder antenna was on the lower fuselage and airframe structure shielded it from interrogation by the Gulfstream's TCAS.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The failure of the pilot to correctly set a new transponder code and an anomaly in ATC software that precluded the controller from manually overriding the resulting inhibition of displayed data. Factors in the accident were impaired function of the collision avoidance system in the other airplane due to structural masking of the airplane's transponder antenna, an intermittent failure of the approach controller's communication radio transmitter which interfered with his ability to communicate traffic information to the flight crew of other airplane, the failure of both the approach controller and the tower controller to issue safety alerts when the traffic conflict became apparent, and the failure of the flight crew of the other airplane to maintain an adequate visual lookout to see and avoid the airplane.

Findings

Occurrence #1: MIDAIR COLLISION
Phase of Operation: APPROACH

Findings
1. TRANSPONDER - RESET/REPOSITIONED - PILOT IN COMMAND
2. (C) TRANSPONDER - INCORRECT - PILOT IN COMMAND
3. (C) ATC AUTOMATION SYSTEM - IMPROPER
4. ATC AUTOMATION SYSTEM - LOSS(TOTAL)
5. (F) COLLISION AVOIDANCE SYSTEM - IMPEDED
6. (F) SAFETY ADVISORY - NOT ISSUED - ATC PERSONNEL(DEP/APCH)
7. (F) SAFETY ADVISORY - NOT ISSUED - ATC PERSONNEL(LCL/GND/CLNC)
8. (F) MISCELLANEOUS,ATC FACILITY/EQUIPMENT - LOSS(PARTIAL)
9. (F) VISUAL LOOKOUT - INADEQUATE - FLIGHTCREW OF OTHER AIRCRAFT

Factual Information

HISTORY OF FLIGHT

On October 17, 2000, at 1551 Pacific daylight time, a Beech C90, N1801B, collided in midair with a Gulfstream Aerospace G-1159A, N162JC, while both aircraft were on 4-mile final approach to runway 16R at the Van Nuys, California, airport. Both aircraft subsequently landed safely at Van Nuys airport, and there were no injuries to the airline transport certificated pilot and two passengers aboard the Beech C90, or to the airline transport certificated pilot and two crewmembers aboard the Gulfstream G-1159A. The Beech C90 was substantially damaged and the Gulfstream G-1159A received minor damage. The Beech C90 was operated on a visual flight rules flight plan under 14 CFR Part 135 as a nonscheduled, domestic air taxi flight by Sun Quest Executive Air Charter, and had departed from Bakersfield, California, at 1520. The Gulfstream G-1159A was operated under instrument flight rules by Trans-Exec Air Service, Inc., under 14 CFR Part 91 as a positioning flight, and had departed from Reno, Nevada, about 1500.

A flight instructor, who was employed by the flight school division of Sun Quest Executive Air Charter, witnessed the midair collision from his car while driving westbound on the 118 freeway just past the 405 freeway interchange. The instructor said he just happened to look upward and his attention was attracted to two aircraft flying in close proximity, one behind the other, nearly co-speed but with the rear aircraft overtaking the aircraft in front of it. The swept wing aircraft that he later learned was a Gulfstream G3 was overtaking a smaller airplane. He couldn't judge altitude precisely; however, as he watched the two aircraft came together and the smaller airplane shuddered and then dropped down out of view behind some trees. It appeared the larger, swept-wing aircraft initiated a go-around maneuver.

Another witness observed the collision from his home in the 10,000 block of Odessa Avenue (2 miles north of the Van Nuys airport). He reported looking up after hearing a jet aircraft and seeing a corporate jet aircraft (which he identified as a "G-3", i.e. Gulfstream) making what he considered a normal approach to the airport but with a smaller, twin-engine propeller aircraft (which he identified as a "King Air") behind and to the left of the corporate jet. The King Air was about one plane length behind the Gulfstream, one fuselage diameter below the jet, and was offset to the left so that the fuselage centerline of the King Air was even with the Gulfstream's left wingtip. As he watched for the next 5 - 7 seconds, the King Air overtook the Gulfstream until the King Air was under the left wing of the Gulfstream. About the time the King Air was under the wing of the Gulfstream, the vertical gap also closed and he observed the King Air to "make some slight maneuvering motions. The wings and fuselage moved around some. The King Air then fluttered like a falling leaf. The nose pointed down and the King Air dove toward the ground with its wings rocking back and forth." The King Air then recovered and continued flying toward the airport. He heard the engines of the Gulfstream

increase in power and the aircraft pulled up and banked right before continuing toward the airport. He lost sight of both airplanes about 5 - 7 seconds after the collision.

PERSONNEL INFORMATION

In an interview the day following the accident, the pilot of the Beech C90 told the Safety Board investigator that the accident flight was conducted under 14 CFR Part 135, he was the sole pilot, and there were two passengers aboard. His flying day started at 0845, and the accident flight was his fifth flight of the day. The accident flight originated from Bakersfield. He said that the flight was conducted under visual flight rules with flight following from Los Angeles Air Route Traffic Control Center (Los Angeles Center). While descending toward Newhall Pass, as the aircraft reached about 4,000 feet (msl), he was advised that radar contact was lost and to squawk 1200 and contact the Van Nuys Air Traffic Control Tower (Van Nuys Tower). He contacted the tower at Newhall Pass with (ATIS) information Papa and was issued a discrete transponder code and was told to make a straight in approach to runway 16R. He saw the airport and aligned the aircraft with runway 16R. The weather was clear, the visibility was unrestricted, and the sun angle was not a factor. The approach was made by visual reference alone. He stated he never heard anything on the radio about another aircraft that was a factor for him. When he was 3 - 4 miles out on final for 16R with airspeed of 120 - 125 knots, with landing gear down and flaps at the approach position, suddenly and unexpectedly, there was a shadow over his aircraft and the nose of the Gulfstream became visible in the top of his windshield. Immediately there was a loud "bang," his aircraft rocked violently, and he thinks it turned to the right. He looked outside and saw the damage to the left wing and asked his passengers if they were okay. They were very frightened and he said, "We are okay" to reassure them. He heard the Gulfstream transmit that they (the Gulfstream) had either encountered wake turbulence or had hit someone. He transmitted that the Gulfstream had hit them; they were going to land and to "bring out the trucks." Unbeknownst to the King Air pilot, his aircraft's radio antenna had been broken off and he could neither transmit nor could he hear the tower. He slowed the aircraft and proceeded to land. While on short final approach he received a green light from the control tower. After landing, without radio contact, he taxied with care to parking.

In an interview the day following the accident, the pilot-in-command of the Gulfstream G-1159A reported that on the morning of the accident he and the first officer had flown from Van Nuys to Reno, Nevada, as a 14 CFR Part 135 air taxi flight and dropped passengers in Reno. The accident occurred on the return flight, which was a 14 CFR Part 91 repositioning flight. His first officer was the pilot flying for the return trip. They departed Reno on an instrument flight rules (IFR) flight plan and remained IFR throughout the approach (where the accident occurred) and landing. Their arrival route was via the Fillmore VORTAC (navigational aide) and then radar vectors to the Van Nuys ILS (navigational aide) runway 16R final approach course.

The Gulfstream pilot said that as they were established on the ILS final near Magic Mountain [amusement park, 10 miles north of Van Nuys] at 5,000 - 6,000 feet msl and north of the Newhall Pass, they received a traffic advisory from Southern California Terminal Radar

Approach Control (SOCAL Approach) advising them of traffic. He wasn't certain of the bearing but recalled that the traffic was generally in front of them at 2,900 feet msl. As the pilot-not-flying, he spent most of his time looking outside the aircraft for traffic. He recalled looking at the TCAS display, which was on the 5-mile scale, and noting a single target about 5 miles ahead of them. His practice in the terminal area is to keep the TCAS on short range settings to avoid clutter, so he reset the scale to 3 miles and there was no traffic displayed. As they continued the approach, with landing gear and landing flaps extended, they received a second traffic advisory from SOCAL Approach regarding the traffic ahead, and at one point, the first officer flattened the approach until they were about a dot high on the glideslope. He did not recall any TCAS annunciation. He reported that at no time did SOCAL Approach say what the traffic ahead was doing (i.e. preceding them to the airport) nor instruct them to follow anyone or offer or issue vectors for separation from the traffic.

