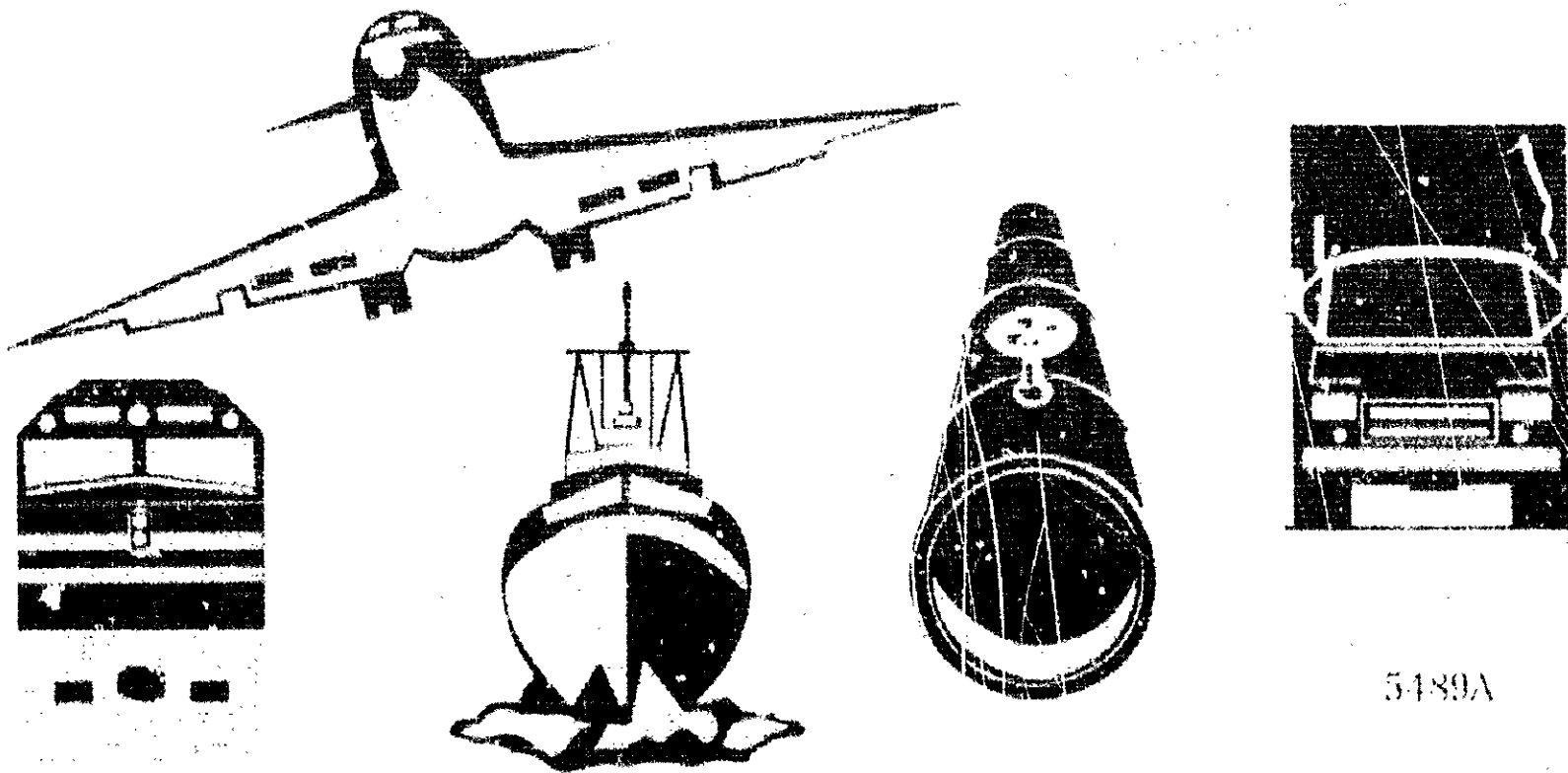


NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

AIRCRAFT ACCIDENT/INCIDENT SUMMARY REPORT

MIDAIR COLLISION INVOLVING
LYCOMING AIR SERVICES PIPER AEROSTAR PA-60 AND
SUN COMPANY AVIATION DEPARTMENT BELL 412,
MERION, PENNSYLVANIA
APRIL 4, 1991



5489A

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APRIL 4, 1991**

**ADOPTED: September 17, 1991
NOTATION 5489A**

Abstract: This report explains the midair collision involving a Lycoming Air Services Piper Aerostar PA-60 and a Sun Company Aviation Department Bell 412. The Safety issues discussed include pilot judgment, the training and checking of flightcrews, the adequacy of the PA-60 flight manual, and FAA surveillance of the carrier.



**National
Transportation
Safety Board**

Washington, D.C. 20594

AIRCRAFT ACCIDENT/INCIDENT SUMMARY

Accident No:	DCA-91-MA-031A/B
Aircraft Operator No.1:	Lycoming Air Services, Inc.
Aircraft Type and Registration No.1:	Piper PA-60, N3645D
Aircraft Operator No.2:	Sun Company Aviation Department
Aircraft Type and Registration No.2:	Bell Helicopter Model 412SP, N78S
Location:	Merion, Pennsylvania
Date and Time:	April 4, 1991, 1210 eastern standard time
Injuries:	7 Fatal, 1 Serious, 4 Minor
Type of Occurrence:	Midair Collision
Phase of Operation:	Maneuvering for Landing

1. THE ACCIDENT

On April 4, 1991, a Lycoming Air Services Piper Aerostar, PA-60, N3645D, was operating as an on-demand air taxi flight under 14 Code of Federal Regulations (CFR) Part 135. The airplane had departed the Williamsport-Lycoming County Airport (IPT), Williamsport, Pennsylvania, around 1022 eastern standard time on an instrument flight rules (IFR) flight plan for the Philadelphia International Airport (PHL), Philadelphia, Pennsylvania. The captain, first officer, and one passenger were on board.

The takeoff and en route portions of the flight were uneventful. As it approached PHL, the flight was cleared for an instrument landing system approach to runway 17. While on the approach, at 1201:28, the captain of N3645D reported that the nose landing gear position light had not illuminated to indicate that the nose gear was in the down and locked position and that he might need to cycle the landing gear. Lycoming Air Service representatives, upon listening to the air traffic control (ATC) recording, identified the captain's voice as making the transmissions from the airplane. Lycoming Air Service officials reported that the PA-60 is normally a single-pilot airplane. The Safety Board believes that the captain was flying the airplane, as well as making the radio transmissions.

Shortly before N3645D began its approach, a Bell 412SP helicopter, N78S, operated by Sun Company Aviation Department, departed from the company's helicopter landing pad at PHL on a visual flight rules (VFR) flight to Sun Company corporate headquarters in Radnor, Pennsylvania. The captain and first officer were the only persons on board. The aircraft was operated under 14 CFR Part 91. As N78S departed the PHL terminal control area (TCA), the pilots heard the communications regarding the possible unsafe nose gear indication on N3645D.

The crew of N3645D was told to maintain 1,500 feet to allow N78S to pass underneath as the helicopter departed the area. As he passed under N3645D, at 1202:29, one of the pilots of N78S reported to the tower "that Aerostar that went past us, looks like the gear is down." Sun Company personnel identified the voice making the radio transmissions from the flight to ATC as being that of the first officer. However, several subsequent transmissions from N78S were made by the captain. The chief pilot for Sun Company indicated that the flightcrew wore head sets equipped with boom microphones and that there were push-to-talk buttons on the flight controls. Thus, it would not be unusual for the flying pilot to transmit. The Safety Board believes that the captain was flying the helicopter, but the pilots may have switched flying roles at times during the flight.

The captain of N3645D acknowledged to ATC that he had heard N78S's transmission and stated that "I can tell it's down but I don't know if it's locked, that's the only problem." A reflection of the nose landing gear can be seen from the cockpit on the propeller spinner. The tower acknowledged the transmission and advised that the helicopter was no longer a factor and that N3645D was cleared to land on runway 17. The controller later stated that he interpreted N3645D's situation as justifying an emergency. The tower supervisor alerted the airport's aircraft rescue and fire fighting units (ARFF). Additionally, runway 17 arrivals were terminated through a coordinated effort between the tower and approach control, resulting in a relatively clear communications frequency. The local controller contacted N3645D and requested the number of occupants and amount of fuel on board.

At 1203:35, the controller offered N3645D the option of making a low-altitude pass by the control tower so that the tower personnel could observe the position of the nose gear. The controller further stated that there was "almost no traffic right now - we can do whatever you like." N3645D acknowledged that it would do a flyby of the tower. At 1204:12, the captain of N78S advised the tower that they "could take a real close look at that if you wanted." The tower acknowledged the transmission. At 1204:19, the captain replied that N78S was turning back to the airport, presumably to perform an in-flight inspection of N3645D's nose gear.

