United States General Accounting Office

GAO

Report to the Honorable Edward F. Feighan, House of Representatives

July 1988

STRATEGIC AIR COMMAND

KC-135A Crash and the Need for SAC Air Show Regulations

GAO/NSIAD-88-172

542762

GAO

United States
General Accounting Office
Washington, D.C. 20548

National Security and
International Affairs Division

B-230437

July 19, 1988

The Honorable Edward F. Feighan
House of Representatives

Dear Mr. Feighan:

On March 13, 1987, a Strategic Air Command KC-135A aircraft crashed and burned at Fairchild Air Force Base near Spokane, Washington, while it was practicing for an air show being developed by SAC. Seven Air Force personnel, six in the aircraft and one on the ground, died in the crash.

In your July 2, 1987, letter and during subsequent discussions with your Office, you asked us to evaluate the rationale, development, and management of the air show as well as the thoroughness of the Air Force Aircraft Accident Investigation Report. On March 17, 1987, we provided you with a draft of our report. This is our final report.

As arranged with your Office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 5 days after its issue date. At that time, we will send copies to the Secretaries of Defense and the Air Force and other interested parties upon request.

Sincerely yours,

Frank C. Conahan
Assistant Comptroller General

Executive Summary

Purpose

On March 13, 1987, a Strategic Air Command (SAC) KC-135A aircraft crashed and burned at Fairchild Air Force Base (AFB) near Spokane, Washington, while it was practicing for an air show being developed by SAC. Seven Air Force personnel, six in the aircraft and one on the ground, died in the crash.

Congressman Edward F. Feighan asked GAO to evaluate (1) the rationale for the air show program, (2) how well SAC developed and managed the air show program, and (3) the thoroughness of the Air Force's June 10, 1987, Aircraft Accident Investigation Report for the crash.

Background

SAC operates two legs of America's nuclear triad including land-based missiles and bombers such as the B-1, B-52, and FB-111. SAC also operates a large fleet of aerial refueling aircraft such as the KC-10, KC-135A, and KC-135R (a more powerful version of the KC-135A).

Air Force regulations state that all Air Force major commands are authorized to participate in air shows. According to the regulations, the Air Force takes part in aerial events to keep the public and military members informed of U.S. preparedness, demonstrate modern weapon systems, promote good community and international relations, and enhance recruiting and retention. SAC's participation had generally been limited to static displays of its aircraft, with some limited flyovers. However, to enhance morale and increase pilot retention, SAC decided in August 1986 to develop an air show program.

SAC air show plans began with a KC-135R aircraft from McConnell AFB, Kansas, in November 1986. The original KC-135R profile (what the aircraft would be doing during an air show) was designed to highlight the performance characteristics of the aircraft including maximum climb capability, high-speed maneuvering, and a low-altitude simulated refueling demonstration.

In December 1986, SAC added a B-52H from Fairchild AFB to the air show program and designed a profile with several high-performance maneuvers. The original B-52H profile included a maximum performance climb, a simulated low-level bombing run, a high-speed pass down the runway, and steep turns. SAC documents also indicated that SAC planned to develop a B-52H and KC-135R simulated refueling fly-by for a small portion of the air show demonstration.

In early January 1987, Air Force officials at Fairchild AFB decided they would be unable to practice aerial refueling maneuvers with the KC-135R aircraft from McConnell AFB because of the distance between the two bases. As a result, Fairchild AFB officials decided to substitute a KC-135A aircraft located at Fairchild AFB for the KC-135R.

The Commander-in-Chief, Strategic Air Command (CINCSAC) reviewed the KC-135R demonstration and a B-52H/KC-135A demonstration at SAC Headquarters, on January 23, 1987. Air Force documents indicated that the crews were instructed to "keep the aircraft in closer to the field," and the demonstration teams returned to their bases to rework their maneuvers. SAC officials told us that before January 23, 1987, the KC-135A was used only to support a simulated air refueling demonstration during the B-52H profile. After the demonstration for CINCSAC on January 23, senior SAC officials approved the use of the KC-135A for the development of an integrated B-52H/KC-135A profile that would include several different maneuvers.

The Fairchild B-52H/KC-135A demonstration crews reworked their demonstration profile. On February 13, 1987, they performed the integrated B-52H/KC-135A profile for the SAC Headquarters Assistant Deputy Chief of Staff for Operations (SAC ADO) at Malmstrom AFB, Montana. Air Force records indicated that the teams were instructed to further change their profile before a second CINCSAC review scheduled for March 3, 1987.

The B-52H/KC-135A crews at Fairchild AFB then developed and flew a new maneuver. Referred to as the "snake," it was the first maneuver of the integrated demonstration profile and was designed to show the top and underbelly of the KC-135A aircraft. This maneuver was in addition to the simulated low-level aerial refueling demonstration directed by SAC Headquarters.

On March 3, 1987, CINCSAC reviewed the integrated B-52H/KC-135A profile, which included the snake maneuver. Air Force documents indicated that on March 4, SAC officials initiated a short- and long-term program for implementing the SAC aircraft demonstration program in mid-March 1987.

On March 13, 1987, the Fairchild KC-135A aircraft crashed while performing the snake maneuver during a scheduled practice for the demonstration program.

GAO reviewed SAC Headquarters management of the integrated B-52H/KC-135A demonstration profile developed at Fairchild AFB, especially the portion of the profile that included the snake maneuver.