When they were about 4 miles north of the runway threshold, on the ILS at 140 - 145 knots, he felt the aircraft roll. He didn't know what had happened but knew it was not normal. He thought it might have been wake turbulence but he then saw a King Air aircraft below them, on his left and very close. He took control of the aircraft from the first officer and initiated a go-around. The first officer took over communications and reported to Van Nuys Tower that they had possibly had a midair collision and they were going to do a flyby to have the tower check the position of the landing gear and flaps. Following the flyby, the tower said that the landing gear and flaps appeared normal. They turned into right-hand traffic for runway 16R and made two more low passes to confirm the landing gear was undamaged and then made a normal landing.

The Gulfstream pilot also said that the TCAS pretakeoff self-test had been satisfactory prior to both takeoffs that day and that it was his observation, in this and other aircraft, that not all traffic is displayed on TCAS so he still emphasizes visual scanning. He has flown 10 - 15 trips with this first officer previously, and reported they had good cockpit coordination and practiced crew resource management as taught in their training at Flight Safety International.

He also stressed that they had no awareness there had been an aircraft inbound to Van Nuys ahead of them.

In his written statement to the Safety Board, the Gulfstream pilot added that he and his copilot were wearing noise-canceling headsets and communicated via a "hot mic" intercom in which both pilots heard both intercom and radio communications. He elaborated that when they were over Newhall Pass, SOCAL Approach Control "issued a traffic advisory to the effect that traffic was ahead unverified at 2,900 feet (as I recall) and ATC was not talking to them." Following resetting of the TCAS to the 3-mile scale, "both pilots agreed that we had none of the following: 1) Visual contact with any aircraft; 2) TCAS target; 3) ATC vector for traffic or suggested altitude; [or] 4) ATC issuance of instructions to follow another aircraft inbound to Van Nuys. A mutual decision was made by both pilots that we had no traffic within three miles." Following the collision, which he stated was "a soft roll," he "caught sight of a King Air that was 90 degrees left and very close (within 50 feet). I could see the entire airplane

including its tail ahead of our left wing."

In a telephone interview with the Safety Board investigator on the evening of the accident, the first officer (copilot) aboard the Gulfstream said the flight was a Part 135 drop-off in Reno, Nevada and a Part 91 deadhead home. The first officer was the pilot flying on the return trip. He said that the return flight from Reno was unremarkable until the approach to Van Nuys commenced. The flight was on an instrument flight plan and cruised at flight level 330 (approximately 33,000 feet). He said that approaching Van Nuys they could have cancelled IFR because the visibility was very good, however, they remained on the instrument flight plan and executed the "Fernando 5" arrival. About the time they intercepted the glideslope (from above), SOCAL Approach advised they had traffic at 12 o'clock, he did not recall the range, at 2,900 feet, and the controller said, "I'm not talking to him." They replied "we're looking." The captain looked outside full-time to locate the traffic and the first officer divided his time between looking for the traffic and flying the aircraft. There were additional calls about the traffic at 2,900 feet in front of them from SOCAL Approach and he leveled the aircraft for a period of time at 3,000 feet; however, when it appeared the approach was becoming destabilized and they thought the traffic was past, they continued their descent. The aircraft was equipped with TCAS 1 that has a display on both the pilot's and copilot's panels which was set to less than the 10-mile scale. The TCAS announced "traffic, traffic" and he thinks there was traffic displayed close by at near their altitude but he said this version of TCAS does not provide resolution advisories.

They never saw the traffic. About the time they were changing radio frequencies to the Van Nuys tower they felt a shudder in the aircraft that they at first thought was wake turbulence but the captain was suspicious they might have hit another aircraft. The captain took control of the aircraft from the first officer and started a go-around. The first officer notified the tower that they had either encountered severe wake turbulence or had hit someone, and that they were going to do a flyby and ask the tower to look the aircraft over. The landing gear had been extended at the time of the collision and they had three green lights on the landing gear.

They did a flyby and the tower personnel and the pilot of a Hawker HS-125 (on the ground awaiting takeoff clearance) radioed that the gear looked down and normal. Following the flyby, the captain called their company on the radio and the Director of Maintenance (DOM) came out to observe the aircraft as they performed a second flyby. The DOM said the gear looked OK and so the crew returned and made a normal landing with flaps at 20 degrees. The flaps had been at 20 degrees at the time of the collision and they did not want to move them. The first officer said that SOCAL approach was moderately busy but never mentioned the type of aircraft they were looking for or the fact that it was on approach to Van Nuys. He thought, for some reason, that the traffic was crossing in front of them. SOCAL Approach never issued instructions to stop descent and never issued a radar vector for separation.

In his written statement to the Safety Board, the Gulfstream first officer reported that, following the initial traffic advisory from SOCAL Approach Control, "About this time, our TCAS system displayed a traffic advisory in front of us inside three miles. As I recall, SOCAL issued a

second traffic advisory and again mentioned the altitude as 2,900 ft, unverified. At this time, to the best of my recollection, we were descending at approximately 800 fpm, on glide slope, landing gear down at approximately 140-145 KIAS, when I decided to reduce the rate of descent until we were clear of the reported traffic.

We were then handed off to VNY tower, and about this time I recall the TCAS contact disappearing, indicating a non-threat condition. After a minute or two with no traffic conflict announced by VNY tower, displayed on the TCAS, or in sight, [the captain] and I continued our normal descent from a position now approximately one dot above the glide slope. [The captain] suggested full flaps, I concurred, and he lowered the flaps to the full down position. As I gradually increased our rate of descent to recapture the glide slope, we felt the aircraft shudder slightly."

AIRCRAFT INFORMATION

The Gulfstream G3 was equipped with an Allied Signal Aerospace TPU-67A Traffic Collision Avoidance System (TCAS-2) with version 6 software. On October 18, 2000, the TCAS system was ramp tested in accordance with the Allied Signal Aerospace Field Diagnostics Program and satisfied the test for return to service. According to the technician who performed the ramp test, with this model TCAS, when the aircraft's landing gear is extended, the lower TCAS antenna goes into an omni-directional mode wherein targets detected on the lower antenna only are displayed to the flight crew on the cockpit TCAS display with a text message of range and delta altitude but no bearing information. Also, when the aircraft descends below 900 feet radar altitude on approach, resolution advisories are inhibited and only "traffic" advisories are announced. Below 400 feet on approach all audio warnings are inhibited. Version 6 software does not record the history of resolution advisories that have been issued by the TCAS system.

A Federal Aviation Administration (FAA) inspector from the Van Nuys Flight Standards District Office examined the Beech C90 aircraft on the afternoon following the accident and determined that the transponder was set to code 0226. The transponder in the Beech, a King (Honeywell) KT-76 model, was ramp tested in accordance with FAR Part 91.411 and passed the test for return to service on October 18, 2000, including mode C interrogation/reply at airport elevation. The transponder antenna was installed on the lower fuselage, approximately 18 inches to the right of center and even with the wing leading edge. The transponder was installed in the forward instrument panel in a low location and to the right side of the center avionics rack. The pilot told the Safety Board investigator it was a difficult location to both reach across from the pilot's seat to set the transponder and read the characters at the same time.

METEOROLOGICAL INFORMATION

The Van Nuys METAR observation at 1551 included a broken cloud layer at 25,000 feet (msl) and visibility of 10 miles with no restrictions to visibility.

COMMUNICATIONS

Transcripts of radio communications were provided by the FAA's Southwest Region Quality Assurance Office and are attached in the section entitled "Reports from Federal Agencies, FAA."