As N3645D passed by the control tower, the controller advised that the nose gear appeared to be down. The captain of N3645D responded that he could see the nose gear in the reflection of the propeller spinner and that it appeared to be down, but the indicator light was not green. The controller requested N3645D to make a left turn and enter a downwind leg for runway 17. He further advised that N78S was inbound from the north and that N78S could take a look at the nose gear. At 1205:30, the captain of N3645D stated "Okay, I appreciate it." The controller further advised that the ARFF equipment was on the runway.

Sun Company officials reported that it was company policy to be "good neighbors" and that they had offered the services of the company's aircraft and flightcrews to local communities in the event of emergency situations, such as medical evacuations, and searching for lost persons. Several controllers reported that the Sun helicopter had, on previous occasions, assisted the tower in locating vehicles or people on the airport property.

The chief pilot for Sun Company stated that he was not aware of any previous in-flight inspections of other aircraft by the pilots of N78S or other Sun Company pilots.

Commencing at 1205:45, the controller provided directional information to the flightcrew of N78S to assist in visually acquiring N3645D. This information was acknowledged by the first officer. By 1207:54, the pilots of each aircraft acknowledged that they had each other in sight and that a speed of 125 knots would be used during the join up. At that time, the aircraft were joining up on an extended downwind leg for runway 17 at a altitude of about 1,100 feet. The controller advised N3645D of antenna towers 6 miles ahead and requested the pilot of N3645D to notify the tower when he wanted to turn back toward the airport or make a heading change.

At 1208:21, the captain of N78S contacted N3645D directly on tower frequency and requested that the pilot of N3645D slow down. At 1208:52, the first officer of N78S contacted N3645D and stated that "we're going to come up behind you on your left side so just hold your heading." The captain of N3645D responded that the antenna towers were straight ahead and that he might need to change heading by 15° to the left. At 1209:30, the first officer of N78S stated on tower frequency "Aerostar, we're gonna pass around your right side now, take a look at everything as we go by." The captain of N3645D responded with "Okay." At 1210:00, there was a transmission from N3645D that was unintelligible because of a transmission from another aircraft. The controller asked N3645D to repeat the transmission, and the pilot of N3645D again stated that the indicator for the nose gear did not show down and locked.

At 1210:16, the first officer of N78S stated "everything looks good from here. The captain of N3645D replied "Okay, appreciate that we'll start to turn in." These transmissions were the last ones received from either N78S or N3645D. The last transmission was abruptly terminated by considerable noise. At 1210:51, the controller requested N3645D to make a left turn back to the airport, and he cleared the airplane to land on runway 17. Shortly thereafter, the controller noticed a smoke plume to the north of the airport. Subsequent attempts by the controller to contact either N78S or N3645D by radio were unsuccessful.

The reported surface weather at 1150 at PHL was, in part, as follows:

Ceiling--25,000 feet scattered; visibility--10 miles; temperature--59° F; dewpoint--40° F; wind--250° at 8 knots; altimeter setting--30.51 inches of mercury.

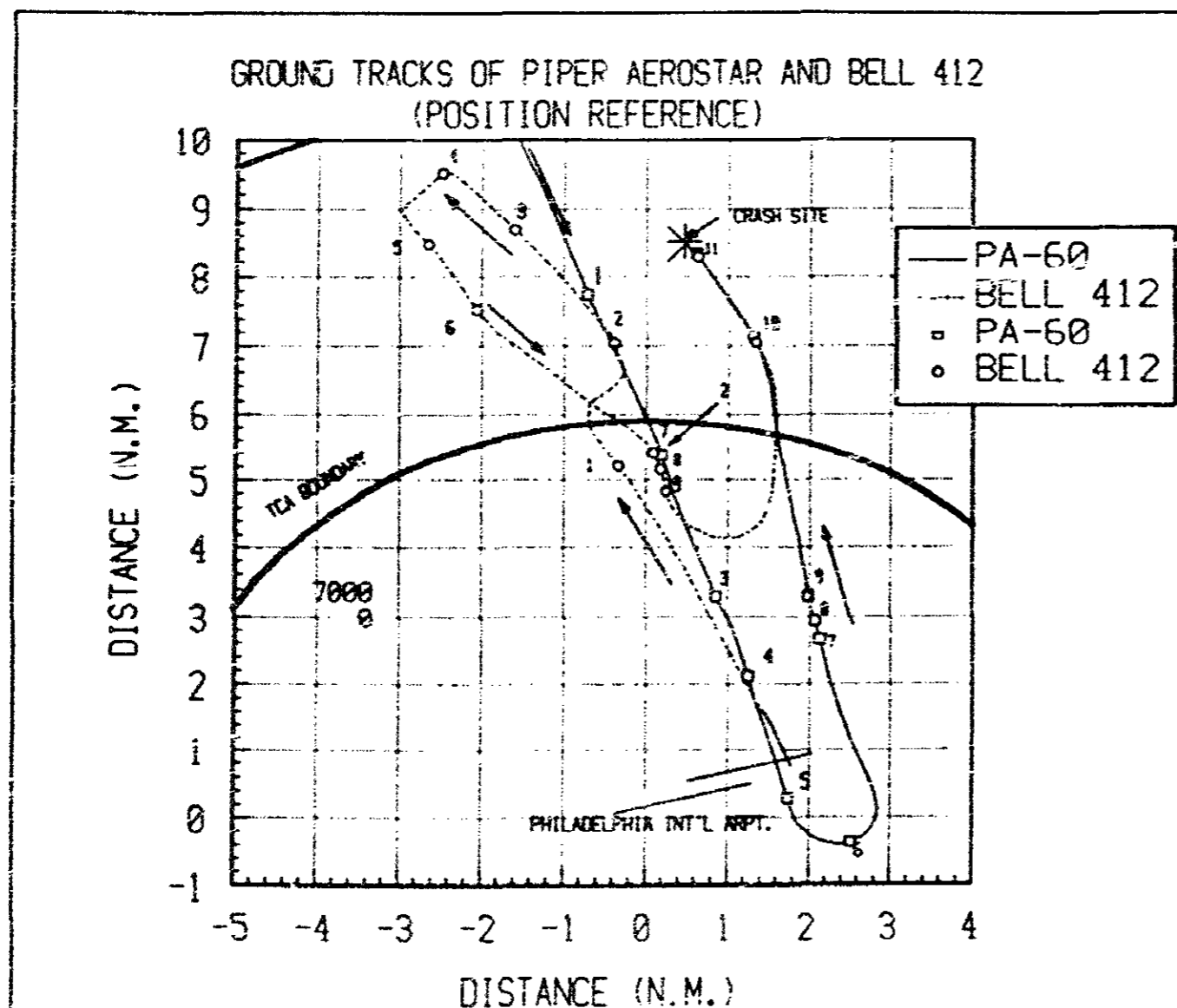
The 1250 weather report was essentially the same; however, the winds had changed to 240° at 10 knots with gusts to 15 knots. Light to moderate turbulence was reported at 1157 by a pilot of a Cessna 150 at a flight level of 3,000 feet. At the time of the report, the Cessna was about 27 nautical miles (nmi) north of PHL. There were no pilot reports of wind gusts near PHL airport.

2. THE COLLISION

Figure 1 represents the ground tracks of N78S and N3645D. Since the encoded altitude (Mode C) coordinates of the radar data have a resolution of 100 feet for a tolerance of plus or minus 50 feet, it was not possible to develop definitive plots of the altitude and airspeed profiles of the two aircraft. However, within the accuracy limits of the data, it would appear that their altitudes and airspeeds were relatively constant during and after the join up maneuver, although there were variations in the altitudes for both aircraft, including a possible gain in altitude by N78S just prior to the collision. Since the helicopter was behind and below N3645D, it would have been virtually impossible for either the captain or first officer of N3645D to maintain a continuous observation of N78S. This situation was further complicated by the need to maintain visual contact with the antenna towers that were nearly directly ahead. The Safety Board believes that during the join up and while the crew of N78S was inspecting the landing gear, it would have been incumbent upon the pilot of N3645D to maintain a constant altitude and airspeed. Such action would have minimized the efforts of the pilots of N78S to maintain position with N3645D. However, the pilot of N78S had a responsibility to maintain a safe distance from the aircraft to allow for any possible deviations in the flightpath of N3645D.

