

In-Flight Collision During Air Show
Commemorative Air Force
Boeing B-17G and Bell P-63F

Dallas, Texas
November 12, 2022

This animated reconstruction documents the in-flight collision between a Boeing B-17 and a Bell P-63 at the Wings Over Dallas air show put on by the Commemorative Air Force. The collision occurred about 1:22 p.m. central standard time on November 12, 2022, at the Dallas Executive Airport in Dallas, Texas.

The sequence of events was reconstructed from Federal Aviation Administration (FAA) Automatic Dependent Surveillance-Broadcast (ADS-B) data and data recorded on an Avidyne unit in the B-17, air boss radio communication, video, and aircraft performance data. The animation includes audio replay of air boss radio communications and a transcript of the radio communications. The animation also includes audio narration.

The animation begins with pictures of the two accident airplanes. A Google Earth satellite image of the airport is used to indicate the position of the air boss, the location of crowd, show lines along which the airplanes were expected to fly that were 500 feet and 1,000 feet from the crowd, and runway 13/31.

The view zooms out to a wider-scale Google Earth satellite image of the airport and its vicinity; the image is rendered in grayscale to minimize contrast with the airplane ground tracks. The airplane ground tracks were derived from ADS-B or the B-17's Avidyne data and are shown as colored lines extending to a symbol identifying the position of each airplane. The airplane positions are initially shown in a still image at 1:20 p.m. (or 13:20 using a 24-hour format) with ground tracks starting from 1:19:15 p.m. (13:19:15).

A legend on the left side of the screen shows the nine airplanes being directed by the air boss listed in three blocks, which are labeled as a bomber group, a fighter formation and a revenue flight. Each airplane is correlated with a path presented as a separate colored line: magenta for the B-17 (the lead bomber); yellow for the B-24; purple for the SB-2C; green for the first B-25; no line is shown for the trailing B-25, which was not broadcasting position data; sky blue for the first P-51 (the lead fighter); blue for the second P-51; orange for the P-63; and brown for the PT-17. Symbols of the same colors indicate the current position of each airplane with the lines forming trailing ground tracks. The symbols for the colliding airplanes (the B-17 and the P-63) are circles; the symbols for the other airplanes are squares.

Photographs of the nine airplanes are displayed sequentially in the center of the screen, with lines connecting the photograph to the legend entry for each airplane. Narration identifies each airplane with the full model designation, the common name and the radio call sign for the lead airplanes and the revenue flight. The bomber group was led by the accident B-17G Flying Fortress (Texas Raiders on the radio), followed by a B-24 Liberator, an SB-2C Helldiver, one B-25J Mitchell and a second B-25J Mitchell. The fighter formation was led by a P-51D Mustang (Gunfighter on the radio), followed by a P-51C Mustang, and the accident fighter, a P-63F Kingcobra. Last was the passenger-carrying revenue flight that landed on runway 31 shortly before the collision, a Boeing PT-17 (Quebec on the radio).

Altitude above ground is shown in text next to the legend for the two colliding airplanes: the B-17 and the P-63. The time is shown in 24-hour format at the top of the screen. The transcript of the air boss radio communications is displayed in text on the right side of the screen. Audio of the radio communications between the air boss and the pilots begins about 13:19. Real-time animation of the airplane symbols and trailing ground tracks begins at 13:20, along with the air boss radio communications and transcript and updates to the altitude text data for the B-17 and P-63 in 10-foot increments. Leading up to the collision, the symbols for the airplanes move from south of the airport to the north and begin to turn west to fly parallel to runway 31. Altitude tags recording the altitudes of the B-17 and the P-63 are connected to the ground tracks of those airplanes at 13:21:25 (B-17 at 740 feet, P-63 at 1,600 feet) and at 13:21:45 (B-17 at 430 feet, P-63 at 540 feet). The location of the in-flight collision is highlighted with a red circle at 13:21:54, at an altitude of 220 feet above ground level.