The Safety Board formed an Air Traffic Control Group to examine the service provided to the two aircraft by FAA Air Traffic Control. The Group Chairman's Factual Report of Investigation is attached. The report notes that the Beech C90 arrived in the Van Nuys terminal area with transponder code 4626 assigned while communicating with Los Angeles Air Route Traffic Control Center. When the Center could not affect a handoff to SOCAL Approach, the Beech pilot was instructed to change his transponder code to 1200 and contact Van Nuys Tower; however, recorded radar data showed that the code was reset to 1206. When initially contacting Van Nuys Tower, the Beech pilot was again given a new transponder code, this time 0220. However, recorded radar data show the Beech replying on code 0226. Code 0226 was a code assigned to the Air Traffic Control Tower at Los Angeles International Airport and, because the Beech was outside Los Angeles' airspace, the air traffic control computer automation software placed the Beech's radar target display in "suspend" status. The "suspend" status resulted in the Beech's target remaining on the radar display but the data block containing the aircraft type, identification and altitude not being displayed, and the data not being available to controllers at SOCAL Approach or Van Nuys Tower until about 1 minute 14 seconds before the collision when the ATC conflict alert activated and displayed a mode-C altitude of 2,900 feet (msl). The report also notes that the controller at SOCAL Approach Control was experiencing frequent, though intermittent, failures of his radio transmitter at the time, and several radio transmissions to the Gulfstream (and other aircraft) had to be repeated numerous times. The controller reported being very frustrated with both the radio (transmitter) and automation (data block) difficulties.

The ATC report notes that the Beech C90 contacted Van Nuys Tower while over the Newhall Pass at 1547:23 while the Gulfstream was still being vectored to the ILS final approach and was 6 miles north of KADIE intersection. The controller instructed the Beech pilot to "make straight in to runway one six right."

At 1549:04, having vectored the Gulfstream onto the Van Nuys Instrument Landing System (ILS) final approach, SOCAL Approach advised the Gulfstream "traffic at twelve to eleven o'clock a mile southbound altitude unknown." The pilot responded, "looking." At 1549:35, SOCAL said, "I'm not talking to the traffic he's twelve o'clock a mile still southbound again I don't know what his altitude is contact van nuys tower [...] maybe they're talking to him." The Gulfstream pilot did not respond. At 1549:50, SOCAL again issued traffic "altitude is unknown twelve o'clock less than a mile contact van nuys tower." Again the Gulfstream pilot did not reply. At 1550:07, SOCAL transmitted "gulfstream two juliet charlie socal." And the pilot responded "yes sir go ahead." At 1550:10, SOCAL Approach said "the traffic's twelve o'clock less than a mile still don't have an altitude on him do you have him in sight?" The Gulfstream pilot replied "negative". At 1550:18, after the conflict alert activated and displayed a mode C

altitude of 2,900 feet, the controller said "two juliet charlie roger just got an altitude now two thousand nine hundred." At 1550:22, the Gulfstream pilot acknowledged and, at 1550:25, SOCAL instructed him to contact Van Nuys Tower, adding "use caution for the traffic once again I'm not talking to him." At this time the Gulfstream was 5.3 miles north of Van Nuys airport and the Beech was 4.9 miles north. According to a SOCAL TRACON airways facility technician, listening to tape recordings made at the facility versus those made at the transmitter site revealed that the two transmissions to the Gulfstream at 1549:35 and 1549:50 were among those that were not transmitted due to the SOCAL transmitter intermittency.

At 1551:06, the Gulfstream made initial contact with Van Nuys tower. Both aircraft were 3 miles north of Van Nuys; the Gulfstream indicated 2,400 feet altitude while the Beech indicated 2,100 feet. The tower transmitted "gulfstream one six two juliet charlie one six right cleared to land." The Gulfstream pilot acknowledged, and asked "do you have any traffic ah for us right in the area?" At 1551:16, the tower replied, "nothing reported." At 1551:32, the tower transmitted "two Juliet Charlie there's uh traffic on final out there who's on uh final?" At 1551:41, the Gulfstream pilot replied "um Juliet charlie's on final we've had a uh we're gonna make a fly by." At 1551:47, the tower said "you're cleared to land runway one six uh right Juliet Charlie there's traffic off your left side for the left runway." At 1551:54, the Gulfstream pilot asked "tower did you see anything just a second ago juliet charlie we hit a strong wake or hit somebody uh do you see anything out here?" At 1552:00, the tower said "uh king air one zero bravo runway one six left cleared to land over," and, at 1552:05, said "uh there's a king air to your left on the left side he's uh just go around this time start a climb and go around six Juliet Charlie." At 1552:11, the Gulfstream pilot said "we'll take it around Juliet Charlie," and, at 1552:15, said "Juliet Charlie has the traffic in sight would like to uh do a flyby then like for you to take a look at the airplane." The radar targets had merged 2.5 miles north of the runway at 1,900 feet. Additional detail is available in the report.

FLIGHT RECORDERS

The Gulfstream G-1159A was equipped with an Allied Signal 980-4700-001, 15-parameter solid state flight data recorder (FDR). The FDR was shipped to the Safety Board recorder laboratory in Washington, D.C. for readout and the specialist's factual report is attached. The parameters recorded are listed on attachment I of the FDR report. The FDR did not record TCAS advisories issued. The specialist's report notes that, about 55 minutes into flight, the normal acceleration parameter spiked to 1.28 g's as the aircraft was descending through 1,886 feet pressure altitude and the bank angle changed from a 0.25-degree left bank to a 7.57-degree right bank. The FDR plot (Attachment II to the report) also shows that about 50 seconds before the normal acceleration spike, the flaps were extended from 20 degrees to 39 degrees and 15 seconds after the spike the flaps were retracted back to 20 degrees.

The Gulfstream G-1159A was also equipped with a Fairchild cockpit voice recorder (CVR). The CVR was also shipped to the Safety Board laboratory; however, the recorder had been permitted to continue operating after the airplane landed and the 30-minute loop of communication tape was overwritten. Because the accident was not captured on the tape, the

Safety Board did not convene a CVR group.

WRECKAGE AND IMPACT INFORMATION

The Safety Board investigator examined the two aircraft on October 18, 2000, at Van Nuys Airport.

The King Air exhibited a dented (flattened) area on the top of the fuselage and a torn skin in the upper surface of the left wing. The flattened area on top of the fuselage extended from over the cockpit bulkhead aft to the frame forming the forward edge of the passenger entry doorway. When viewed from the rear, the flattened area was skewed slightly to the left of the fuselage centerline and was sloped downward to the left side. A string was extended from the flattened area on top of the fuselage to the tear in the wing skin and the slope of the string was measured with an inclinometer to be 15 degrees (down, to the left, when viewed from the rear) with the wings laterally level. The upper communication antenna was broken off at the mounting base.

The left wing of the King Air exhibited a tear in the upper wing skin. The tear was about 3 feet long and extended from immediately in front of the aft wing spar at the midspan of the outer flap segment, forward and outboard; ending immediately aft of the front wing spar even with the flap-aileron juncture. The edges of the wing skin exhibited a torn appearance at the aft, (inboard) end and a folded, compressed appearance at the forward (outboard) end. There was scratch pattern on the upper wing surface along side and parallel to the tear which was angled approximately 40 degrees inboard from front to rear.

The Gulfstream G-1159A exhibited a scratch pattern on the underside of the left wing, damage to the left flap at the outboard tip, and damage to left wing tip fairing and wingtip light lens cover. The scratch pattern on the lower surface of the left wing extended from about 6 inches aft of the leading edge at the aileron midspan diagonally inboard at about a 30-degree angle to the flap/aileron juncture. Approximately the outboard 2 feet of the trailing edge of the left wing trailing edge flap was bent upward about 20 degrees. The left wingtip had minor damage to the tip fairing aft of the light lens cover and the lens cover over the position light and strobe light was broken and absent. In the aft edge of the wingtip light cavity were embedded small pieces of folded aluminum with paint color matching that of the King Air wing skin.

MEDICAL AND PATHOLOGICAL INFORMATION

The Safety Board investigator obtained and reviewed records of the three pilot's medical examination files from the FAA's Medical Certification Branch in Oklahoma City, Oklahoma.

The Beech C90 pilot held a first-class Airmen's Medical Certificate, issued September 25, 2000, with limitation "Holder shall wear corrective lenses." His uncorrected distant vision was 20/200 in each eye separately and with both eyes together. His distant vision was corrected in each eye to 20/20 with corrective lenses. His color vision was marked "pass" and field of

vision "normal." His distant vision on the preceding two applications was reported to be the same.