The investigation found that the cockpit overhead windows on N78S had been permanently covered. When the Bell 412 was certificated for IFR operations, the reflection of light from the main rotor was reportedly found to induce flicker vertigo in the pilots. Consequently, the installation of curtains or other means of blocking the reflected light was required for IFR certification. N78S had initially been fitted with removable curtains. Later, the windows were painted over, and a noise insulation barrier was installed to reduce the ambient cabin noise. Additionally, the pilots of N78S are said to have normally adjusted their seats to a full-up or a nearly full-up position. As a result, the flightcrew of N78S would have had unobstructed vision forward and to the sides but they would have been unable to see objects directly above their aircraft. In this position, upward visibility was limited approximately to an angle that intercepted the main rotor tip.

Eyewitnesses stated that they first noticed the two aircraft because of the relatively loud noise from the helicopter engines and rotor blades. After they saw how close together the two aircraft were flying, the witnesses continued to watch them, primarily because it was unusual to see two aircraft flying in such close proximity at such a relatively low altitude. Most of the witnesses reported that before the collision the aircraft were flying straight and level and that their flight paths were parallel. Although many witnesses saw the aircraft collide, reports about movements of the aircraft just before the collision varied considerably. There was general agreement that before the collision the helicopter was below and to the right of the airplane. Several witnesses reported that the airplane veered to the right and struck the helicopter. Other witnesses reported that the helicopter climbed and collided with the airplane. Most of the witnesses said that the first impact was the rotor of the helicopter striking the underside of the airplane. One witness, who was on the roof of a house, stated that the wind



- 1) N3645D "we don't have a nose gear indication"
- 2) N3645D "I can tell it's down but I don't know if its locked that's the only problem"
- 3) Tower "if you want to make a pass by the tower maybe we can take a look at it"
- 4) N78S "tower seven eight sierra could ch take a real close look at that if you want"
- 5) Tower "gear looks down.... I've got a helicopter north of the airport he said he could take a look at it if you like"
- 6) Tower "that helicopter is about a mile south of the airport... I'll point he out as you get closer"
- 7) N3645D "four five delta has the helicopter in sight"
- 8) Tower "helicopter seven eight sierra the aerostar is on your left northbound"
- 9) N78S "we have the aerostar we'll uh we'll turn left and follow him northbound and take a look at the gear"
- 10) N78S "aerostar we're gonna pass around your right side now and take a look at everything as we go by"
- 11) N78S "everything looks good from here"

CT

Figure 1.--Ground tracks of N3645D and N785.

began to gust shortly before the aircraft collided. The witnesses reported that after the collision they saw fire on the right side of the airplane and fire on top of the helicopter's cabin. Witnesses reported that numerous parts came off both aircraft following the collision. The investigation determined that the outer right wing panel from N3546D and one of the main rotor blades from N78S had separated from the respective aircraft as a result of the collision. Therefore, both aircraft were rendered uncontrollable because of damage from impact with each other.

N3645D came to rest in the front yard of the Merion Elementary School, just to the right of the entrance loop to the school. N78S came to rest just behind the school building. The flightcrews aboard both aircraft and the passenger aboard N3645D were fatally injured. Two persons on the ground at the rear of the school were fatally injured by debris. One person on the ground was severely injured by fire. Four other persons received minor injuries.

The accident occurred about 1210:20, during the hours of daylight, at 40° 00' 05" north latitude and 75° 15' 26" west longitude. At the time of the collision, both aircraft were outside the TCA for PHL.

Both aircraft were destroyed by impact with the ground and postcrash fire. The value of the Piper PA-60 was estimated at \$135,000 before the accident. The value of the Bell 412 helicopter was estimated at \$4,500,000 before the accident. Several private residences were damaged by falling debris. In the school yard, one tree, landscaping timbers, and lawn grass were destroyed or substantially damaged by impact and the postcrash fire.

3. THE FLIGHTCREWS

The investigation revealed that the flightcrews of both aircraft were properly certificated in accordance with existing Federal Aviation Regulations (FARs). People who had seen or talked to the pilots before their respective flights reported that the four pilots were in good spirits and appeared well rested. The investigation revealed that the four pilots were in good general health and had the proper FAA medical certification at the time of the accident. The examination of toxicological specimens obtained following the accident indicated that the pilots were not under the influence of, or impaired by, drugs or alcohol at the time of the accident.

The investigation found that the pilots of N78S had not received any formal training in formation flying. However, on at least one occasion, they had flown in close proximity to another helicopter. There is no evidence that they had experience flying in close proximity to an airplane. The Sun Company chief pilot stated that he had once told the two pilots that if they were ever involved in an in-flight observation of another aircraft, they should maintain a separation of at least 300 to 700 feet. There is no evidence that the pilots onboard N3645D had any experience in or instruction on flying in close proximity to an airplane or a helicopter.

The captain of N3645D held an airline transport pilot certificate, with ratings for airplane multiengine land and commercial privileges for airplane single-engine land. He also held a flight instructor certificate for airplane and instrument airplane. He was issued a first-class airman medical certificate on July 17, 1990, with the limitation that corrective lenses must be worn. Because more than 6 months had passed since his last medical examination, the status of the certificate had automatically changed to second class. The logbooks for the captain indicated that he had accumulated a total of about 1547 hours of single-engine airplane time and about 425 hours of multiengine airplane time. His logbooks indicated that he had received his initial checkout for multiengine air taxi operations (14 CFR Part 135) in a Piper PA-31 on March 12, 1988. The logbooks indicated that on June 23, 1988, he received a checkride in the Piper Aerostar PA-60 for second-in-command (SIC) duties. At that time, his logbook indicated a total of 15.9 hours in the PA-60. On subsequent flights, he logged the time as pilot-in-command (PIC) on nonrevenue flights and as first officer on revenue flights. However, there was inconsistency about the exact nature of some of the flights listed in the logbook and whether he was acting as PIC for the whole flight, or as first officer for part of the flight, or if another pilot had been present.

On March 26, 1991, the captain received a checkride as PIC for revenue operations in the Piper Aerostar PA-60. At that time, his logbooks indicated a total time of about 72 hours as PIC and 42.4 hours as second-in-command in the PA-60. His checkride was administered by the principal operations inspector (POI) assigned to Lycoming Air Services by the Federal Aviation Administration (FAA). The POI stated that he covered the emergency extension of the landing gear during the oral portion of the flight check.

In several cases where the captain had logged PIC time, the company's records indicate that another more senior pilot was responsible for the flight. Additionally, several training flights noted in his logbook were apparently conducted on routine nonpassenger revenue flights that were not designated as training flights in the aircraft records.

The accident flight was his second revenue flight as captain of the PA-60. On April 1, 1991, he had made his first revenue flight in the PA-60, which was an IFR flight, with a single passenger who occupied the right (copilot's) seat. The flight which lasted about 30 minutes, was aborted shortly after reaching cruise altitude because of a surging engine. The passenger had been trained at the Piper factory in PA-60 operations and had accumulated 300 to 500 hours piloting the PA-60 series of airplanes. Additionally, the passenger is a senior executive for the company that manufactured the engines used on the PA-60. He reported that the captain had some problems in starting the engines and that he had to instruct the captain in the proper starting techniques. He described the takeoff roll as "pretty erratic" because the captain was overcontrolling the electric/hydraulic nose wheel steering to the extent that the passenger became concerned. The passenger further stated that after the airplane was at altitude, the captain appeared to handle the airplane well. Shortly after the airplane reached cruise altitude, the right engine began to "...surge about 200 rpm," which the passenger believed to be a problem with the fuel controller. The

passenger stated that the captain did not appear to respond to the problem and that he had to convince the captain to return to the airport. Subsequent maintenance inspection found that the fuel controller was defective.

The Safety Board recognizes that gaining flight hours on "deadheading" or "positioning" trips is a common method for pilots low in flight time to gain flight experience or to otherwise accumulate flight hours. However, the Safety Board is also aware that the primary mission of these flights is to return the airplane to its home base as quickly as possible and that flight training or detailed systems training during the flight is a secondary consideration. Additionally, the pilot/student flying the airplane on the "positioning" trip usually operates the airplane under the direction of the captain, a situation that may lead to a deferral of many decisions affecting the flight. Therefore, the flight time that a pilot logs as an apprentice preparing for a flying career does not necessarily indicate adequate knowledge in airplane systems, emergency procedures, or the ability to make decisions or exercise good judgement regarding safety of flight situations. Only that time spent in actual training may be significant, and such training time is often minimal. The Safety Board recognizes that the checkrides administered by company check airmen and FAA operational inspectors are intended to determine the pilot's ability to assume command. However, the Safety Board is concerned that many of these attributes cannot be adequately assessed during the limited observations provided by a checkride.