Results in Brief

SAC officials believe the KC-135A crew flew the aircraft into a position that it could not recover from while flying the snake maneuver on March 13, 1987. GAO did not independently investigate the cause of the crash.

GAO asked National Transportation Safety Board (NTSB) officials to do an independent assessment of the Air Force's Aircraft Accident Investigation Report for the KC-135A crash. According to Board officials, the report was thorough and complete.

GAO found that SAC's planning, direction, and oversight for the 92nd Bombardment Wing's (92nd BMW's) development of an integrated B-52H/KC-135A demonstration were less thorough than for the other SAC aircraft to be included in the air show.

SAC did not have regulations for air show demonstrations. GAO believes that appropriate regulations are an important first step in the development and management of an air show program.

The Tactical Air Command (TAC) has an established air show program. However, neither SAC nor the 92nd BMW consulted TAC officials or regulations when developing the integrated B-52H/KC-135A profile.

Principal Findings

SAC Officials Believe Crew Error Contributed to Crash

SAC officials told GAO that it is not known why the KC-135A flight crew allowed the aircraft to descend to an altitude of 200 feet above ground level. According to SAC officials, this placed the aircraft in a position that it could not recover from when it encountered turbulence created by the wing of the B-52H aircraft, which was flying approximately 30 seconds in front of the KC-135A.

SAC's Planning, Direction, and Oversight for the B-52H/KC-135A Integrated Profile Were Less Thorough

GAO found that SAC's planning, direction, and oversight for the 92nd BMW's development of an integrated B-52H/KC-135A profile were less thorough than they were for the other air show aircraft. The primary differences are outlined below.

- SAC Headquarters issued written orders for developing aircraft air show demonstrations to other SAC units involved in the air show. SAC Headquarters did not issue written orders to include the KC-135A when it was first added to the air show program by the 92nd BMW. SAC Headquarters, however, verbally approved including the KC-135A aircraft at a demonstration flown for SAC officials approximately 2 weeks later.
- Early in the development of the SAC air show program, SAC officials directed that there be no practice flights of profiles until they were reviewed and approved by SAC Headquarters. Flight profiles for other aircraft in the air show were approved in advance by SAC Headquarters before any practice flying was done. However, the 92nd BMW developed and flew potential profiles in the B-52H and KC-135A aircraft before they were approved by SAC Headquarters. The 92nd BMW profile included having the B-52H and KC-135A fly toward the crowd.
- Flight parameters—specific guidance on items such as air speed and altitude—were established by SAC Headquarters for other air show aircraft. However, crews at the 92nd BMW established their own parameters for the KC-135A maneuver that called for 170 knots indicated air speed as the minimum air speed, 45 degrees maximum bank angle, and an altitude of 500 feet above ground level or alternatively 100 feet above the B-52H, which was authorized to fly at 200 feet above the ground. Although the 92nd BMW crew changed the B-52H profile several times, they appeared to retain some of the parameters SAC Headquarters originally established for the aircraft, such as air speed of 170 knots indicated air speed and minimum altitude of 200 feet above the ground.
- Flight profiles for other air show aircraft were simulated before they were flown in actual aircraft. There was no simulation of the integrated B-52H/KC-135A profile developed by the 92nd BMW. SAC officials told GAO that an integrated profile cannot be effectively simulated, and actual flight was necessary.
- Flight profiles for other air show aircraft were evaluated and validated by SAC pilots from the 1st Combat Evaluation Group. However, the 1st Combat Evaluation Group did not evaluate and validate the integrated B-52H/KC-135A profile developed by the 92nd BMW.
- There were meetings and consultations with aircraft manufacturers to discuss flight profiles and parameters for other aircraft in the air show. However, except for a telephone call to discuss a technical question,

there were no conferences with the manufacturer of the KC-135A to discuss proposed profiles and parameters to be used in the integrated B-52H/KC-135A profile being developed by the 92nd BMW.

- Limited pilot selection procedures were developed by SAC for other aircraft, including the B-52H. However, no specific procedures were sent to the 92nd BMW for the KC-135A pilot selection process.
- SAC issued a waiver of sections of its flight operations regulations for the other aircraft involved in the air show. However, according to the Air Force Aircraft Accident Investigation Report, no waiver was issued for the KC-135A aircraft that was included in the integrated B-52H/KC-135A profile. Waivers were required for such items as air speed, altitude, and bank angles.

SAC did not have air show regulations. The procedures initially followed by SAC in the development of profiles for the other aircraft in the air show were similar to tight command and control procedures developed by TAC for its air show programs. However, neither SAC nor the 92nd BMW appear to have followed the tight command and control requirements contained in the TAC regulations when they developed the integrated B-52H/KC-135A profile.

Need for Regulations and Documentation of Procedures

SAC officials told GAO that they believe their guidance on the development of the integrated B-52H/KC-135A profile was adequate and ensured flight safety. However, they also told GAO that SAC planning, direction, and oversight for the integrated B-52H/KC-135A profile development were not as well documented as they were for the other air show aircraft. GAO believes that because of the safety issues involved, SAC should develop regulations and document compliance with the regulations.

NTSB Believes Air Force Accident Report Was Thorough and Complete

GAO obtained a copy of the Air Force Aircraft Accident Investigation Report and related briefing materials developed by SAC on the KC-135A crash and asked NTSB officials to provide a technical opinion on their adequacy. The officials believed that the report and briefing materials were thorough and complete and reflected an objective and accurate investigation.