The animation is followed by a video of the collision taken from the area of the crowd. The video starts with the B-17 and the P-63 circled and labeled about 4 seconds before the impact. Five other airplanes are also visible in the video. The left bank of the P-63 obscured the pilot's view of the B-17, and the B-17 pilot likely did not see the P-63 as it came from behind the B-17's left wing. The video is stopped at the point of impact. All five people on board the B-17 and the pilot of the P-63 were fatally injured.

A series of slides with text and narration presents the Probable Cause and Safety Recommendations resulting from the investigation into the in-flight collision.

The National Transportation Safety Board determined that the probable cause of the in-flight collision was the air boss's and air show organizer's lack of an adequate, prebriefed aircraft separation plan for the air show performance, relying instead on the air boss's real-time deconfliction directives and the see-and-avoid strategy for collision avoidance. Also causal was the diminished ability of the pilots to see and avoid other aircraft due to flight path geometry, view obscuration by aircraft structures, attention demands associated with the air show performance, and the

inherent limitations of human performance. Contributing to the collision were the lack of Federal Aviation Administration guidance on developing plans and performing risk assessments that ensure the separation of aircraft during air shows, and the lack of Federal Aviation Administration requirements and guidance for recurrent evaluations of air bosses and direct surveillance of their performance.

The recipients of seven new safety recommendations are listed in text, along with the logos of each agency. The agencies are the Federal Aviation Administration, the International Council of Air Shows, and the Commemorative Air Force. Slides with text and narration summarize the new safety recommendations.

The first slide covers recommendation A-24-31 to the Federal Aviation Administration and recommendation A-34-36 to the International Council of Air Shows. We recommended that they work together to establish standard operating procedures for air show event organizers and air bosses. These procedures would include controls to ensure aircraft remain deconflicted, a safety risk assessment for each show, and a debriefing after each show that includes feedback to the Federal Aviation Administration and the International Council of Air Shows.

The next slide covers recommendation A-24-33 to the Federal Aviation Administration and recommendation A-34-35 to the International Council of Air Shows. We recommended that they work together to develop standardized, unambiguous terms to ensure that directives from air bosses are clear and brief.

The next slide covers recommendations A-24-32 and A-24-34 to the Federal Aviation Administration. We recommended that the Federal Aviation Administration require recurrent air boss evaluations, that they provide guidance for Federal Aviation Administration inspectors who evaluate the performance of air bosses, and that they require Federal Aviation Administration inspectors to conduct direct observations of air bosses and provide feedback during the air show debriefing.

The next slide covers recommendation A-24-37 to the Commemorative Air Force. We recommended that they use Federal Aviation Administration guidance on Safety Management Systems to establish a safety risk assessment process for their unique air show operations, which include serving as event organizer; participating in air boss directed performances involving multiple, dissimilar aircraft; and ensuring the safety of revenue passenger rides.

The recommendation numbers and their recipients are provided in a list along with the logos of each agency. The status of each recommendation can be found through a search beginning on [NTSB.GOV](https://www.ntsb.gov). An image of the [NTSB.GOV](https://www.ntsb.gov) homepage is shown, indicating the options to search for investigation and recommendation data or for case materials in our dockets. Additional information on this investigation, including

the final report, the docket of supporting reports, and the safety recommendations issued, can be found by visiting [NTSB.GOV](https://www.ntsb.gov) and searching for the accident number CEN23MA034.