The first officer of the PA-60 held a commercial pilot certificate with multiengine, single-engine, and instrument ratings, as well as a flight instructor certificate. He held a first-class medical certificate with no limitations. He had completed an airman competency/proficiency check for copilot duties only in operations conducted under 14 CFR Part 135 on May 30, 1990, in a PA-31-350. On October 10, 1990, he received a checkride in the PA-60 for copilot duties in operations conducted under 14 CFR Part 135. The second officer's logbooks indicated that he had accumulated a total of about 1,351 hours in single-engine airplanes and about 104 hours in multiengine airplanes. Operation of the PA-60 did not, by FAA regulation, require the services of a SIC, although the passenger on this flight required two pilots to be aboard all aircraft that he chartered. The investigation determined that the captain and first officer were friends and had flown together on numerous occasions.

The first officer had flown a revenue flight on the night before the accident in which he had accumulated approximately 3 hours of flight time. His duty time was from approximately 2100 on April 3rd until 0600 on the day of the accident. He had reportedly slept from about 0630 to 0900. The first officer's flight and duty time had not exceeded the limitations for unscheduled one- and two-pilot crews (14 CFR section 135.267). However, the Safety Board believes that it was probably ill-advised for the first officer to have accepted additional flying duties after having been on duty the entire previous night. Sleep deprivation resulting from such a schedule may have adversely effected his alertness and his effectiveness as a SIC pilot on the flight.

The captain of N78S held an airline transport pilot (ATP) rating for rotorcraft-helicopters and multiengine and single-engine land airplanes with instrument privileges. He also held a flight instructor certificate for airplanes and helicopters with multiengine and instrument instructor ratings. His last FAA medical examination was on July 18, 1990, when he was issued a first-class medical certificate with no limitations. More than 6 months had passed since his examination and the status of his medical certificate had automatically reverted to second class. His last recurrent training in the Bell 412SP was on February 6, 1991. The captain had a total of about 8,000 flight hours, of which approximately 2,380 were in Sun Company helicopters.

The first officer of N78S held an ATP certificate with ratings in helicopter and multiengine airplanes and single-engine land. He also possessed a flight instructor certificate for airplanes and helicopters with multiengine and instrument instructor ratings. On November 5, 1990, he received a first-class medical certificate with no limitations. His most recent recurrent training in the Bell 412SP was accomplished on February 20, 1991. The first officer had also accumulated about 8,000 hours total flight time, of which approximately 1,629 were in Sun Company helicopters. Officials with Sun Company's Aviation Department noted that his application for employment indicated that he had some flight experience in the Piper Aerostar.

4. FLIGHT RECORDERS

Neither aircraft was required to be equipped with either a cockpit voice recorder (CVR) or a flight data recorder. However, N78S was equipped with a CVR in accordance with company policy. This CVR recorded only incoming transmissions. The outgoing and intracockpit transmissions were not recorded. The examination of the wiring drawings for the CVR installation indicted no capability to feed the signals from N78S's radio transmissions or the cockpit intercom to the CVR. Thus, the faulty CVR system resulted from incorrect installation instructions rather than errors in the installation process. The FAA has informed the facility that designed and installed the CVR of this problem. The facility has reviewed its records and inspected other CVRs that were installed by its personnel to ensure that the problem is resolved in other aircraft. Additionally, as a result of this investigation, the FAA has issued Action Notice A8300.56 to ensure that all CVR installations are evaluated by technically qualified airworthiness inspectors to determine that the installation complies with the appropriate standards and that the CVR functions properly.

Although the CVR in N78S did not provide intracockpit communications, the tape was acoustically analyzed in an attempt to determine whether there were any sounds that could be associated with a reduction in engine power (collective) or an initiation of a turn before the collision with N3645D. An acoustic recording of various flight maneuvers and power settings was recorded on a comparable make and model CVR mounted in a similar Bell 412SP. A comparison of the test recordings with the sounds recorded from N78S indicated that no abrupt or steep turns took place prior to the collision. However, helicopter pilots who have listened to the CVR believe that just before the collision the rotor noise decreased, which suggested to them a

lowering of the collective. An analysis of the CVR sound spectrum indicates that the sound that the helicopter pilots associated with the collective movement became indistinguishable from other background noises about 1.7 seconds before the collision. However, the relationship of changes in perceived power-related noise to actual power levels could not be determined.

Although the pilots may have lowered the collective in order to descend the helicopter, the events that preceded this action cannot be determined with certainty. It is most probable that this action was taken to prevent the collision. Whether N3645D had turned into N78S, or the pilots of N78S discovered that they were climbing into N3645D or had overtaken N3645D and were trying to slow down quickly are equally likely scenarios. It is also possible that aerodynamic interaction between the two aircraft caused them to move toward each other. The possible aerodynamic interaction will be discussed later in this report.

5. THE WRECKAGE

The examination of the wreckage of both aircraft revealed no evidence of precollision damage or structural or system failures. Additionally, the maintenance records of each aircraft did not indicate any deferred maintenance items or recent maintenance that contributed to the accident. Pilots who had previously flown N3645D did not report problems with the airplane's nose gear position indicator light or any control problems with the airplane. Both aircraft were properly maintained and certificated and were operating within their respective weight and balance limitations at the time of the accident. The captain of the N3645D occupied its left cockpit seat and the captain of N78S occupied its right cockpit seat, the normal captain positions for fixed-wing and helicopter operations, respectively.

Figure 2 shows the wreckage diagram and relative positions of the two aircraft on the ground. Numerous parts of both aircraft were located on residential properties near the school. A piece of the helicopter's main rotor blade, the most distant component found, was about 1,000 feet southeast of the main helicopter wreckage. The airplane's nose wheel fork was located about 875 feet southwest of the main airplane wreckage. Additionally, the right main landing gear had separated from its wing structure and was found 500 feet southeast of the main wreckage.

Inspection of the nose landing gear of N3645D revealed that the gear assembly had separated from the airplane structure during the collision sequence. The majority of the assembly, including the oleo strut, was found near the main wreckage. The drag link was found 675 feet southwest of the main wreckage. The tire remained attached to the rim and was 750 feet southwest of the main wreckage; however, a section of the tire, approximately 2 inches below the edge of the hub had been severed and was completely missing. The cut was very clean as if it was made by a sharp object. The hub and tire exhibited no evidence of foreign material, paint transfer, fire, or heat damage.