Recommendations

SAC officials stated that no decision has been made whether to continue the air show program. However, they noted that SAC units have expressed a desire to continue the program. If SAC continues to develop

the air show program, GAO recommends that the Secretary of the Air Force direct the CINSAC to (1) establish official regulations for the air show program, (2) ensure that all participating units in its command are aware of the regulations and their specific responsibilities, and (3) ensure through documentation that its procedures and orders are followed and units are maintaining an adequate margin of safety for aircraft maneuvers.

Agency Comments

The Department of Defense (DOD) disagreed with GAO's conclusions that SAC planning, direction, and oversight for the integrated B-52H/KC-135A profile were less thorough than they were for other air show aircraft. DOD agreed, however, that SAC planning, oversight, and direction were not as well documented for the integrated B-52H/KC-135A profile as they were for the other aircraft in the air show. DOD stated that directions for the development and revisions to the program were verbal and were not followed up with written documentation. DOD noted that the lack of documentation may tend to give the appearance of less thorough planning, direction, and oversight. However, DOD believes it should not be interpreted this way.

DOD stated that the KC-135A profile involved normal operational maneuvers flown at typical traffic pattern air speeds and did not in any way approach the limits of the aircraft or the crew. GAO's review of SAC documentation and its discussions with SAC officials indicated that portions of the KC-135A profile did not involve normal operational maneuvers. For example, SAC regulations limit multi-engine aircraft to 30 degrees of bank, compared to the 45 degrees of bank used in the profile. SAC officials told GAO that a 45-degree bank angle is not a usual or required maneuver for the KC-135A.

DOD agreed with GAO's recommendations. DOD stated that, if a decision is made to continue the SAC air show program, before the decision is implemented, SAC would finalize and publish air show regulations. Also, if published, the regulations would detail specific responsibilities at all levels of SAC's command and ensure documentary requirements and adequate safety margins are provided for and followed. GAO believes that this is a prudent approach.

Contents

Figures

Abbreviations

AFB	Air Force Base
CINCSAC	Commander-in-Chief, Strategic Air Command
DOD	Department of Defense
FAA	Federal Aviation Administration
GAO	General Accounting Office
KIAS	knots indicated air speed
NTSB	National Transportation Safety Board
SAC	Strategic Air Command
SAC ADO	SAC Headquarters Assistant Deputy Chief of Staff for Operations
TAC	Tactical Air Command
1CEVG	1st Combat Evaluation Group
92nd BMW	92nd Bombardment Wing

Introduction

On March 13, 1987, a Strategic Air Command (SAC) KC-135A aircraft crashed and burned at Fairchild Air Force Base (AFB) near Spokane, Washington, while practicing for an air show authorized by SAC Headquarters. The aircraft and military personnel involved were members of the 92nd Bombardment Wing (92nd BMW) based at Fairchild AFB. Seven Air Force personnel, six on board the aircraft and one on the ground, died in the crash.

On July 2, 1987, Congressman Edward F. Feighan asked us to evaluate (1) the rationale for the air show program, (2) how well SAC developed and managed the air show program, and (3) the thoroughness of the Air Force's June 10, 1987, Aircraft Accident Investigation Report for the crash.

Mission of the SAC and 92nd BMW

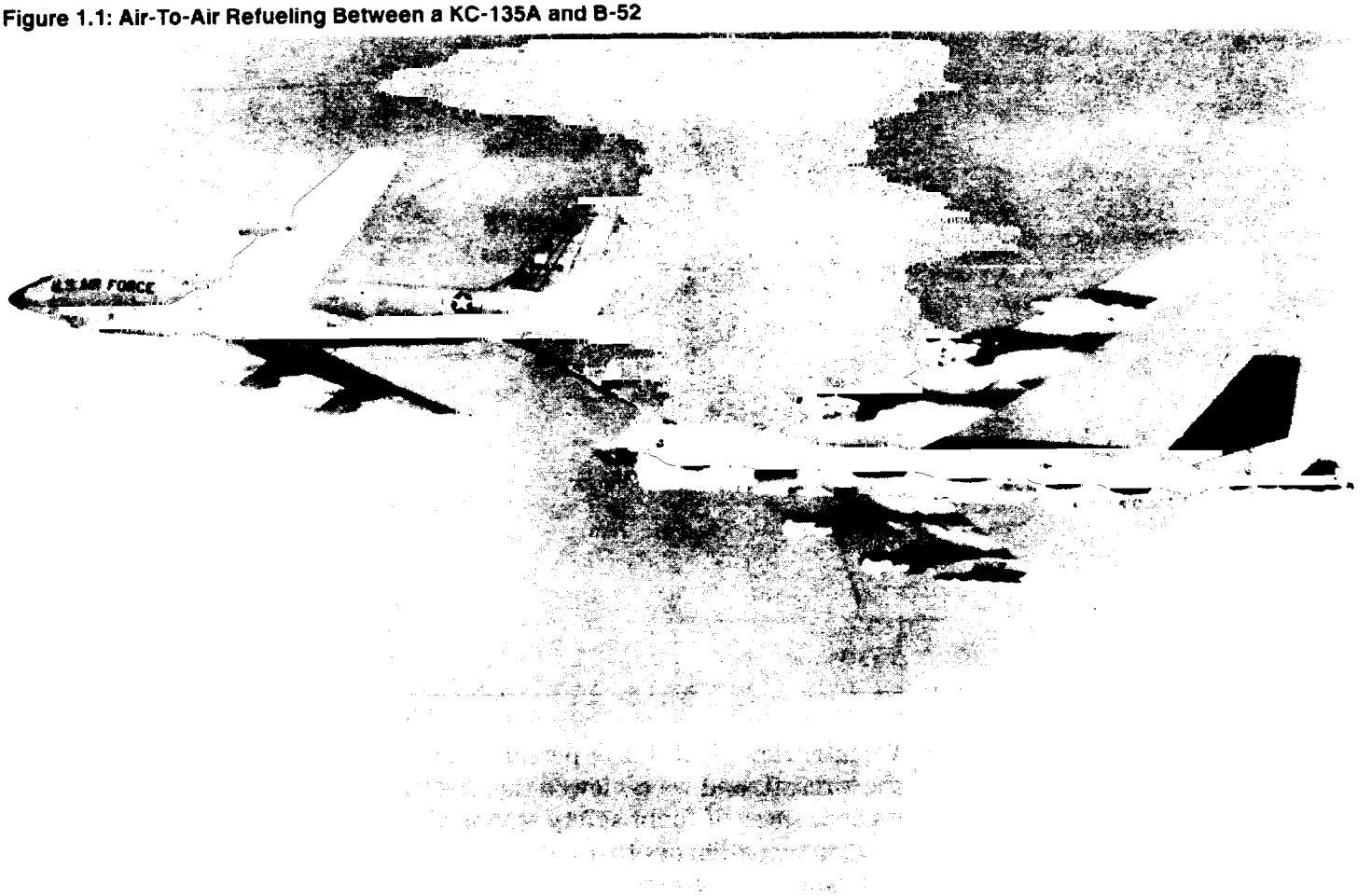
The Strategic Air Command is the U.S. Air Force's long-range force of bombers, tanker aircraft, and intercontinental ballistic missiles. It is also the Air Force's single tanker manager for aerial refueling. SAC's mission is to maintain a force instantly ready to conduct air warfare and other operations on a worldwide basis. The primary objective of SAC's mission is to deter war through the ability to deliver nuclear weapons across the world.

