



National Transportation Safety Board
Washington, D.C. 20594

Safety Recommendation

Date: **JUN 8 1999**

In reply refer to: A-99-46

Honorable Jane F. Garvey
Administrator
Federal Aviation Administration
Washington, D.C. 20591

On April 4, 1998, at 1034 eastern standard time, N111LR, a Cessna 525 CitationJet, and N737WD, a Cessna 172 Skyhawk, collided in flight over Marietta, Georgia. Visual meteorological conditions (VMC) prevailed at the time of the accident. The CitationJet departed from the DeKalb-Peachtree Airport about 1030 on an instrument flight plan to Harrisburg, Pennsylvania. The Skyhawk departed Mathis Airfield, near Cummings, Georgia, about 1025 under visual flight rules. The CitationJet was initially cleared to depart runway 34 and climb on runway heading to 3,000 feet. At 1032:14, it was assigned heading 280 degrees by Atlanta Terminal Radar Approach Control (TRACON). At 1032:54, the CitationJet was assigned heading 360 degrees and cleared to climb to 4,000 feet. At 1033:55, it was cleared to climb to 9,000 feet. According to recorded radar data, at 1034:03 the CitationJet was climbing through 3,400 feet when its transponder¹ target merged with an untracked primary target² later identified as N737WD. Radio and radar contact with the CitationJet was lost, and both aircraft crashed into the residential area below. The pilot of the Skyhawk and all four occupants of the CitationJet were killed, and both airplanes were destroyed.

On February 11, 1998, N8343D, a Beech J35 Bonanza, collided with a California Army National Guard Boeing CH-47D, call sign Schooner 14, near Morgan Hill, California. Recorded radar data showed that at approximately 2327:20 UTC the CH-47D's transponder target merged with a primary-only target later identified as N8343D. VMC prevailed with a 20-mile visibility and scattered clouds at 3,000 feet. The Bonanza was destroyed, and the pilot, the sole occupant,

¹ A transponder is a radar receiver/transmitter that actively responds to interrogations from air traffic control (ATC) radar systems, enhancing the visibility of aircraft to radar and, under some circumstances, providing target identity and altitude information as well.

² Typically, Federal Aviation Administration (FAA) radar controllers use two radar systems simultaneously. One system only detects responses from transponders attached to aircraft ("secondary" radar target), whereas the other only detects radar energy reflected from the structure of the aircraft itself ("primary" radar target). Individual aircraft may be detected by either or both systems. The two sets of targets are combined on controller displays, producing a unified depiction of radar-observed traffic.

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was killed. The CH-47D sustained substantial damage, but none of the four crewmen aboard were injured. The Bonanza was being operated as a personal flight by its owner/pilot. The CH-47D was being operated as a military flight by the California Army National Guard and was the lead ship of a two-helicopter formation flight. The Bonanza departed at 1510 from the Reid-Hillview Airport in San Jose, California. The CH-47D departed from the Monterey Peninsula Airport, in Monterey, California, at 1505. The pilot of the CH-47D was receiving radar traffic advisory services³ from Bay TRACON at the time of the accident but had not received any information about the Bonanza before the collision occurred. All crewmembers aboard the CH-47D stated that they did not see the Bonanza at any time before the collision. The pilot of the Bonanza was not in communication with any Federal Aviation Administration air traffic control (ATC) facility.

In both cases, fatalities resulted from collisions between transponder-equipped aircraft receiving radar traffic advisory service (the CitationJet and the CH-47D) and aircraft that were neither in contact with ATC nor operating a transponder to enhance their visibility to radar (the Skyhawk and the Bonanza). The Automated Radar Tracking System (ARTS) equipment installed at Atlanta TRACON and Bay TRACON uses transponder replies to create conspicuous radar targets and attach altitude information (if available) for display to controllers. Aircraft not equipped with an operating transponder are much less conspicuous and are presented only as bright spots that illuminate approximately every 4 seconds when the radar antenna passes the targets. The spots then fade away within 1 to 2 seconds. National Transportation Safety Board investigators observed the ARTS displays used by both controllers and noted that such primary-only targets can be difficult to recognize as possible representations of aircraft in flight.

Recorded radar data from Atlanta TRACON and Bay TRACON showed that primary targets for the non-transponder aircraft were detected by the radar systems before the collisions, indicating that it was possible for the controllers involved to have detected the potential conflicts and provided advisories to the pilots of the transponder-equipped aircraft. Although they were providing advisories to other aircraft as needed, in both cases, the controllers reported that they did not see any conflicting non-transponder targets. Both controllers also stated that they routinely configure their displays to show primary targets and that if they had noticed a potential traffic conflict, they would have provided an advisory to the other aircraft involved.

The Safety Board is concerned about the lack of conspicuity of primary targets in ARTS systems. The Board concludes that increasing primary targets' visibility to controllers is essential to enhancing flight safety.

³A pilot operating under visual flight rules may request radar traffic advisory service from FAA air traffic controllers. On a workload-permitting basis, controllers will advise the pilot of any radar-observed traffic that may present a collision hazard. There is no guarantee that controllers will notice all traffic or provide an advisory in every case, and the pilot still retains full responsibility for seeing and avoiding other aircraft while operating in VMC.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

Modify all variants of Automatic Radar Tracking System software to automatically track primary radar targets that have characteristics consistent with aircraft in flight and tag them with a persistent track symbol that will be continuously displayed to controllers. Further, this feature should be incorporated into all future Federal Aviation Administration terminal radar data processing systems. (A-99-46)

Chairman HALL, Vice Chairman FRANCIS, and Members HAMMERSCHMIDT, GOGLIA, and BLACK concurred in this safety recommendation.


By: Jim Hall
Chairman