The pilot of the Gulfstream held a first-class Airmen's Medical Certificate, issued June 12, 2000, without any waivers or limitations. His uncorrected distant vision was report 20/20 in each eye and with both eyes. His color vision was marked "pass" and field of vision "normal." On block 19 of the medical application form, "Visits to Health Professional Within Last three Years," the block "no" was checked and there were no entries on the lines below for health professionals consulted. His prior first-class Airmen's Medical Certificate application, issued November 15, 1999, recorded his uncorrected distant vision as 20/50 in each eye and both eyes together, corrected to 20/20 in each eye separately and both eyes together. The Airmen's Medical Certificate was issued with the limitation: "Must wear corrective lenses." His prior two Airmen's Medical Certificate applications (first-class), dated November 2, 1998, and December 4, 1997, also reported his uncorrected vision as 20/50 and his corrected vision as 20/20. Two first-class airmen's medical certificates issued to the pilot subsequent to the accident on November 7, 2000, and May 14, 2001, were both issued without limitations and both reported the pilot's uncorrected vision to have been 20/20. In a letter to the Safety Board, dated January 22, 2002, the pilot stated he had Lasik eye surgery performed in November 1998, and, subsequently, his vision was 20/20.

The first officer (copilot) of the Gulfstream held a first-class Airmen's Medical Certificate, issued June 6, 2000, with limitation "Holder shall wear corrective lenses." His uncorrected distant vision was reported to be 20/20 in each eye separately and with both eyes together. His color vision was marked "pass" and field of vision "normal." His uncorrected distant vision on the preceding two applications, dated December 6, 1999, and May 4, 1999, was reported to be 20/100 and 20/200, respectively, corrected to 20/20 by contact lenses. A later Airmen's Medical Certificate, issued December 4, 2000 (subsequent to the accident), was issued with the limitation "Holder shall wear corrective lenses" and reported the first officer's uncorrected vision was 20/100, corrected to 20/15."

TESTS AND RESEARCH

The Safety Board prepared a Recorded Aircraft Radar Study to examine the flight path of the two aircraft in the time preceding the collision. The Specialist's Factual Report of Investigation is attached. Figure 3E of the report shows recorded lateral flight path data for the two aircraft based upon Continuous Data Recording (CDR) Air Surveillance Radar (ASR) data that is recorded at approximately 4.5-second intervals. The report author has identified the location at which the two radar targets merged at time 22:51:27 (coordinated universal time, 15:51:27 PDT). The Van Nuys airport is identified at the bottom of the figure as "VNY" and the two aircraft are shown as they approach the airport from the north, the Beech C90 in red and the Gulfstream in Green. In the 6 data sampling intervals prior to the target merge (approximately 27 seconds elapsed time), the Gulfstream's symbol approaches the Beech C90's symbol from the right, rear. Similarly, figure 3K, an alternative software plotting of the same data, shows that at time 22:50:41 (approximately 46 seconds before the collision), the Gulfstream was

approximately 0.2 miles behind the Beech C90, 0.05 miles to the right of the C90, and 500 feet higher altitude. Figure 3M shows the radar altitude profile of the two descending aircraft and again shows the same time at which the two altitude descent profiles merge. In approximately the 40-second time period prior the descent profiles merging, the Gulfstream descent profile approaches the profile of the Beech C90 from above. Page 3G-2, a Track Separation Examination, shows that 6 data sampling intervals (approximately 27-seconds elapsed time) before the altitude separation became "0" (descent profiles merged); the altitude difference between the two aircraft was 500 feet and decreased to "0" over the ensuing 27 seconds.

The Safety Board did not perform a cockpit visibility analysis of either aircraft.

ADDITIONAL INFORMATION

Each aircraft was released to its respective owner on October 18, 2000.

Pilot Information

Certificate:	Airline transport; Commercial	**Age:**	60,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 1 Valid Medical--w/ waivers/lim	**Last FAA Medical Exam:**	September 25, 2000
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	September 14, 2000
Flight Time:	2740 hours (Total, all aircraft), 35 hours (Total, this make and model), 2522 hours (Pilot In Command, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Beech	**Registration:**	N1801B
Model/Series:	C90 C90	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	LJ0634
Landing Gear Type:	Retractable - Tricycle	**Seats:**	8
Date/Type of Last Inspection:	July 14, 2000 Continuous airworthiness	**Certified Max Gross Wt.:**	9650 lbs
Time Since Last Inspection:	62 Hrs	**Engines:**	2 Turbo prop
Airframe Total Time:	8577 Hrs	**Engine Manufacturer:**	Pratt & Whitney Canada
ELT:	Installed, not activated	**Engine Model/Series:**	PT6A-20
Registered Owner:	G&S Equipment Leasing	**Rated Power:**	550 Horsepower
Operator:	SUN QUEST EXECUTIVE AIR CHARTE	**Operating Certificate(s) Held:**	On-demand air taxi (135)
Operator Does Business As:		**Operator Designator Code:**	EIEA

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	VNY,799 ft msl	**Distance from Accident Site:**	4 Nautical Miles
Observation Time:	15:51 Local	**Direction from Accident Site:**	161°
Lowest Cloud Condition:	Unknown	**Visibility**	10 miles
Lowest Ceiling:	Broken / 25000 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	5 knots / None	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	170°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.95 inches Hg	**Temperature/Dew Point:**	31°C / 4°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	BAKERSFIELD, CA (BFL)	**Type of Flight Plan Filed:**	Company VFR
Destination:	VAN NUYS, CA (VNY)	**Type of Clearance:**	VFR
Departure Time:	15:23 Local	**Type of Airspace:**	Class D

Airport Information

Airport:	Van Nuys VNY	**Runway Surface Type:**	Asphalt
Airport Elevation:	799 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	16R	**IFR Approach:**	None
Runway Length/Width:	8001 ft / 150 ft	**VFR Approach/Landing:**	Full stop;Straight-in

Wreckage and Impact Information

Crew Injuries:	1 None	**Aircraft Damage:**	Substantial
Passenger Injuries:	2 None	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	3 None	**Latitude, Longitude:**	34.189697,-118.490097(est)

Administrative Information

Investigator In Charge (IIC):	Parker, R.
Additional Participating Persons:	DONALD S WARNER; FAA Flt Stnds Dist Office; Van Nuys, CA
Original Publish Date:	October 24, 2002
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=50494

Aviation Investigation Final Report

Location:	VAN NUYS, California	**Accident Number:**	LAX01FA018
Date & Time:	October 17, 2000, 15:51 Local	**Registration:**	N162JC
Aircraft:	Gulfstream G-1159A	**Aircraft Damage:**	Minor
Defining Event:		**Injuries:**	3 None
Flight Conducted Under:	Part 91: General aviation - Positioning		

Analysis

The Gulfstream descended from above and behind the Beech C90 and collided with it while both aircraft were on 2.5-mile final approach to the same runway. Visual meteorological conditions prevailed. The Gulfstream was on an ILS instrument approach and the Beech was on a VFR approach. Both airplanes subsequently landed without additional damage or injury to the occupants. Upon initial contact with the air traffic control tower, the Beech C90 was instructed to make a straight-in approach to the runway and was given a transponder code. The pilot miss-set the assigned code, which, due to an air traffic control computer software anomaly, caused the Beech's identifying data block to be suppressed and not available to the radar approach controller. The approach controller attempted to provide traffic advisories to the overtaking Gulfstream pilot but could not determine the Beech's type, destination, or altitude. (Altitude data became available to the controller 1 minute 14 seconds before the collision via a conflict alert message.) The controller did not issue a traffic alert to the Gulfstream crew when the Beech's altitude became known. Additionally, for unrelated reasons, the approach controller experienced frequent failures of his communication radio transmitter and was required to repeat transmissions to the Gulfstream and other aircraft. Despite the traffic point-out, in front of them 1 mile, altitude unknown, and later at short distance at a known altitude near theirs, the Gulfstream flight crew did not visually identify and avoid the Beech nor did they request radar separation services. On initial contact with the tower, the Gulfstream crew was cleared to land on the same runway the tower had previously cleared the Beech to make a straight-in approach to. When asked by the Gulfstream if there was any traffic in their vicinity, the tower replied, "nothing reported." The tower controller realized his mistake approximately 16 seconds later, however, the collision had already occurred. The Gulfstream pilot reported there were no TCAS 2 traffic advisories within 3 miles and there were no resolution advisories. The Gulfstream first officer recalled a TCAS "traffic" advisory close by at near their altitude, but no annunciation in the minute or two before the collision. With the model TCAS aboard the Gulfstream, when the aircraft's landing gear is extended, the lower TCAS antenna goes into an omni-directional mode wherein targets