Headquartered at Offutt AFB near Omaha, Nebraska, SAC's operational responsibilities are divided between two numbered Air Forces: the 8th Air Force headquartered at Barksdale AFB near Shreveport, Louisiana, and the 15th Air Force headquartered at March AFB near Riverside, California. The numbered Air Forces operate SAC's mixed force of bomber, tanker, and reconnaissance aircraft in addition to its intercontinental ballistic missile units. The 92nd BMW at Fairchild AFB is an operational unit assigned to the 15th Air Force. It trains bombardment and air refueling crews and units for the performance of global bombardment operations and operates B-52H bombers and KC-135A tankers to carry out its mission (see fig. 1.1). It is headquartered at Fairchild AFB near Spokane, Washington (see fig. 1.2).

Objectives, Scope, and Methodology

Our objectives were to evaluate (1) the rationale for the air show program, (2) how well SAC developed and managed the air show program, and (3) the thoroughness of the Air Force's June 10, 1987, Aircraft Accident Investigation Report for the crash.

Figure 1.1: Air-To-Air Refueling Between a KC-135A and B-52



In our evaluation of the air show program, we focused on the process SAC followed in developing aircraft profiles (what the aircraft would be doing during the the air show) and, particularly, top management's involvement in developing and approving various aspects of the air show, especially the portions of its integrated B-52H/KC-135A profile called the "snake." The KC-135A aircraft crashed while performing this maneuver. The Tactical Air Command (TAC) has an existing air show program, and we consulted TAC officials and regulations when reviewing the KC-135A profile.