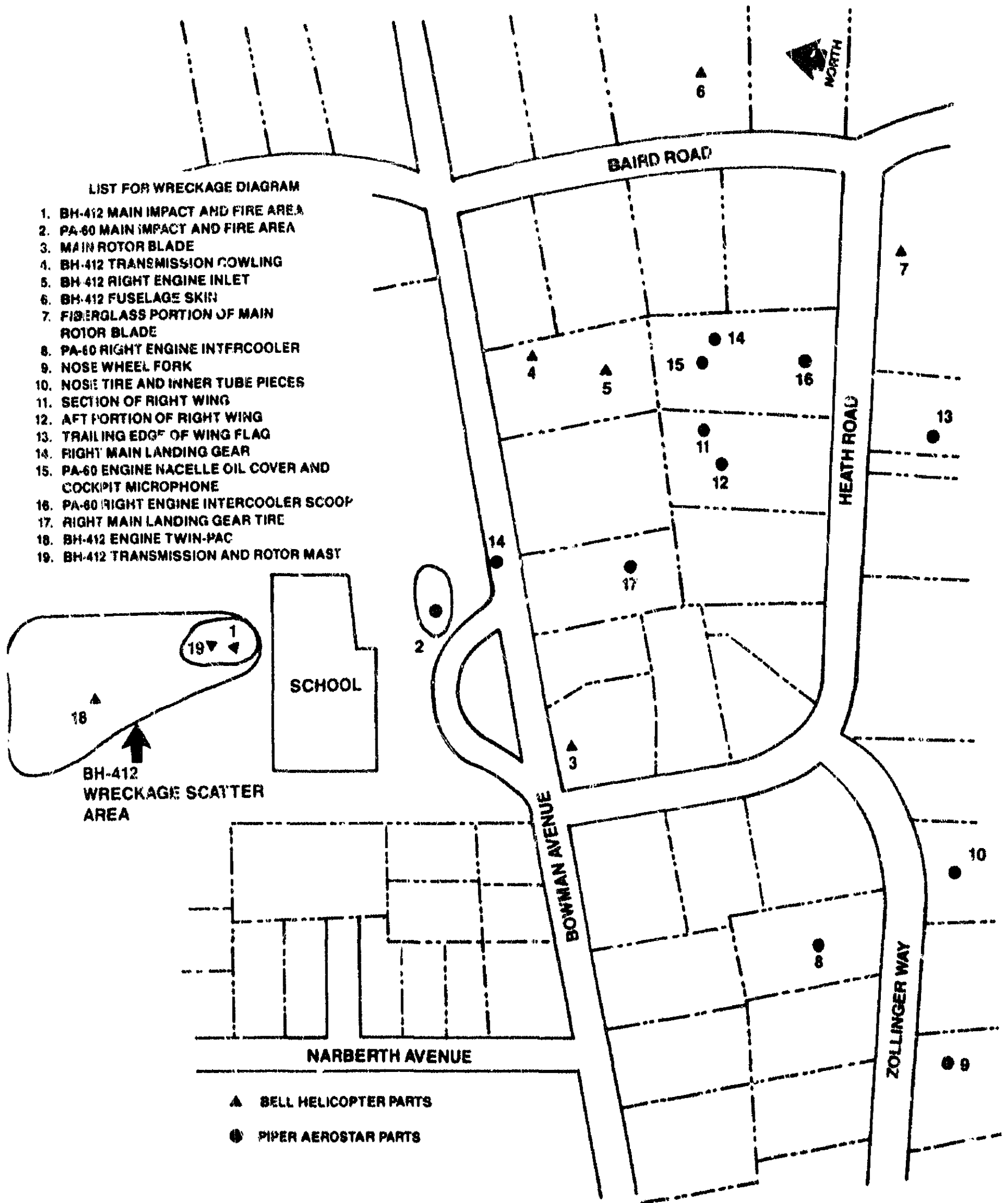


Figure 2.--Wreckage diagram.

The nose gear down-lock micro switch remained attached to the strut. Subsequent testing of the switch revealed normal operation. Damage to the nose landing gear and linkage did not allow a functional check of the position indicating system. The landing gear indicator panel was recovered from the wreckage. However, no useful information could be obtained because of impact and fire damage. The tire for the right main landing gear was located 250 feet south of the main wreckage and was cut from tread to bead on one side and was torn on the other side. The wheel hub rim had a sharp impact mark that aligned with the cut on the tire. Neither the tire, wheel, nor landing gear assembly exhibited any fire or heat damage. No foreign material or paint transfer was noted on the tire or rim.

The instrument panel of N3645D was destroyed by impact and fire to the extent that no useful information was obtained. The landing gear selector handle was free of its panel mount and its interior cable was extended from the housing 4.5 inches, indicating a gear down selection.

The left engine revealed evidence of rotation and power at impact. The propeller on the right engine was in the feathered position. The examination of the engine oil filter on the right engine revealed no evidence of metal particles, and an external examination indicated no evidence of gross internal failure. The intercooler had separated from the engine and was 575 feet southwest of the main wreckage. The propeller governor assembly was in the full RPM stop position. A representative of the propeller manufacturer indicated that if oil pressure was lost while the engine was producing power, the propeller would feather in 5 to 10 seconds.

One of the four rotor blades on N78S had separated from the main rotor hub assembly and was 450 feet southwest of the main wreckage; it was bent in two areas, and a large portion of the fiberglass trailing edge was missing. There was no fire damage to the blade. Rubber transfer marks were observed on the leading edge of the blade from its tip to 16 inches inboard. A portion of the blade's leading edge was cut 82 inches inboard from the tip. Rubber and metal slash marks, and a dent 13 inches long, were observed 150 inches from the tip. Another blade was also detached from the rotor head and was located near the wreckage; the tip of the blade (4 inches long) was broken and missing. The blade was slightly bent and contained oil marks 22 inches from its tip. The leading edge, from 90 to 132 inches inboard of the tip, was completely destroyed. The other two blades remained attached to the main rotor hub assembly and displayed multiple breakages and fire damage. Evidence of slash or impact marks could not be found on the blades because of extensive fire damage.

Figure 3, based upon the impact marks found on the helicopter's rotor blades and the marks on the airplane's tires, indicates the position of the airplane relative to the helicopter's main rotor blade. It was not possible to develop an exact orientation of the two fuselages to each other or their positions relative to the ground at the time of the collision because of the large number of indeterminate variables involved. Additionally, because of the dynamics of the collision and possible gyrations of the helicopter's damaged main rotor, the investigation was unable to determine the exact breakup sequence following the initial rotor blade impact.

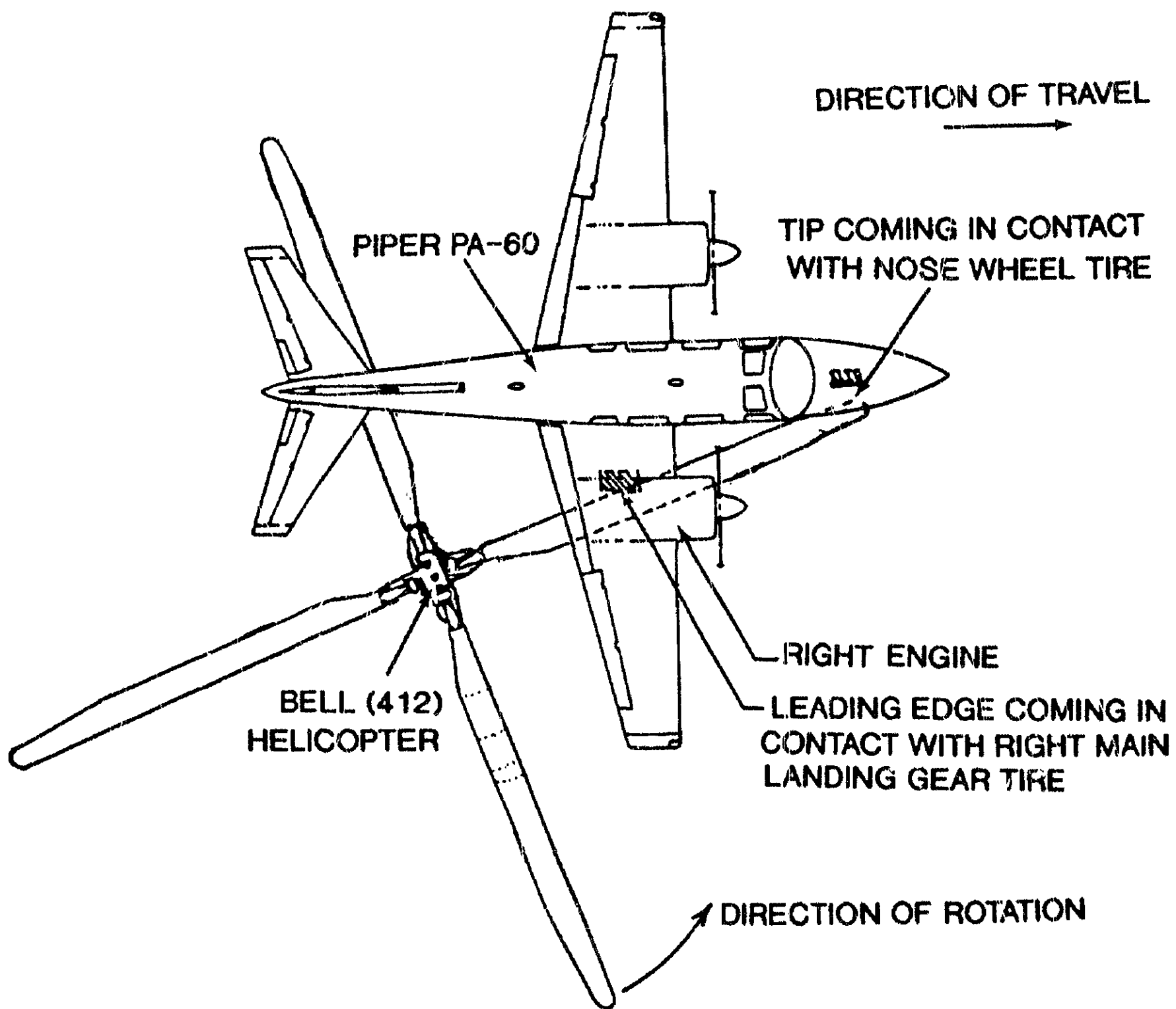


Figure 3.--Relative positions prior to collision.

6. FLIGHTCREW ACTIONS

Because the collision occurred following the intentional actions of both pilots to engage in close proximity flight, the analysis of this accident focuses on the decision of the captain of N3645D to permit the close inspection of his airplane during flight and the decision and procedures of the captain of N78S to conduct that inspection.