detected on the lower antenna only are displayed to the flight crew on the cockpit TCAS display with a text message of range and delta altitude but no bearing information. The Beech's transponder antenna was on the lower fuselage and airframe structure shielded it from interrogation by the Gulfstream's TCAS.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The failure of the pilot of the other airplane to correctly set a new transponder code and an anomaly in ATC software that precluded the controller from manually overriding the resulting inhibition of displayed data. Factors in the accident were impaired function of the collision avoidance system in the airplane due to structural masking of the other airplane's transponder antenna, an intermittent failure of the approach controller's communication radio transmitter which interfered with his ability to communicate traffic information to the pilots, the failure of both the approach controller and the tower controller to issue safety alerts when the traffic conflict became apparent, and the failure of the flight crew to maintain an adequate visual lookout to see and avoid the other airplane.

Findings

Occurrence #1: MIDAIR COLLISION
Phase of Operation: APPROACH

Findings
1. TRANSPONDER - RESET/REPOSITIONED - PILOT OF OTHER AIRCRAFT
2. (C) TRANSPONDER - INCORRECT - PILOT OF OTHER AIRCRAFT
3. (C) ATC AUTOMATION SYSTEM - IMPROPER
4. ATC AUTOMATION SYSTEM - LOSS(TOTAL)
5. (F) COLLISION AVOIDANCE SYSTEM - IMPEDED
6. (F) SAFETY ADVISORY - NOT ISSUED - ATC PERSONNEL(DEP/APCH)
7. (F) SAFETY ADVISORY - NOT ISSUED - ATC PERSONNEL(LCL/GND/CLNC)
8. (F) MISCELLANEOUS,ATC FACILITY/EQUIPMENT - LOSS(PARTIAL)
9. (F) VISUAL LOOKOUT - INADEQUATE - FLIGHTCREW

Factual Information

HISTORY OF FLIGHT

On October 17, 2000, at 1551 Pacific daylight time, a Beech C90, N1801B, collided in midair with a Gulfstream Aerospace G-1159A, N162JC, while both aircraft were on 4-mile final approach to runway 16R at the Van Nuys, California, airport. Both aircraft subsequently landed safely at Van Nuys airport, and there were no injuries to the airline transport certificated pilot and two passengers aboard the Beech C90, or to the airline transport certificated pilot and two crewmembers aboard the Gulfstream G-1159A. The Beech C90 was substantially damaged and the Gulfstream G-1159A received minor damage. The Beech C90 was operated on a visual flight rules flight plan under 14 CFR Part 135 as a nonscheduled, domestic air taxi flight by Sun Quest Executive Air Charter, and had departed from Bakersfield, California, at 1520. The Gulfstream G-1159A was operated under instrument flight rules by Trans-Exec Air Service, Inc., under 14 CFR Part 91 as a positioning flight, and had departed from Reno, Nevada, about 1500.

A flight instructor, who was employed by the flight school division of Sun Quest Executive Air Charter, witnessed the midair collision from his car while driving westbound on the 118 freeway just past the 405 freeway interchange. The instructor said he just happened to look upward and his attention was attracted to two aircraft flying in close proximity, one behind the other, nearly co-speed but with the rear aircraft overtaking the aircraft in front of it. The swept wing aircraft that he later learned was a Gulfstream G3 was overtaking a smaller airplane. He couldn't judge altitude precisely; however, as he watched the two aircraft came together and the smaller airplane shuddered and then dropped down out of view behind some trees. It appeared the larger, swept-wing aircraft initiated a go-around maneuver.

Another witness observed the collision from his home in the 10,000 block of Odessa Avenue (2 miles north of the Van Nuys airport). He reported looking up after hearing a jet aircraft and seeing a corporate jet aircraft (which he identified as a "G-3", i.e. Gulfstream) making what he considered a normal approach to the airport but with a smaller, twin-engine propeller aircraft (which he identified as a "King Air") behind and to the left of the corporate jet. The King Air was about one plane length behind the Gulfstream, one fuselage diameter below the jet, and was offset to the left so that the fuselage centerline of the King Air was even with the Gulfstream's left wingtip. As he watched for the next 5 - 7 seconds, the King Air overtook the Gulfstream until the King Air was under the left wing of the Gulfstream. About the time the King Air was under the wing of the Gulfstream, the vertical gap also closed and he observed the King Air to "make some slight maneuvering motions. The wings and fuselage moved around some. The King Air then fluttered like a falling leaf. The nose pointed down and the King Air dove toward the ground with its wings rocking back and forth." The King Air then recovered and continued flying toward the airport. He heard the engines of the Gulfstream

increase in power and the aircraft pulled up and banked right before continuing toward the airport. He lost sight of both airplanes about 5 - 7 seconds after the collision.

PERSONNEL INFORMATION

In an interview the day following the accident, the pilot of the Beech C90 told the Safety Board investigator that the accident flight was conducted under 14 CFR Part 135, he was the sole pilot, and there were two passengers aboard. His flying day started at 0845, and the accident flight was his fifth flight of the day. The accident flight originated from Bakersfield. He said that the flight was conducted under visual flight rules with flight following from Los Angeles Air Route Traffic Control Center (Los Angeles Center). While descending toward Newhall Pass, as the aircraft reached about 4,000 feet (msl), he was advised that radar contact was lost and to squawk 1200 and contact the Van Nuys Air Traffic Control Tower (Van Nuys Tower). He contacted the tower at Newhall Pass with (ATIS) information Papa and was issued a discrete transponder code and was told to make a straight in approach to runway 16R. He saw the airport and aligned the aircraft with runway 16R. The weather was clear, the visibility was unrestricted, and the sun angle was not a factor. The approach was made by visual reference alone. He stated he never heard anything on the radio about another aircraft that was a factor for him. When he was 3 - 4 miles out on final for 16R with airspeed of 120 - 125 knots, with landing gear down and flaps at the approach position, suddenly and unexpectedly, there was a shadow over his aircraft and the nose of the Gulfstream became visible in the top of his windshield. Immediately there was a loud "bang," his aircraft rocked violently, and he thinks it turned to the right. He looked outside and saw the damage to the left wing and asked his passengers if they were okay. They were very frightened and he said, "We are okay" to reassure them. He heard the Gulfstream transmit that they (the Gulfstream) had either encountered wake turbulence or had hit someone. He transmitted that the Gulfstream had hit them; they were going to land and to "bring out the trucks." Unbeknownst to the King Air pilot, his aircraft's radio antenna had been broken off and he could neither transmit nor could he hear the tower. He slowed the aircraft and proceeded to land. While on short final approach he received a green light from the control tower. After landing, without radio contact, he taxied with care to parking.

In an interview the day following the accident, the pilot-in-command of the Gulfstream G-1159A reported that on the morning of the accident he and the first officer had flown from Van Nuys to Reno, Nevada, as a 14 CFR Part 135 air taxi flight and dropped passengers in Reno. The accident occurred on the return flight, which was a 14 CFR Part 91 repositioning flight. His first officer was the pilot flying for the return trip. They departed Reno on an instrument flight rules (IFR) flight plan and remained IFR throughout the approach (where the accident occurred) and landing. Their arrival route was via the Fillmore VORTAC (navigational aide) and then radar vectors to the Van Nuys ILS (navigational aide) runway 16R final approach course.