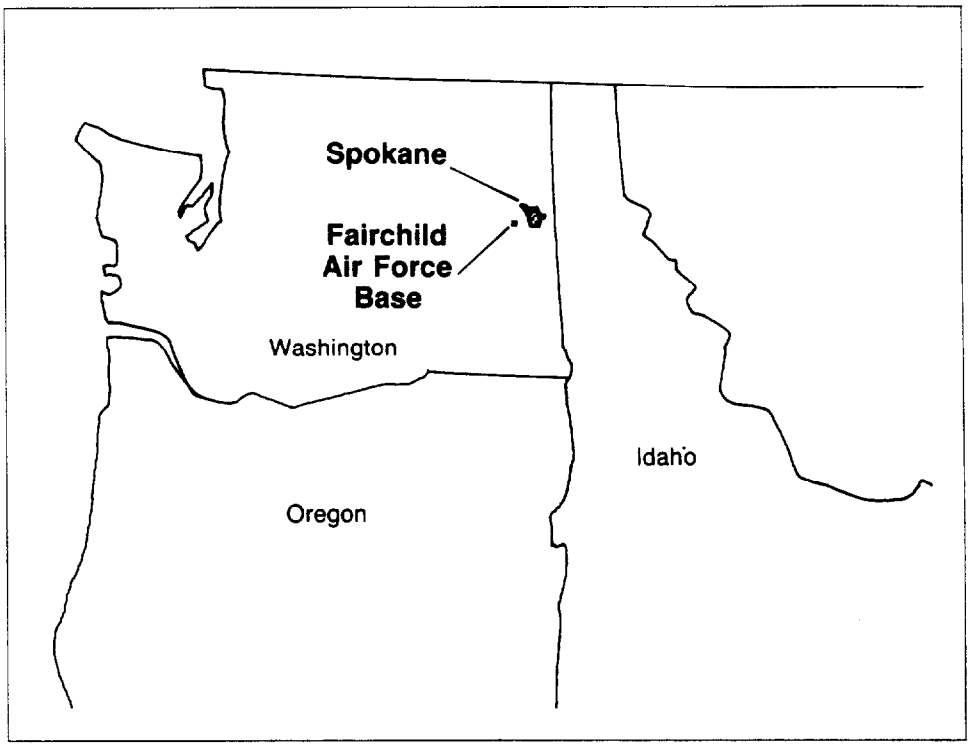


Figure 1.2: Fairchild Air Force Base, Washington

We interviewed Air Force personnel involved in planning for the use of the aircraft, and we reviewed the flight team's operating procedures and its awareness of flight safety standards. We also determined the role and participation of other SAC training and evaluation teams in the demonstration and observed several simulations of the KC-135A's planned and actual flight paths. We obtained information from the manufacturer on the flight capabilities of the aircraft.

In our evaluation of the Air Force's investigation of the crash, we reviewed the Air Force's accident investigation regulations and accident report on the crash and discussed the investigation process with Air Force personnel responsible for Air Force accident investigations. We also requested that officials from the National Transportation Safety Board (NTSB) review the completeness and methodology used by the Air Force in preparing its Aircraft Accident Investigation Report. NTSB is an autonomous agency established to promote transportation safety by conducting independent accident investigations and by making recommendations on safety measures and practices.

We performed work at Fairchild AFB, Washington; 1st Combat Evaluation Group (1CEVG), Barksdale AFB, Louisiana; Central Flight Instructors Course, Castle AFB, California; the Air Force Inspection and Safety Center, Norton AFB, California; TAC Headquarters, Langley AFB, Virginia; Boeing Military Airplanes, Wichita, Kansas; field offices of the Federal Aviation Administration (FAA), and SAC Headquarters, Offutt AFB, Omaha, Nebraska. We also conducted work at the Department of Defense (DOD), FAA, and NTSB offices in Washington, D.C.

Our review was conducted between July 1987 and February 1988 in accordance with generally accepted government auditing standards. DOD provided written comments on a draft of this report. These comments are presented and evaluated in chapter 3 (and are included in app. II).

SAC Air Show Development and the Crash of the KC-135A Aircraft at Fairchild AFB

Air Force regulations establish procedures for Air Force participation in aerial events that apply to all major commands. According to the regulations, the Air Force takes part in aerial events to keep the public and military members informed of U.S. preparedness, demonstrate modern weapon systems, promote good community and international relations, and enhance recruiting and retention. In August 1986, SAC Headquarters decided to develop an air show program.

Development of SAC Air Show Program

SAC Headquarters receives over 600 requests each year to participate in air shows, open houses, and related events. Its participation has been limited to static displays of its aircraft and high-level aircraft flyovers. SAC's regulation for air operations states that static displays are the primary method for SAC participation in public events and open houses.

However, in August 1986, SAC Headquarters requested its units and bases to participate in developing an air show program to enhance morale and increase pilot retention. SAC asked its units to submit a list of possible maneuvers that would display its aircraft's capabilities in relation to its mission. SAC received several responses, and it began to plan for the air show program. At that time, SAC Headquarters announced that its program would initially be confined to a KC-135R aircraft located at McConnell AFB, Kansas.

In November 1986, SAC Headquarters officials met with the aircraft manufacturer and SAC evaluation and instructor pilots to develop specific demonstration maneuvers and flight parameters for the KC-135R aircraft. The original KC-135R profile was designed to highlight the performance characteristics of the aircraft and included maximum climb capability, high-speed maneuvering, and a low-altitude simulated refueling demonstration. SAC selected the most experienced KC-135R instructor pilot to participate in the profile validation process with 1CEVG. The pilot first flew the planned profile in the simulator and then validated it at high altitudes in a real environment. Flight testing was completed, and the profile was reviewed by the Commander-in-Chief, SAC (CINCSAC) on January 23, 1987.

In December 1986, SAC Headquarters expanded the program to include a B-52H aircraft (see app. I for aircraft description) from Fairchild AFB. SAC Headquarters designed the original B-52H air show maneuvers which included a maximum performance climb, simulated low-level bombing run, high-speed pass down the runway, and steep turns. SAC documents from the 1CEVG's evaluation of the initial B-52H profile in

November 1986 indicate that SAC intended to develop a B-52H and KC-135R simulated low-level aerial refueling fly-by demonstration as a portion of the air show demonstration. SAC Headquarters instructions to the air show teams at Fairchild AFB included (1) flying the profile in the B-52H simulator until the crew was confident and comfortable that they could safely perform the scenario in the aircraft, (2) performing the profile at high altitude to validate it in flight, and (3) performing the profile at the airfield at demonstration altitudes. The aircrews were instructed to practice their profiles for an initial review by CINCSAC on January 23, 1987. Other aircraft, such as the KC-10, FB-111, and B-1B, were also added to the program after the initial planning for the KC-135R and B-52H.

KC-135A Aircraft Added at Fairchild AFB

In early January 1987, Fairchild AFB officials decided that they would be unable to practice aerial refueling maneuvers with the KC-135R aircraft from McConnell AFB because of the distance between the two bases. As a result, they decided to substitute a KC-135A aircraft located at Fairchild AFB for the KC-135R. SAC officials told us they were aware of the substitution. However, there were no documents to indicate that SAC was aware of the change.