The Safety Board believes that the inexperience of the captain of N3645D as a PIC in revenue operations was a significant factor in the sequence of events that followed his observation that the nose gear position light did not illuminate when he extended his landing gear. Because he could see the reflection of the nose gear in the propeller spinner, the captain knew that the gear was down but he was unsure whether it was properly locked in place because the green position light on the instrument panel did not illuminate to indicate that the locking action had taken place.

The FAA-approved flight manual for the Piper PA-60 does not contain emergency landing gear extension procedures in the emergency procedures section. However, the section containing information on hydraulic pump failure provides information on lowering the gear. If hydraulic pressure is lost, the landing gear will free fall to the down and locked position because of gravity and springs. To prevent the accumulator pressure from holding the gear up, the manual advises that the gear handle be placed in the down position. Additionally, the manual states that the landing gear warning horn will sound if the throttles are set to about the idle position and the nose gear is not locked. Therefore, a method to check whether the nose landing gear is down and locked is to reduce the throttle setting. If the landing gear warning horn does not sound, the pilot can presume that the nose gear is locked. If the horn does sound, the appropriate procedure is to turn off the hydraulic pump, bleed off the hydraulic pressure, and place the landing gear handle into the down position. The gear should then drop into the down and locked position. By retarding the throttles again, it can be determined if the gear is locked into place. The training/check pilot for Lycoming Air Services stated that he did not instruct the captain of N3645D on the operation of the landing gear warning horn but that he had taught him about the push-to-test function of the gear indicator lights.

Without the benefit of a CVR, it could not be determined whether the captain took any action to isolate the problem to the indicator light or verify that the nose gear was locked in the down position. Although he may have retarded the throttles to check the status of the gear warning horn, he did not mention the results of such a test during his communications with the tower. The Safety Board believes that if he had made this check, he would most likely have informed the tower.

The Safety Board views the captain's transmissions advising the tower of his uncertainty about the nose gear status to have been proper because it would have been his desire to have emergency equipment available for the landing. The Safety Board notes that the captain's voice inflection during the radio transmissions did not indicate concern about the problem. Furthermore, the captain did not make any special requests for assistance or

actions by others to confirm whether the nose gear was locked. However, when the tower offered to view the gear during a flyby and subsequently to have N78S conduct a closer inspection, the captain accepted.

Safety Board investigators examined the nose gear installation of another Piper PA-60 and found that in the down position the landing gear doors close, leaving a very small area around the nose gear strut exposed. Even on the ground, it was difficult to inspect the nose gear steering system and locking mechanism. The Safety Board believes that it would have been virtually impossible for either the tower controllers or the pilots of N78S to have determined by visual inspection if the gear was indeed locked. The Safety Board believes that the captain of N3645D should have been aware that the nose gear locking mechanism was concealed and that there was no benefit to be gained by having another aircraft, in close proximity, observe the gear. A more experienced pilot would probably have accomplished the emergency procedures and proceeded to land the airplane accepting the possibility that the nose gear could collapse during the landing roll. Many pilots confronting such a situation would consider shutting the engines down after touchdown of the main gear to minimize the potential for propeller and engine damage and would attempt to keep weight off the nose gear until the airplane is slowed. Although it is not a frequent occurrence, a nose gear collapse after landing does not generally result in a major accident or occupant injury. Therefore, the captain should have rejected the offer for the close inspection by N78S.

Having accepted the offer from the captain of N78S to approach his airplane to observe the nose gear, the captain of N3645D should have assured himself that the in-flight inspection would be accomplished without hazard. By direct communication with the pilot of N78S, he should have coordinated the direction of approach and the minimum separation between the two aircraft. Also, the maneuver should have been conducted so that the pilots of both aircraft could keep each other in sight at all times without compromising the agreed upon separation. Instead, the captain of N3645D relinquished the responsibility for ensuring the safety of his airplane, giving it entirely to the pilot of N78S. In fact, N78S approached N3645D from behind and below. It is probable that the captain of N3645D did not see the helicopter and, therefore, did not realize the close proximity of the N78S when the collision occurred.

The Safety Board considers the passive role of the captain of N3645D to be a further indication of a lack of command leadership experience and a causal factor in the accident.

Unlike the captain of N3645D, the pilots of N78S had considerable flight experience, but their judgment was also faulty. The Safety Board does not consider the offer by a pilot of one aircraft to view the landing gear of another to verify its down position to be appropriate if the gear can be seen from the cockpit of the airplane having the unsafe indication. Moreover, an observation to distinguish between an extended or retracted gear does not require extremely close proximity flight. The gear locking mechanism in most airplanes cannot be seen by an observing pilot from a safe distance. In some airplanes, like the Aerostar, the locking mechanism could

not be seen even at an unsafe distance. The first officer of N78S reportedly had flight time in or was experienced in Piper Aerostar operations. Therefore, he should have realized that the nose gear locking mechanism was concealed and that there was no reason to maneuver his aircraft closer to visually determine that the nose gear was fully extended to the down position. Furthermore, there is no benefit in such an inspection since it should be assumed that the pilot of the airplane indicating a gear problem had already used all the procedures available to him to attain a safe gear indication. The same precautions should be used on landing regardless of the observation by another aircraft.

The captain of N78S should have known that he was undertaking a futile and ultimately unsafe task when he offered to take a "real close look" at the nose gear of N3645D. His upward visibility was restricted by the covered eyebrow windows and therefore he would have had a difficult time positioning his aircraft to view the gear. Moreover, he had no experience flying in close proximity to another aircraft to judge closure rates, rotor tip clearance, or the potential effects on controllability resulting from the aerodynamic interaction between the aircraft.

The Safety Board concludes that after the captain of N78S made the decision to close on N3645D, he assumed the burden of responsibility for assuring that safe separation was maintained. He should have communicated his intentions to the captain of N3645D and kept him advised of his relative position throughout the encounter. More importantly, he should have maintained sufficient distance to be able at any time to maneuver away from N3645D if its flightpath changed. Thus, regardless of the geometry of the collision, the Safety Board views the poor judgment of the captain of N78S to conduct the inspection and his poor procedures in doing so as a cause of the accident.

The Safety Board acknowledges that in the interest of safety there may be situations that justify the close in-flight inspection of another aircraft. However, such situations are extremely rare and the Safety Board does not condone them under any circumstances by pilots who have not been specifically trained for or do not have experience in formation flying. When in-flight inspections are necessary, the Safety Board believes that a leader should be designated, communications should be established on a clear, preferably separate, frequency, and all procedures and maneuvers should be agreed to by both captains before the inspection. Further, the Safety Board believes that the impromptu in-flight inspection of N3645D was accomplished without either flightcrew assessing their potential danger or the danger to the community over which they were flying. The investigation found that the flightpath of N3645D was an extended pattern for runway 17. Because of the geographic position of Lower Merion Township relative to PHL and the extended centerline of runway 17, the flightpath of N3645D was over Lower Merion Township and several other densely populated areas. The Safety Board believes that nothing was to be gained by the in-flight inspection of N3645D. Additionally, the inspection of N3645D was not a time sensitive requirement because N3645D did not have a critical fuel problem. Therefore, the Safety Board believes that after the pilots of the two aircraft decided

to conduct the ill-advised inspection, it should have taken place over an area that presented the least possible risk to the community.

The Safety Board's investigation of this and other accidents has demonstrated the consequences of poor judgment and poor decision making by pilots. The Safety Board is aware that in the last decade, the FAA, Transport Canada, and several aviation industry organizations have supported major research projects. Such projects have resulted in the development of training materials that include a series of manuals on "Aeronautical Decision Making" (ADM) specifically tailored for several categories of pilots, including student and private, instructor, commercial, helicopter, and others. A critical part of this training is improving a pilot's ability to recognize and control hazardous thought processes and situations. Both civil and military airmen trained with these materials have been shown to make substantially fewer judgment errors and to demonstrate improved decision making.

The Safety Board commends the FAA and the many aviation organizations that supported these research and development efforts and publicized the existence and availability of ADM materials. Moreover, the Safety Board also acknowledges the FAA's emphasis on the principles of ADM in its "Back-to-Basics" accident prevention program conducted in 1988 and 1989. However, in view of the obvious significant accident prevention benefits that could result from the widespread implementation of ADM training for pilots, the Safety Board believes that the FAA should disseminate more aggressively information and materials pertaining to ADM training and actively promote its implementation among all categories of pilots in the civil aviation community.

The investigation determined that the two aircraft had operated in close proximity to each other for a relatively short period of time. The Safety Board did not categorize the inspection as a "formation flight" since there was no designated flight leader and the two aircraft did not operate as a single flight. The inspection was conducted strictly as an impromptu emergency action in which N78S was to fly close to N3645D, briefly, in an attempt to verify that the nose landing gear was in the down and locked position. The Safety Board believes that despite the lack of good judgment in his decision, the captain of N3645D was within his authority to allow the in-flight inspection of his airplane.