The Gulfstream pilot said that as they were established on the ILS final near Magic Mountain [amusement park, 10 miles north of Van Nuys] at 5,000 - 6,000 feet msl and north of the Newhall Pass, they received a traffic advisory from Southern California Terminal Radar

Approach Control (SOCAL Approach) advising them of traffic. He wasn't certain of the bearing but recalled that the traffic was generally in front of them at 2,900 feet msl. As the pilot-not-flying, he spent most of his time looking outside the aircraft for traffic. He recalled looking at the TCAS display, which was on the 5-mile scale, and noting a single target about 5 miles ahead of them. His practice in the terminal area is to keep the TCAS on short range settings to avoid clutter, so he reset the scale to 3 miles and there was no traffic displayed. As they continued the approach, with landing gear and landing flaps extended, they received a second traffic advisory from SOCAL Approach regarding the traffic ahead, and at one point, the first officer flattened the approach until they were about a dot high on the glideslope. He did not recall any TCAS annunciation. He reported that at no time did SOCAL Approach say what the traffic ahead was doing (i.e. preceding them to the airport) nor instruct them to follow anyone or offer or issue vectors for separation from the traffic.

When they were about 4 miles north of the runway threshold, on the ILS at 140 - 145 knots, he felt the aircraft roll. He didn't know what had happened but knew it was not normal. He thought it might have been wake turbulence but he then saw a King Air aircraft below them, on his left and very close. He took control of the aircraft from the first officer and initiated a go-around. The first officer took over communications and reported to Van Nuys Tower that they had possibly had a midair collision and they were going to do a flyby to have the tower check the position of the landing gear and flaps. Following the flyby, the tower said that the landing gear and flaps appeared normal. They turned into right-hand traffic for runway 16R and made two more low passes to confirm the landing gear was undamaged and then made a normal landing.

The Gulfstream pilot also said that the TCAS pretakeoff self-test had been satisfactory prior to both takeoffs that day and that it was his observation, in this and other aircraft, that not all traffic is displayed on TCAS so he still emphasizes visual scanning. He has flown 10 - 15 trips with this first officer previously, and reported they had good cockpit coordination and practiced crew resource management as taught in their training at Flight Safety International.

He also stressed that they had no awareness there had been an aircraft inbound to Van Nuys ahead of them.

In his written statement to the Safety Board, the Gulfstream pilot added that he and his copilot were wearing noise-canceling headsets and communicated via a "hot mic" intercom in which both pilots heard both intercom and radio communications. He elaborated that when they were over Newhall Pass, SOCAL Approach Control "issued a traffic advisory to the effect that traffic was ahead unverified at 2,900 feet (as I recall) and ATC was not talking to them." Following resetting of the TCAS to the 3-mile scale, "both pilots agreed that we had none of the following: 1) Visual contact with any aircraft; 2) TCAS target; 3) ATC vector for traffic or suggested altitude; [or] 4) ATC issuance of instructions to follow another aircraft inbound to Van Nuys. A mutual decision was made by both pilots that we had no traffic within three miles." Following the collision, which he stated was "a soft roll," he "caught sight of a King Air that was 90 degrees left and very close (within 50 feet). I could see the entire airplane

including its tail ahead of our left wing."

In a telephone interview with the Safety Board investigator on the evening of the accident, the first officer (copilot) aboard the Gulfstream said the flight was a Part 135 drop-off in Reno, Nevada and a Part 91 deadhead home. The first officer was the pilot flying on the return trip. He said that the return flight from Reno was unremarkable until the approach to Van Nuys commenced. The flight was on an instrument flight plan and cruised at flight level 330 (approximately 33,000 feet). He said that approaching Van Nuys they could have cancelled IFR because the visibility was very good, however, they remained on the instrument flight plan and executed the "Fernando 5" arrival. About the time they intercepted the glideslope (from above), SOCAL Approach advised they had traffic at 12 o'clock, he did not recall the range, at 2,900 feet, and the controller said, "I'm not talking to him." They replied "we're looking." The captain looked outside full-time to locate the traffic and the first officer divided his time between looking for the traffic and flying the aircraft. There were additional calls about the traffic at 2,900 feet in front of them from SOCAL Approach and he leveled the aircraft for a period of time at 3,000 feet; however, when it appeared the approach was becoming destabilized and they thought the traffic was past, they continued their descent. The aircraft was equipped with TCAS 1 that has a display on both the pilot's and copilot's panels which was set to less than the 10-mile scale. The TCAS announced "traffic, traffic" and he thinks there was traffic displayed close by at near their altitude but he said this version of TCAS does not provide resolution advisories.

They never saw the traffic. About the time they were changing radio frequencies to the Van Nuys tower they felt a shudder in the aircraft that they at first thought was wake turbulence but the captain was suspicious they might have hit another aircraft. The captain took control of the aircraft from the first officer and started a go-around. The first officer notified the tower that they had either encountered severe wake turbulence or had hit someone, and that they were going to do a flyby and ask the tower to look the aircraft over. The landing gear had been extended at the time of the collision and they had three green lights on the landing gear.

They did a flyby and the tower personnel and the pilot of a Hawker HS-125 (on the ground awaiting takeoff clearance) radioed that the gear looked down and normal. Following the flyby, the captain called their company on the radio and the Director of Maintenance (DOM) came out to observe the aircraft as they performed a second flyby. The DOM said the gear looked OK and so the crew returned and made a normal landing with flaps at 20 degrees. The flaps had been at 20 degrees at the time of the collision and they did not want to move them. The first officer said that SOCAL approach was moderately busy but never mentioned the type of aircraft they were looking for or the fact that it was on approach to Van Nuys. He thought, for some reason, that the traffic was crossing in front of them. SOCAL Approach never issued instructions to stop descent and never issued a radar vector for separation.

In his written statement to the Safety Board, the Gulfstream first officer reported that, following the initial traffic advisory from SOCAL Approach Control, "About this time, our TCAS system displayed a traffic advisory in front of us inside three miles. As I recall, SOCAL issued a

second traffic advisory and again mentioned the altitude as 2,900 ft, unverified. At this time, to the best of my recollection, we were descending at approximately 800 fpm, on glide slope, landing gear down at approximately 140-145 KIAS, when I decided to reduce the rate of descent until we were clear of the reported traffic.

We were then handed off to VNY tower, and about this time I recall the TCAS contact disappearing, indicating a non-threat condition. After a minute or two with no traffic conflict announced by VNY tower, displayed on the TCAS, or in sight, [the captain] and I continued our normal descent from a position now approximately one dot above the glide slope. [The captain] suggested full flaps, I concurred, and he lowered the flaps to the full down position. As I gradually increased our rate of descent to recapture the glide slope, we felt the aircraft shudder slightly."

AIRCRAFT INFORMATION

The Gulfstream G3 was equipped with an Allied Signal Aerospace TPU-67A Traffic Collision Avoidance System (TCAS-2) with version 6 software. On October 18, 2000, the TCAS system was ramp tested in accordance with the Allied Signal Aerospace Field Diagnostics Program and satisfied the test for return to service. According to the technician who performed the ramp test, with this model TCAS, when the aircraft's landing gear is extended, the lower TCAS antenna goes into an omni-directional mode wherein targets detected on the lower antenna only are displayed to the flight crew on the cockpit TCAS display with a text message of range and delta altitude but no bearing information. Also, when the aircraft descends below 900 feet radar altitude on approach, resolution advisories are inhibited and only "traffic" advisories are announced. Below 400 feet on approach all audio warnings are inhibited. Version 6 software does not record the history of resolution advisories that have been issued by the TCAS system.

A Federal Aviation Administration (FAA) inspector from the Van Nuys Flight Standards District Office examined the Beech C90 aircraft on the afternoon following the accident and determined that the transponder was set to code 0226. The transponder in the Beech, a King (Honeywell) KT-76 model, was ramp tested in accordance with FAR Part 91.411 and passed the test for return to service on October 18, 2000, including mode C interrogation/reply at airport elevation. The transponder antenna was installed on the lower fuselage, approximately 18 inches to the right of center and even with the wing leading edge. The transponder was installed in the forward instrument panel in a low location and to the right side of the center avionics rack. The pilot told the Safety Board investigator it was a difficult location to both reach across from the pilot's seat to set the transponder and read the characters at the same time.