Early in the development of the SAC air show program, SAC officials directed that there be no practice flights of profiles until they were reviewed and approved by SAC Headquarters. However, flight records indicated that the Fairchild B-52H/KC-135A integrated air show team, known as the Thunderhawks, began to develop and fly simulated low-altitude aerial refueling practice flights on January 9, 1987, 2 weeks before the scheduled CINCSAC review of the planned KC-135R/B-52H profile. This 2-week period also coincided with the validation phase of the B-52H profile.

CINCSAC reviewed the KC-135R demonstration and a B-52H/KC-135A demonstration at SAC Headquarters on January 23, 1987, and instructed the teams to "keep the aircraft in closer to the field." SAC officials told us that before January 23, 1987, the KC-135A was used only to support a simulated air refueling demonstration during the B-52H profile. After the demonstration for CINCSAC on January 23, senior SAC officials approved the use of the KC-135A for the development of an integrated B-52H/KC-135A profile that would include several different maneuvers. SAC officials told us the simulated low-level air refueling was only a small portion of the program.

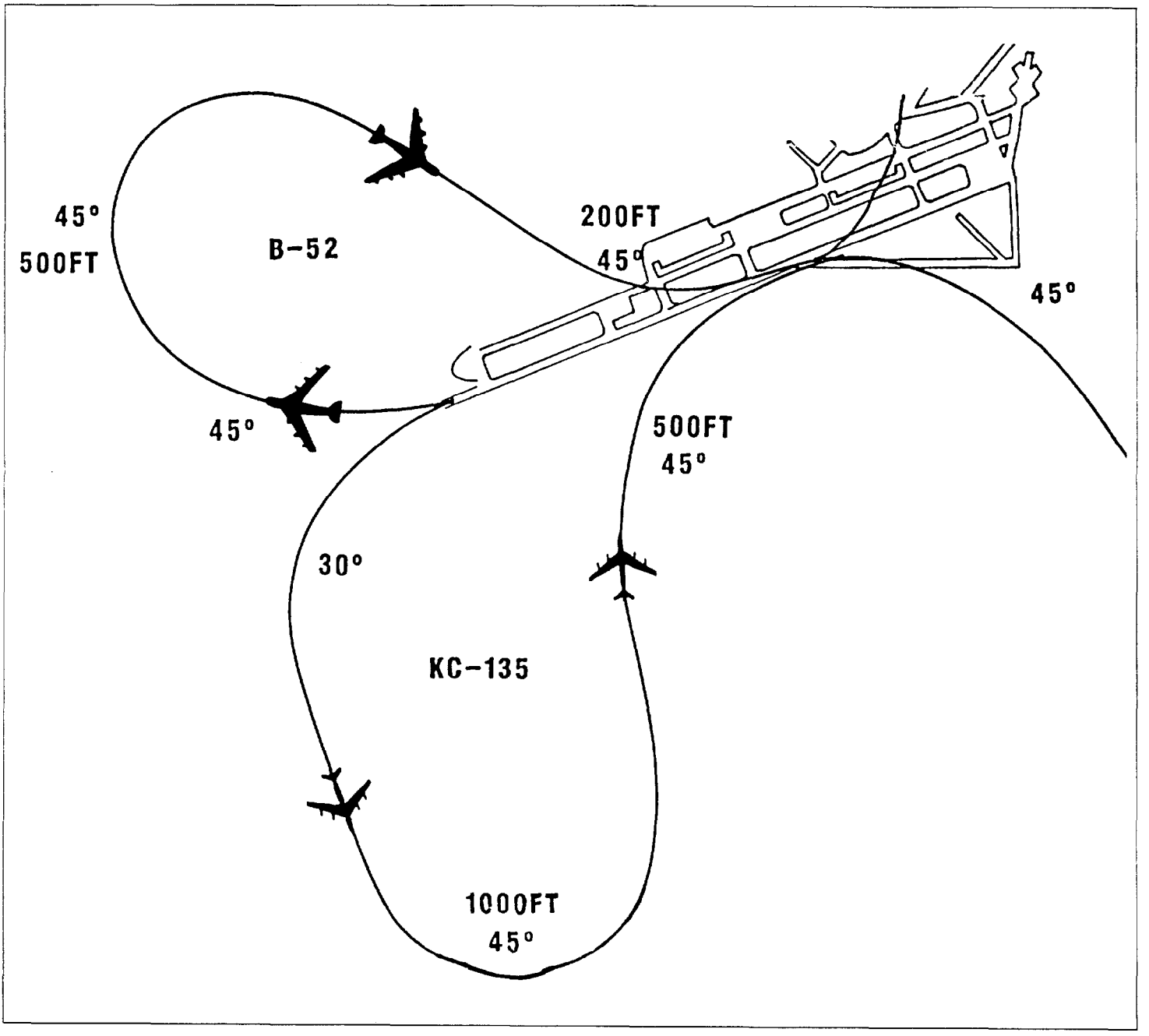
Between January 23 and February 13, 1987, the Thunderhawks flew seven practice sorties that involved several different pilots. On February 13, 1987, the Thunderhawks performed the integrated B-52H/KC-135A profile for the SAC Headquarters Assistant Deputy Chief of Staff for Operations (SAC ADO) at Malmstrom AFB, Montana. Air Force records indicated that the teams were instructed to change their integrated profile further before a second CINCSAC review on March 3, 1987. Air Force records also indicated that the Thunderhawks performed again on February 27, 1987, at Fairchild AFB for the Commander of the 15th Air Force.