Witness interviews and radar data did not provide sufficient information to determine the last movements of the two aircraft before the collision. A review of the aerodynamic interaction between fixed- and rotary-wing aircraft in close proximity was performed; however, no quantitative data were developed. Qualitative information was obtained that indicated two distinct and potentially hazardous aerodynamic interactions. Those interactions are:

- (1) turbulence-induced blade stall and settling experienced by rotary-wing aircraft when flying in the turbulent area behind and below a fixed-wing aircraft, and
- (2) opposing pitch changes experienced by both aircraft when one aircraft flies closely behind and below the other.

The textbook Aerodynamics for Naval Aviators¹ specifically refers to the case of one aircraft inspecting the landing gear of another. It states that when one aircraft is flying closely behind and below another, the lower aircraft experiences a nose-up pitching moment and the higher aircraft experiences a nose-down pitching moment. The author states that the opposing pitch moment changes can be large and must be anticipated or a collision may result. Engineers at Bell Helicopter have stated that the Bell 412 would experience such a nose-up pitch change.

Although the final seconds of raw radar data suggest an upward movement of the N78S toward N3645D, the data do not show a downward movement of N3645D toward N78S. Nevertheless, the accuracy limitations and sampling rate of these data do not permit identification of small, short duration flightpath deviations that would most likely result from the trim change scenario under discussion.

7. CONTROLLER ACTIONS

Upon receiving the report from N3645D that it had a nose gear problem, both the local controller and the tower supervisor believed that an emergency situation existed even though N3645D had not specifically declared an emergency. Accordingly, the tower supervisor alerted the ARFF units about the potential problem. The controllers considered that their primary duty was to assist the pilot in any way possible and to provide separation between N3645D and other traffic. After N78S offered to inspect the nose gear, the tower personnel stated that they assisted the two aircraft in locating each other but that after they had each other in sight it was the responsibility of the pilots to maintain adequate separation. The local controller stated that after the two aircraft had joined up, he did not provide any instructions to the crews so that he would not distract the pilots during any maneuvers. After the aircraft were out of the TCA, the controller considered the aircraft to be on their own, but he still monitored and assisted as needed. The Safety Board agrees that the controllers' primary duty was to provide adequate separation between the two aircraft and other aircraft in the TCA. The Safety Board considers proper the controllers' actions in providing assistance to the two aircraft during the join up and inspection maneuvers and in providing all possible emergency assistance.

¹p. 384-385, Aerodynamics for Naval Aviators, H.H. Hurt, Jr., NAVLEPS 00-807-80

8. FAA SURVEILLANCE

The FAA's POI for Lycoming Air Services had served in that capacity since September 1990. During this time, the POI was responsible for 16 other certificate holders, including one scheduled commuter carrier that had purchased and was bringing into service several larger, more sophisticated airplanes. The POI stated that his work schedule was extremely heavy and that he had been unable to visit Lycoming Air Services personally until mid-January 1991. He said that the previous POI for Lycoming Air Services had assumed a position as a consultant/assistant manager for the company following his retirement from the FAA. He further stated that he would occasionally contact the former POI and inquire about the status of the company.

In December 1990, two of Lycoming Air Services' pilots required recurrency checkrides from the POI. Both pilots failed the first checkride. One pilot passed the second checkride and the other did not. Based upon this experience, the POI decided to perform a personal inspection of the company. In mid-January 1991, the POI inspected the company's records and found that the training records, pilot recordkeeping, and other operational records were not in compliance with the FARs. He notified the chief pilot of the problems and allowed the company 30 days to correct the discrepancies. The POI later stated that the company made satisfactory corrections and that prior to the accident on April 4, 1991, the company was in full compliance with the FARs.

On February 25, 1991, the POI administered a competency flight check of the company's check airman. The POI described the flight check as "pretty bad" and later notified the pilot of his unsatisfactory performance and the loss of his 14 CFR Part 135 airman's privileges. The POI told the chief pilot that the check airman was not to conduct any more check flights until the POI "let him know." The POI did not formally advise, in writing, the chief pilot that the check airman's authorization had been removed. When the POI was asked why no formal action had been taken, he replied that "by the time we get the paperwork through, he would have passed his retest anyway." The pilot was retested and successfully passed the competency flight check on February 27, 1991. It was not until early May 1991 that the POI informed the chief pilot of Lycoming Air Services that the pilot's check airman authority was restored. The relatively long delay in reinstating the pilot's check airman authority was reportedly an oversight.

The Safety Board believes that, because of his workload, the POI for Lycoming Air Service did not have sufficient time to adequately survey the operator. The Safety Board noted a similar problem in other investigations. Most recently, as a result of the investigation of Aloha IslandAir flight 1712,² the Safety Board recommended to the FAA that it conduct a special study of the staffing adequacy of Flight Standards District Offices. In its letter of February 8, 1991, the FAA stated that it had contracted for a study that will evaluate its staffing standards based upon the availability of work

²Aloha IslandAir, Inc., flight 1712, de Havilland DHC-6-300, near Halawa Point, Molokai, Hawaii, October 28, 1989 (NTSB/AAR-90/05).

hours, geographic areas of responsibility, and the size and complexity of operations. The FAA anticipates that the study will be completed by October 1991.

9. CONCLUSIONS

1. Both aircraft were certificated, equipped, and maintained in accordance with Federal regulations and approved procedures.
2. There were no preexisting defects to either aircraft that contributed to the accident. The Safety Board could not determine the functional status of the nose gear down indicating light on N3645D prior to the collision.
3. Both flightcrews possessed the appropriate airmen's certificates for their respective duties.
4. Weather was not a factor in the accident.
5. The Safety Board found deficiencies in the training program of Lycoming Air Services, Inc., and the flightcrew checking procedures of the FAA principal operations inspector assigned to the operator.
6. The emergency procedures section of the Piper PA-60 flight manual does not contain sufficient information on the actions to take if the nose landing gear down indicating light fails to illuminate.
7. The captain of N3645D could see from the reflection of the nose landing gear in the propeller spinners that the nose landing gear was fully extended and that the gear doors closed over the wheel well area. Therefore, there was no additional information that could be gained by flying by the tower or from an in-flight inspection.
8. None of the flight crewmembers of the two aircraft had experience flying in close proximity to another aircraft.
9. The captain of N3645D, after accepting the offer of the in-flight inspection, did not coordinate with the flightcrew of N78S the maneuvering procedures to be used to ensure the safety of his aircraft.
10. N78S was maneuvered into a position where it could not be seen by the flightcrew of N3645D.
11. The flightcrew of N78S should have terminated the inspection after they saw that the nose landing gear locking mechanism was concealed in the wheel well.

12. The final movements of both aircraft that led to the midair collision could not be determined, but the pilots of N78S had the responsibility for maintaining safe separation from N3645D.
13. The air traffic controllers at Philadelphia International Airport acted in accordance with approved air traffic control procedures in providing assistance to the two aircraft.
14. The FAA principal operations inspector assigned to Lycoming Air Services, Inc., did not have sufficient time to adequately survey the operator.

10. PROBABLE CAUSE

The National Transportation Safety Board determines that the probable causes of this accident were the poor judgment by the captain of the airplane to permit the in-flight inspection after he had determined to the best of his ability that the nose landing gear was fully extended, the poor judgment of the captain of the helicopter to conduct the inspection, and the failure of the flightcrew of the helicopter to maintain safe separation. Contributing to the accident was the incomplete training and checking that the flightcrew of N3645D received from Lycoming Air Services, Inc., and the FAA principal operations inspector assigned to the operator.

11. RECOMMENDATIONS

As a result of its investigation of this accident, the National Transportation Safety Board makes the following recommendations:

--to the Federal Aviation Administration:

Include in the Airman's Information Manual advisories on the potential dangers that can be encountered when flying aircraft in close proximity to one another. This information should include consideration of the potential risks involved in the maneuver, the importance of thorough planning and communication among all the pilots, and the aerodynamic interactions that can be encountered in close proximity flight. (Class II, Priority Action) (A-91-91)

Require that the flight manual for the Piper Aerostar PA-60 be modified so that the emergency procedures section includes information on actions to be taken in the event of an unsafe landing gear indication. (Class II, Priority Action) (A-91-92)

Disseminate more aggressively available information and materials pertaining to Aeronautical Decision Making training and actively promote its implementation among all categories of pilots in the civil aviation community. (Class II, Priority Action) (A-91-93)

--to the National Business Aircraft Association (NBAA), the Helicopter Association International (HAI), and the Aircraft Owners and Pilots Association (AOPA):

Advise your members of the circumstances of the midair collision involving Bell Helicopter N78S and Piper Aerostar N3645D and of the potential dangers associated with performing in-flight inspections of other aircraft or other close proximity maneuvers. (Class II, Priority Action) (A-91-94)

Also as a result of its investigation of this accident, the National Transportation Safety Board reiterates Safety Recommendation A-90-136 to the Federal Aviation Administration:

A-90-136

Perform a special study of the adequacy of Flight Standards District Office staffing considering the availability of work hours, the geographic area of responsibility, and the size and complexity of the assigned operations.