METEOROLOGICAL INFORMATION

The Van Nuys METAR observation at 1551 included a broken cloud layer at 25,000 feet (msl) and visibility of 10 miles with no restrictions to visibility.

COMMUNICATIONS

Transcripts of radio communications were provided by the FAA's Southwest Region Quality Assurance Office and are attached in the section entitled "Reports from Federal Agencies, FAA."

The Safety Board formed an Air Traffic Control Group to examine the service provided to the two aircraft by FAA Air Traffic Control. The Group Chairman's Factual Report of Investigation is attached. The report notes that the Beech C90 arrived in the Van Nuys terminal area with transponder code 4626 assigned while communicating with Los Angeles Air Route Traffic Control Center. When the Center could not affect a handoff to SOCAL Approach, the Beech pilot was instructed to change his transponder code to 1200 and contact Van Nuys Tower; however, recorded radar data showed that the code was reset to 1206. When initially contacting Van Nuys Tower, the Beech pilot was again given a new transponder code, this time 0220. However, recorded radar data show the Beech replying on code 0226. Code 0226 was a code assigned to the Air Traffic Control Tower at Los Angeles International Airport and, because the Beech was outside Los Angeles' airspace, the air traffic control computer automation software placed the Beech's radar target display in "suspend" status. The "suspend" status resulted in the Beech's target remaining on the radar display but the data block containing the aircraft type, identification and altitude not being displayed, and the data not being available to controllers at SOCAL Approach or Van Nuys Tower until about 1 minute 14 seconds before the collision when the ATC conflict alert activated and displayed a mode-C altitude of 2,900 feet (msl). The report also notes that the controller at SOCAL Approach Control was experiencing frequent, though intermittent, failures of his radio transmitter at the time, and several radio transmissions to the Gulfstream (and other aircraft) had to be repeated numerous times. The controller reported being very frustrated with both the radio (transmitter) and automation (data block) difficulties.

The ATC report notes that the Beech C90 contacted Van Nuys Tower while over the Newhall Pass at 1547:23 while the Gulfstream was still being vectored to the ILS final approach and was 6 miles north of KADIE intersection. The controller instructed the Beech pilot to "make straight in to runway one six right."

At 1549:04, having vectored the Gulfstream onto the Van Nuys Instrument Landing System (ILS) final approach, SOCAL Approach advised the Gulfstream "traffic at twelve to eleven o'clock a mile southbound altitude unknown." The pilot responded, "looking." At 1549:35, SOCAL said, "I'm not talking to the traffic he's twelve o'clock a mile still southbound again I don't know what his altitude is contact van nuys tower [...] maybe they're talking to him." The Gulfstream pilot did not respond. At 1549:50, SOCAL again issued traffic "altitude is unknown twelve o'clock less than a mile contact van nuys tower." Again the Gulfstream pilot did not reply. At 1550:07, SOCAL transmitted "gulfstream two juliet charlie socal." And the pilot responded "yes sir go ahead." At 1550:10, SOCAL Approach said "the traffic's twelve o'clock less than a mile still don't have an altitude on him do you have him in sight?" The Gulfstream pilot replied "negative". At 1550:18, after the conflict alert activated and displayed a mode C

altitude of 2,900 feet, the controller said "two juliet charlie roger just got an altitude now two thousand nine hundred." At 1550:22, the Gulfstream pilot acknowledged and, at 1550:25, SOCAL instructed him to contact Van Nuys Tower, adding "use caution for the traffic once again I'm not talking to him." At this time the Gulfstream was 5.3 miles north of Van Nuys airport and the Beech was 4.9 miles north. According to a SOCAL TRACON airways facility technician, listening to tape recordings made at the facility versus those made at the transmitter site revealed that the two transmissions to the Gulfstream at 1549:35 and 1549:50 were among those that were not transmitted due to the SOCAL transmitter intermittency.

At 1551:06, the Gulfstream made initial contact with Van Nuys tower. Both aircraft were 3 miles north of Van Nuys; the Gulfstream indicated 2,400 feet altitude while the Beech indicated 2,100 feet. The tower transmitted "gulfstream one six two juliet charlie one six right cleared to land." The Gulfstream pilot acknowledged, and asked "do you have any traffic ah for us right in the area?" At 1551:16, the tower replied, "nothing reported." At 1551:32, the tower transmitted "two Juliet Charlie there's uh traffic on final out there who's on uh final?" At 1551:41, the Gulfstream pilot replied "um Juliet charlie's on final we've had a uh we're gonna make a fly by." At 1551:47, the tower said "you're cleared to land runway one six uh right Juliet Charlie there's traffic off your left side for the left runway." At 1551:54, the Gulfstream pilot asked "tower did you see anything just a second ago juliet charlie we hit a strong wake or hit somebody uh do you see anything out here?" At 1552:00, the tower said "uh king air one zero bravo runway one six left cleared to land over," and, at 1552:05, said "uh there's a king air to your left on the left side he's uh just go around this time start a climb and go around six Juliet Charlie." At 1552:11, the Gulfstream pilot said "we'll take it around Juliet Charlie," and, at 1552:15, said "Juliet Charlie has the traffic in sight would like to uh do a flyby then like for you to take a look at the airplane." The radar targets had merged 2.5 miles north of the runway at 1,900 feet. Additional detail is available in the report.

FLIGHT RECORDERS

The Gulfstream G-1159A was equipped with an Allied Signal 980-4700-001, 15-parameter solid state flight data recorder (FDR). The FDR was shipped to the Safety Board recorder laboratory in Washington, D.C. for readout and the specialist's factual report is attached. The parameters recorded are listed on attachment I of the FDR report. The FDR did not record TCAS advisories issued. The specialist's report notes that, about 55 minutes into flight, the normal acceleration parameter spiked to 1.28 g's as the aircraft was descending through 1,886 feet pressure altitude and the bank angle changed from a 0.25-degree left bank to a 7.57-degree right bank. The FDR plot (Attachment II to the report) also shows that about 50 seconds before the normal acceleration spike, the flaps were extended from 20 degrees to 39 degrees and 15 seconds after the spike the flaps were retracted back to 20 degrees.

The Gulfstream G-1159A was also equipped with a Fairchild cockpit voice recorder (CVR). The CVR was also shipped to the Safety Board laboratory; however, the recorder had been permitted to continue operating after the airplane landed and the 30-minute loop of communication tape was overwritten. Because the accident was not captured on the tape, the

Safety Board did not convene a CVR group.

WRECKAGE AND IMPACT INFORMATION

The Safety Board investigator examined the two aircraft on October 18, 2000, at Van Nuys Airport.

The King Air exhibited a dented (flattened) area on the top of the fuselage and a torn skin in the upper surface of the left wing. The flattened area on top of the fuselage extended from over the cockpit bulkhead aft to the frame forming the forward edge of the passenger entry doorway. When viewed from the rear, the flattened area was skewed slightly to the left of the fuselage centerline and was sloped downward to the left side. A string was extended from the flattened area on top of the fuselage to the tear in the wing skin and the slope of the string was measured with an inclinometer to be 15 degrees (down, to the left, when viewed from the rear) with the wings laterally level. The upper communication antenna was broken off at the mounting base.

The left wing of the King Air exhibited a tear in the upper wing skin. The tear was about 3 feet long and extended from immediately in front of the aft wing spar at the midspan of the outer flap segment, forward and outboard; ending immediately aft of the front wing spar even with the flap-aileron juncture. The edges of the wing skin exhibited a torn appearance at the aft, (inboard) end and a folded, compressed appearance at the forward (outboard) end. There was scratch pattern on the upper wing surface along side and parallel to the tear which was angled approximately 40 degrees inboard from front to rear.

The Gulfstream G-1159A exhibited a scratch pattern on the underside of the left wing, damage to the left flap at the outboard tip, and damage to left wing tip fairing and wingtip light lens cover. The scratch pattern on the lower surface of the left wing extended from about 6 inches aft of the leading edge at the aileron midspan diagonally inboard at about a 30-degree angle to the flap/aileron juncture. Approximately the outboard 2 feet of the trailing edge of the left wing trailing edge flap was bent upward about 20 degrees. The left wingtip had minor damage to the tip fairing aft of the light lens cover and the lens cover over the position light and strobe light was broken and absent. In the aft edge of the wingtip light cavity were embedded small pieces of folded aluminum with paint color matching that of the King Air wing skin.