According to testimony in the Air Force Aircraft Accident Investigation Report, the KC-135A pilots at Fairchild AFB developed and flew a new maneuver. Referred to as "the snake," it was to be the first maneuver of the integrated B-52H/KC-135A profile and was designed to show the top and underbelly of the KC-135A aircraft. This was in addition to the planned aerial refueling demonstration directed by SAC Headquarters. Earlier in the air show development, SAC directed that there be no practice flying until the profiles were reviewed and approved by SAC Headquarters. Air Force records showed that the 92nd BMW flew three practice sorties that included the snake before the second scheduled CINCSAC review on March 3, 1987. CINCSAC reviewed the integrated B-52H/KC-135A profile, which included the snake maneuver, on March 3, 1987.

KC-135A Flight of March 13, 1987

On March 13, 1987, another demonstration practice flight, including the snake maneuver, was scheduled. Figure 2.1 shows the planned flight path of the initial portion of the integrated B-52H/KC-135A profile. The plan called for the B-52H to be the first of the two aircraft passing the demonstration area. The KC-135A maneuver was to be flown at 170 knots indicated air speed (about 196 miles per hour), at an altitude of 500 feet above ground level, or alternatively 100 feet higher than the B-52H, and with a 45-degree maximum bank angle.

Figure 2.1: Planned Flight Path of the KC-135A and B-52H Aircraft



According to an Air Force account, the KC-135A aircraft took off first, followed by the B-52H bomber. The KC-135A then made a left climbing

turn to its leveling-off altitude of approximately 1,100 feet. It continued flying straight for about 10 seconds and then started a left turn to position itself back toward the departure end of the runway. About two-thirds of the way through the turn, it started to descend to its level-off altitude above the runway. At a position short of the runway, the KC-135A began a descending right turn to parallel the runway, straightened out to a wings-level position, and then immediately went into a left bank turn. At this point, the radar plots show the aircraft had descended to approximately 200 feet above ground level. This was below the 92nd BMW altitude parameter of 500 feet above ground level or alternatively 100 feet above the flight path of the B-52H (300 feet above ground level). The aircraft stabilized at about 45 degrees of bank, then abruptly rolled left with wings nearly vertical, and decelerated and descended rapidly. The aircraft corrected its roll to almost wings-level, but continued its rapid descent, slightly nose high, and crashed approximately 1,800 feet from the runway centerline.

SAC Officials Believe Crew Error Contributed to Crash

According to SAC officials, it is not known why the KC-135A flight crew allowed the aircraft to descend to 200 feet above ground level where SAC officials believe it encountered the turbulence created by the wing tip of the B-52H and rolled to almost 90 degrees of bank. SAC officials told us they believe the crew flew the aircraft into a position that it could not recover from. The crash is discussed in further detail in chapter 4.

SAC Planning, Direction, and Oversight for Integrated B-52H/KC-135A Profile Less Thorough

SAC planning, direction, and oversight for the integrated B-52H/KC-135A profiles were less thorough than they were for the other aircraft in the air show. In contrast, SAC appeared to apply tight command and control procedures for the initial B-52H and KC-135R profiles. These initial procedures were similar to those used by TAC in its air show program. However, these procedures were not used for the integrated B-52H/KC-135A profile developed by the 92nd BMW.

SAC Headquarters officials told us that SAC planning, direction, and oversight for the KC-135A were not as well documented as they were for the other air show aircraft. However, SAC officials also told us that they believe positive command and control of the program existed through direct feedback between the 92nd BMW Wing Commander and the SAC ADO.

SAC Planning, Direction, and Oversight for the Integrated B-52H/KC-135A Profile Were Less Thorough Than They Were for Other Air Show Aircraft

SAC's planning, direction, and oversight for the development of the integrated B-52H/KC-135A part of its air show program were less thorough than they were for the other SAC aircraft included in the air show. The primary differences are outlined below.

- SAC Headquarters issued written orders for developing aircraft air show demonstrations to other SAC units involved in the air show. SAC did not issue written orders to include the KC-135A when it was first added to the air show program by the 92nd BMW. SAC Headquarters, however, verbally approved including the KC-135A aircraft at a demonstration flown for SAC officials approximately 2 weeks later.
- Flight profiles for the other aircraft in the air show were to be approved in advance by SAC Headquarters before any practice flying was done. Early in the development of the SAC air show program, SAC officials directed that there be no practice flights of profiles until they were reviewed and approved by SAC Headquarters. However, the 92nd BMW developed and flew potential profiles in the B-52H and KC-135A aircraft before they were approved by SAC Headquarters. The 92nd BMW profile included having the B-52H and KC-135A fly toward the crowd.
- Flight parameters (specific guidance on items such as air speed and altitude) were established by SAC for other aircraft. However, crews at the 92nd BMW established their own parameters for the KC-135A maneuver that called for 170 knots indicated air speed (KIAS) minimum air speed, a

45-degree maximum bank angle, and altitude of 500 feet above ground level or alternatively 100 feet above the flight path of the B-52H (which was authorized to fly at 200 feet above ground level). Although the 92nd BMW changed the B-52H profile several times, they appeared to retain some of the parameters SAC Headquarters originally established for the aircraft, such as air speed of 170 KIAS and minimum altitude of 200 feet above the ground.