Narration script

1. On November 12, 2022, about 1:22 p.m. central standard time, a Boeing B-17 and a Bell P-63 collided in-flight while performing in the Wings Over Dallas air show. The air show was put on by the Commemorative Air Force at the Dallas Executive Airport in Dallas, Texas.
2. The air show was directed via radio communications by the air boss, who stood on a set of airstairs near the center of the airport, giving him a clear view of the flying display area.
3. The crowd was positioned on the ramp adjacent to runway 13/31.
4. The airplanes were to fly past the crowd along show lines that were 500 feet and 1000 feet away from the crowd.
5. The airplanes in the air show were all historic, former military airplanes.
6. They were organized into a bomber group and a fighter formation.
7. The bomber group was led by the accident bomber, a Boeing B-17G Flying Fortress called Raiders or Texas Raiders on the radio.
8. The B-17 was followed by a B-24 Liberator, an SB-2C Helldiver, one B-25J Mitchell and a second B-25J Mitchell.
9. The trailing B-25 was not broadcasting position data.
10. The fighter formation was led by a P-51D Mustang called Gunfighter on the radio, followed by a P-51C Mustang, and the accident fighter, a P-63F Kingcobra.
11. A revenue flight in a Boeing PT-17 was also being directed by the air boss and landed on runway 31 just before the accident. The PT-17 was called Quebec on the radio.
12. The air show performance relied on real-time directives from the air boss.
13. The air boss preferred not to assign altitudes and expected the pilots to maintain separation visually.
14. During the air show, the fighters generally flew higher than 1,000 feet above the ground, and the bombers generally flew below 1,000 feet.
15. However, during the final maneuver, the fighters descended to gain speed to cross in front of the bombers, as directed.

16. The following animation will combine the recorded radio communications and Global Positioning System-based ground tracks.
17. Altitude above the ground is shown next to the legend for the two colliding airplanes.
18. The animation begins in the middle of the air show a few minutes before the collision.
19. The following is a video taken from the area of the crowd that starts with the B-17 and the P-63 about 4 seconds before the impact.
20. The left bank of the P-63 obscured the pilot's view of the B-17. The B-17 pilot likely did not see the P-63 as it came from behind the B-17's left wing.
21. All five people on board the B-17 and the pilot of the P-63 were fatally injured.
22. The National Transportation Safety Board determined that the probable cause of the accident was the air boss's and air show event organizer's lack of an adequate, prebriefed aircraft separation plan for the air show performance, relying instead on the air boss's real-time deconfliction directives and the see-and-avoid strategy for collision avoidance.
23. Also causal was the diminished ability of the pilots to see and avoid other aircraft due to flight path geometry, view obscuration by aircraft structures, attention demands associated with the air show performance, and the inherent limitations of human performance.
24. Contributing to the accident were the lack of Federal Aviation Administration guidance on developing plans and performing risk assessments that ensure the separation of aircraft during air shows, and the lack of Federal Aviation Administration requirements and guidance for recurrent evaluations of air bosses and the direct surveillance of their performance
25. We issued seven new safety recommendations to the Federal Aviation Administration, the International Council of Air Shows, and the Commemorative Air Force.
26. We recommended that the Federal Aviation Administration and the International Council of Air Shows work together to establish standard operating procedures for air show event organizers and air bosses. These procedures would include controls to ensure aircraft remain deconflicted, a safety risk assessment for each show, and a debriefing after each show that includes feedback to the Federal Aviation Administration and the International Council of Air Shows.
27. We also recommended that the Federal Aviation Administration and the International Council of Air Shows work together to develop standardized, unambiguous terms to ensure that directives from air bosses are clear and brief.

28. We further recommended that the Federal Aviation Administration require recurrent air boss evaluations, that they provide guidance for Federal Aviation Administration inspectors who evaluate the performances of air bosses, and that they require Federal Aviation Administration inspectors to conduct direct observations of air bosses and provide feedback during the air show debriefing.
29. Finally, we recommended that the Commemorative Air Force use Federal Aviation Administration guidance on Safety Management Systems to establish a safety risk assessment process for their unique air show operations, which include serving as an event organizer; participating in air boss-directed performances involving multiple, dissimilar aircraft; and ensuring the safety of revenue passenger rides.
30. If enacted, these safety recommendations will prevent similar accidents from happening in the future.
31. All the safety recommendations from this investigation and their status can be found on [NTSB.GOV](https://www.ntsb.gov) using the associated recommendation numbers.
32. For additional information on this investigation, including the final report, the docket of supporting reports, and the safety recommendations issued, visit [NTSB.GOV](https://www.ntsb.gov) and search for the accident number CEN23MA034.