MEDICAL AND PATHOLOGICAL INFORMATION

The Safety Board investigator obtained and reviewed records of the three pilot's medical examination files from the FAA's Medical Certification Branch in Oklahoma City, Oklahoma.

The Beech C90 pilot held a first-class Airmen's Medical Certificate, issued September 25, 2000, with limitation "Holder shall wear corrective lenses." His uncorrected distant vision was 20/200 in each eye separately and with both eyes together. His distant vision was corrected in each eye to 20/20 with corrective lenses. His color vision was marked "pass" and field of

vision "normal." His distant vision on the preceding two applications was reported to be the same.

The pilot of the Gulfstream held a first-class Airmen's Medical Certificate, issued June 12, 2000, without any waivers or limitations. His uncorrected distant vision was report 20/20 in each eye and with both eyes. His color vision was marked "pass" and field of vision "normal." On block 19 of the medical application form, "Visits to Health Professional Within Last three Years," the block "no" was checked and there were no entries on the lines below for health professionals consulted. His prior first-class Airmen's Medical Certificate application, issued November 15, 1999, recorded his uncorrected distant vision as 20/50 in each eye and both eyes together, corrected to 20/20 in each eye separately and both eyes together. The Airmen's Medical Certificate was issued with the limitation: "Must wear corrective lenses." His prior two Airmen's Medical Certificate applications (first-class), dated November 2, 1998, and December 4, 1997, also reported his uncorrected vision as 20/50 and his corrected vision as 20/20. Two first-class airmen's medical certificates issued to the pilot subsequent to the accident on November 7, 2000, and May 14, 2001, were both issued without limitations and both reported the pilot's uncorrected vision to have been 20/20. In a letter to the Safety Board, dated January 22, 2002, the pilot stated he had Lasik eye surgery performed in November 1998, and, subsequently, his vision was 20/20.

The first officer (copilot) of the Gulfstream held a first-class Airmen's Medical Certificate, issued June 6, 2000, with limitation "Holder shall wear corrective lenses." His uncorrected distant vision was reported to be 20/20 in each eye separately and with both eyes together. His color vision was marked "pass" and field of vision "normal." His uncorrected distant vision on the preceding two applications, dated December 6, 1999, and May 4, 1999, was reported to be 20/100 and 20/200, respectively, corrected to 20/20 by contact lenses. A later Airmen's Medical Certificate, issued December 4, 2000 (subsequent to the accident), was issued with the limitation "Holder shall wear corrective lenses" and reported the first officer's uncorrected vision was 20/100, corrected to 20/15."

TESTS AND RESEARCH

The Safety Board prepared a Recorded Aircraft Radar Study to examine the flight path of the two aircraft in the time preceding the collision. The Specialist's Factual Report of Investigation is attached. Figure 3E of the report shows recorded lateral flight path data for the two aircraft based upon Continuous Data Recording (CDR) Air Surveillance Radar (ASR) data that is recorded at approximately 4.5-second intervals. The report author has identified the location at which the two radar targets merged at time 22:51:27 (coordinated universal time, 15:51:27 PDT). The Van Nuys airport is identified at the bottom of the figure as "VNY" and the two aircraft are shown as they approach the airport from the north, the Beech C90 in red and the Gulfstream in Green. In the 6 data sampling intervals prior to the target merge (approximately 27 seconds elapsed time), the Gulfstream's symbol approaches the Beech C90's symbol from the right, rear. Similarly, figure 3K, an alternative software plotting of the same data, shows that at time 22:50:41 (approximately 46 seconds before the collision), the Gulfstream was

approximately 0.2 miles behind the Beech C90, 0.05 miles to the right of the C90, and 500 feet higher altitude. Figure 3M shows the radar altitude profile of the two descending aircraft and again shows the same time at which the two altitude descent profiles merge. In approximately the 40-second time period prior the descent profiles merging, the Gulfstream descent profile approaches the profile of the Beech C90 from above. Page 3G-2, a Track Separation Examination, shows that 6 data sampling intervals (approximately 27-seconds elapsed time) before the altitude separation became "0" (descent profiles merged); the altitude difference between the two aircraft was 500 feet and decreased to "0" over the ensuing 27 seconds.

The Safety Board did not perform a cockpit visibility analysis of either aircraft.

ADDITIONAL INFORMATION

Each aircraft was released to its respective owner on October 18, 2000.

Pilot Information

Certificate:	Airline transport; Commercial	**Age:**	45,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 1 Valid Medical--no waivers/lim.	**Last FAA Medical Exam:**	June 12, 2000
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	June 8, 2000
Flight Time:	9921 hours (Total, all aircraft), 4034 hours (Total, this make and model), 6078 hours (Pilot In Command, all aircraft), 190 hours (Last 90 days, all aircraft), 79 hours (Last 30 days, all aircraft), 2 hours (Last 24 hours, all aircraft)		

Co-pilot Information

Certificate:	Airline transport; Commercial; Flight instructor	**Age:**	44,Male
Airplane Rating(s):	Single-engine land; Single-engine sea; Multi-engine land; Multi-engine sea	**Seat Occupied:**	Right
Other Aircraft Rating(s):	Glider	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	Airplane single-engine; Glider	**Toxicology Performed:**	No
Medical Certification:	Class 1 Valid Medical--w/ waivers/lim	**Last FAA Medical Exam:**	June 6, 2000
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	September 1, 1999
Flight Time:	2644 hours (Total, all aircraft), 366 hours (Total, this make and model), 1849 hours (Pilot In Command, all aircraft), 178 hours (Last 90 days, all aircraft), 49 hours (Last 30 days, all aircraft), 2 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Gulfstream	**Registration:**	N162JC
Model/Series:	G-1159A G-1159A	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Transport	**Serial Number:**	373
Landing Gear Type:	Retractable - Tricycle	**Seats:**	17
Date/Type of Last Inspection:	July 21, 2000 Continuous airworthiness	**Certified Max Gross Wt.:**	69700 lbs
Time Since Last Inspection:	102 Hrs	**Engines:**	2 Turbo jet
Airframe Total Time:	6162 Hrs at time of accident	**Engine Manufacturer:**	Rolls-Royce
ELT:	Installed, not activated	**Engine Model/Series:**	Spey 511-8
Registered Owner:	Pit Bull Productions, Inc.	**Rated Power:**	11400 Lbs thrust
Operator:	TRANS-EXEC AIR SERVICE, INC.	**Operating Certificate(s) Held:**	On-demand air taxi (135)
Operator Does Business As:		**Operator Designator Code:**	DVYA

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	VNY,799 ft msl	**Distance from Accident Site:**	4 Nautical Miles
Observation Time:	15:51 Local	**Direction from Accident Site:**	161°
Lowest Cloud Condition:	Unknown	**Visibility**	10 miles
Lowest Ceiling:	Broken / 25000 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	5 knots / None	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	170°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.95 inches Hg	**Temperature/Dew Point:**	31°C / 4°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	RENO, NV (RNO)	**Type of Flight Plan Filed:**	IFR
Destination:	VAN NUYS, CA (VNY)	**Type of Clearance:**	IFR
Departure Time:	14:55 Local	**Type of Airspace:**	Class D

Airport Information

Airport:	Van Nuys VNY	**Runway Surface Type:**	Asphalt
Airport Elevation:	799 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	16R	**IFR Approach:**	None
Runway Length/Width:	8001 ft / 150 ft	**VFR Approach/Landing:**	Full stop;Straight-in

Wreckage and Impact Information

Crew Injuries:	3 None	**Aircraft Damage:**	Minor
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	3 None	**Latitude, Longitude:**	34.189697,-118.490097(est)

Administrative Information

Investigator In Charge (IIC):	Parker, R.
Additional Participating Persons:	DONALD S WARNER; FAA Flt Stnds Dist Office; Van Nuys, CA
Original Publish Date:	October 24, 2002
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=50494