Attached is the brief of accident.

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ James L. Kolstad
Chairman

/s/ Susan Coughlin
Vice Chairman

/s/ John K. Lauber
Member

/s/ Christopher A. Hart
Member

/s/ John Hammerschmidt
Member

September 17, 1991

National Transportation Safety Board
Washington, D.C. 20594

Brief of Accident

File No. - 50 4/04/91 MERION, PA A/C Reg. No. N78S Time (Lcl) - 1210 EST

-----Basic Information-----

Type Operating Certificate-NONE (GENERAL AVIATION)	Aircraft Damage DESTROYED	Fatal	Injuries		
Type of Operation -EXECUTIVE/CORPORATE	Fire	Crew 2	Serious 0	Minor 0	None 0
Flight Conducted Under -14 CFR 91	ON GROUND	Pass 0	0	0	0
Accident Occurred During -MANEUVERING		Other 5	1	4	0

-----Aircraft Information-----

Make/Model - BELL 412SP	Eng Make/Model - P&W PT6T-3B	ELT Installed/Activated - YES/NO
Landing Gear - SKID	Number Engines - 2	Stall Warning System - NO
Max Gross Wt - 11900	Engine Type - TURBOSHAFT	
No. of Seats - 7	Rated Power - 1350 HP	

-----Environment/Operations Information-----

Weather Data	Itinerary	Airport Proximity
Wx Briefing - NO RECORD OF BRIEFING	Last Departure Point PHILADELPHIA, PA	OFF AIRPORT/STRIP
Method - N/A	Destination RADNOR, PA	Airport Data
Completeness - N/A	ATC/Airspace	Runway Ident - N/A
Basic Weather - VMC	Type of Flight Plan - VFR	Runway Lth/Wid - N/A
Wind Dir/Speed- 240/010 KTS	Type of Clearance - VFR	Runway Surface - N/A
Visibility - 10.0 SM	Type Apch/Lnds - NONE	Runway Status - N/A
Lowest Sky/Clouds - 25000 FT SCATTERED		
Lowest Ceiling - NONE		
Obstructions to Vision- NONE		
Precipitation - NONE		
Condition of Light - DAYLIGHT		

-----Personnel Information-----

Pilot-In-Command	Age - 42	Medical Certificate - VALID MEDICAL-NO WAIVERS/LIMIT
Certificate(s)/Rating(s)	Biennial Flight Review	Flight Time (Hours)
COMMERCIAL, ATP, CFI	Current - YES	Total - 8000
SE LAND, ME LAND	Months Since - 2	Make/Model- UNK/NR
HELICOPTER	Aircraft Type - BH-412	Instrument- UNK/NR
		Multi-Eng - UNK/NR
		Last 24 Hrs - 2
		Last 30 Days- 6
		Last 90 Days- 17
		Rotorcraft - UNK/NR

Instrument Rating(s) - AIRPLANE, HELICOPTER

-----Narrative-----

PIPER AEROSTAR 601, N3645D, WAS ARRQ AS BELL 412 (HELICOPTER), N78S, WAS DEPG. N3645D RPRTD THE ACFT'S NOSE GEAR INDCR LGT DID NOT ILLUMINATE TO VERIFY THE NOSE GEAR WAS DWN & LOCKED. CREW OF N78S HEARD THE COM & SAW N3645D AS THEY CROSSED BENEATH N78S'S APCH PATH. THEY RPRTD N3645D'S NOSE GEAR APPEARED TO BE EXTDD. N3645D FLEN PAST THE TWR & TWR PSNL ALSO RPRTD THE NOSE GEAR APPEARED TO BE EXTDD. AS N3645D WAS CLRD TO TURN DUNWD, N78S OFFERED TO JOIN FOR A CLOSER LOOK. CAPT OF N3645D ACCEPTED THE OFFER. DRG JOINUP, N78S CONVERGED FM LEFT REAR, THEN RPRTD THEY WOULD PASS ARND THE RGT SIDE & LOOK AT EVERYTHING AS THEY WENT BY. THEY RPRTD THAT EVERYTHING LOOKED OK. MOMENTS LTR, THE 2 ACFT COLLIDED & CRASHED TO THE GND. NO MECH RSN WAS FND THAT WOULD HAVE RESULTED IN THE ACNT. NONE OF THE PLTS HAD TRNG FOR FLT IN CLOSE PROX-IMITY TO ANOTHER ACFT. THERE WERE INDCNS THE CAPT OF N3645D LACKED TRNG IN ACFT SYSTEMS & THAT HIS EMPLOYER (THE OPER) LACKED SURVEILLANCE BY THE FAA. THE EMERG PROC SXN OF THE AEROSTAR FLT MANUAL LACKED INFO ON EMERG GEAR EXTN.

Brief of Accident (Continued)

File No. - 50

4/04/91

MERION, PA

A/C Reg. No. N785

Time (Lcl) - 1210 EST

Occurrence #1 MIDAIR COLLISION
Phase of Operation APPROACH

Findings(s)

1. JUDGEMENT - POOR - PILOT OF OTHER AIRCRAFT
2. JUDGEMENT - POOR - PILOT IN COMMAND
3. CLEARANCE - NOT MAINTAINED - PILOT IN COMMAND

Occurrence #2 IN FLIGHT COLLISION WITH TERRAIN/WATER
Phase of Operation DESCENT - UNCONTROLLED

-----Probable Cause-----

The National Transportation Safety Board determines that the Probable Cause(s) of this accident was:
THE POOR JUDGEMENT BY THE CAPTAIN OF THE AIRPLANE TO PERMIT THE IN-FLIGHT INSPECTION AFTER HE HAD DETERMINED TO THE
BEST OF HIS ABILITY THAT THE NOSE LANDING GEAR WAS FULLY EXTENDED, THE POOR JUDGMENT OF THE CAPTAIN OF THE HELICOPTER
TO CONDUCT THE INSPECTION, AND THE FAILURE OF THE FLIGHTCREW OF THE HELICOPTER TO MAINTAIN SAFE SEPARATION.

Brief of Accident (Continued)

File No. - 50 4/04/91 MERION, PA A/C Reg. No. N3645D Time (Lcl) - 1210 EST

Occurrence #1 MIDAIR COLLISION
Phase of Operation MANEUVERING

Findings:

1. LANDING GEAR, GEAR INDICATING SYSTEM - INOPERATIVE
 2. EMERGENCY PROCEDURE - PERFORMED - PILOT IN COMMAND
 3. JUDGEMENT - POOR - PILOT IN COMMAND
 4. INADEQUATE TRANSITION/UPGRADE TRAINING - COMPANY/OPERATOR MANAGEMENT
 5. INADEQUATE SURVEILLANCE OF OPERATION; INSUFFICIENT STAFF - FAA (ORGANIZATION)
 6. JUDGEMENT - POOR - PILOT OF OTHER AIRCRAFT
 7. CLEARANCE - NOT MAINTAINED - PILOT OF OTHER AIRCRAFT
-

Occurrence #2 IN FLIGHT COLLISION WITH TERRAIN/WATER
Phase of Operation DESCENT - UNCONTROLLED

----Probable Cause----

The National Transportation Safety Board determines that the Probable Cause(s) of this accident was:
THE POOR JUDGEMENT BY THE CAPTAIN OF THE AIRPLANE TO PERMIT THE IN-FLIGHT INSPECTION AFTER HE HAD DETERMINED TO THE BEST OF HIS ABILITY THAT THE NOSE LANDING GEAR WAS FULLY EXTENDED, THE POOR JUDGMENT OF THE CAPTAIN OF THE HELICOPTER TO CONDUCT THE INSPECTION, AND THE FAILURE OF THE FLIGHTCREW OF THE HELICOPTER TO MAINTAIN SAFE SEPARATION. CONTRIBUTING TO THE ACCIDENT WAS THE INCOMPLETE TRAINING AND CHECKING THAT THE FLIGHTCREW OF N3645D RECEIVED FROM LYCOMING AIR SERVICE AND THE FAA PRINCIPAL OPERATIONS INSPECTOR ASSIGNED TO THE OPERATOR.