- Flight profiles for other aircraft were simulated before they were flown in actual aircraft. There was no simulation of the integrated B-52H/KC-135A profile. SAC officials told us they believed simulation for the KC-135A was unnecessary because there was nothing in the integrated B-52H/KC-135A profile that exceeded aircraft or aircrew limits. In addition, SAC officials told us that the KC-135A flight simulator was not capable of simulating an integrated profile; therefore, actual inflight practice was required.
- Flight profiles for other aircraft were evaluated and validated by 1CEVG pilots. However, the 1CEVG did not evaluate and validate the integrated B-52H/KC-135A profile developed by the 92nd BMW.
- There were meetings and consultations with aircraft manufacturers to discuss flight profiles and parameters for other aircraft in the air show. However, officials from Boeing Military Airplanes, the KC-135A manufacturer, told us that except for a telephone call to discuss a technical question, there were no meetings with SAC to discuss proposed profiles and parameters to be used in the integrated B-52H/KC-135A profile being developed by the 92nd BMW.
- Limited pilot selection procedures were developed by SAC for other aircraft involved in the show. However, no specific procedures were sent to the 92nd BMW for the KC-135A pilot selection process.
- SAC issued a waiver of sections of its flight operations regulations for the other aircraft involved in the air show. However, according to the Air Force Aircraft Accident Investigation Report, no waiver was issued for the KC-135A aircraft that was included in the integrated B-52H/KC-135A profile. Waivers were required for such items as air speed, altitude, and bank angles.

DOD did not agree with our conclusion that SAC planning, direction, and oversight for the integrated B-52H/KC-135A profile were less thorough than they were for the other air show aircraft. It agreed that SAC planning, direction, and oversight were not as well documented for the integrated B-52H/KC-135A profile as they were for the other aircraft. DOD added that directions for the development and revisions to the program were verbal and were not followed up with written documentation. It also commented that the lack of documentation may tend to give the

appearance of less thorough planning, direction, and oversight. However, DOD believes it should not be interpreted this way. DOD's comments on our findings are outlined in the following sections.

No Written SAC Orders Adding KC-135A to Air Show

SAC issued written orders covering other air show aircraft. However, SAC did not issue written orders adding the KC-135A to the air show. Testimony in the Air Force Aircraft Accident Investigation Report indicated that the KC-135A was added to the air show based on a decision made at Fairchild AFB. According to the report, SAC originally intended to have a simulated aerial refueling demonstration with a B-52H from Fairchild AFB and a KC-135R from McConnell AFB. However, according to the Air Force Aircraft Accident Investigation Report, Air Force officials from Fairchild determined it would not be possible to develop the joint profile because of the distance between the bases. Therefore, Air Force officials at Fairchild decided to add the KC-135A aircraft, which was initially included only as a refueling platform for the B-52H profile, and they developed an integrated B-52H/KC-135A demonstration at the base. According to SAC officials, the decision to include the KC-135A was coordinated verbally between the Fairchild Wing Commander and senior SAC staff, including the SAC ADO. Air Force officials also told us that SAC gave verbal approval to add the KC-135A about 2 weeks after the 92nd BMW had added it.

Even though DOD agreed with our finding that no written orders were issued adding the KC-135A to the demonstration program, they noted that the SAC ADO verbally approved the KC-135A to participate in a simulated refueling demonstration profile. DOD also noted that the senior SAC staff verbally directed the Fairchild Wing Commander to develop an integrated B-52H/KC-135A demonstration profile, and no practice sessions were flown without SAC knowledge. Verbal direction was inconsistent with the procedures used for other air show aircraft and with readily available TAC procedures. We believe that verbal direction without follow-up written orders for the integrated B-52H/KC-135A profile indicated a lack of thoroughness in the planning and development of the air show.

92nd BMW Developed Integrated B-52H/KC-135A Air Show Profile

SAC officials told us that although they were aware of the B-52H/KC-135A demonstration being developed at Fairchild, they did not provide profile scenario guidance (the maneuvers the aircraft would fly during the air show) for the integrated B-52H/KC-135A profile as they had for the other aircraft involved in the air show. Also, early in the air

show development, SAC required that no practice flying would be done until the profiles were approved by SAC Headquarters. According to the Air Force Aircraft Accident Investigation Report, the integrated B-52H/KC-135A profile was developed and flown by the crews at Fairchild AFB without SAC Headquarters approval. According to SAC officials, Fairchild had verbal approval from the SAC ADO, who was acting as the approval authority for CINCSAC. The officials told us the approval was given directly to the Fairchild Wing Commander.

DOD agreed that SAC did not issue specific documents to Fairchild crews outlining the maneuver parameters for the KC-135A. DOD noted that the profiles were developed under the direct supervision of the Wing Commander's staff at Fairchild, consistent with the verbal direction of Senior SAC staff to develop an integrated B-52H/KC-135A profile. However, this was inconsistent with the command and control used by SAC earlier in the air show program.

Integrated B-52H/KC-135A Flight Parameters Not Established or Approved by SAC

Flight parameters were established by SAC for the other air show aircraft. However, crews at the 92nd BMW established their own parameters for the integrated B-52H/KC-135A maneuver that called for 170 KIAS minimum air speed, a 45-degree maximum bank angle, and altitude for the KC-135A of 500 feet above ground level or alternatively 100 feet above the B-52H (which was authorized to fly at 200 feet above the ground). Although the 92nd BMW changed the B-52H profile several times, they appeared to retain some of the parameters SAC Headquarters originally established for the aircraft, such as air speed of 170 KIAS and minimum altitude of 200 feet above the ground.

SAC established the minimum altitude for the B-52H portion of the profile at 200 feet above ground level. According to the Aircraft Accident Investigation Report, the initial demonstration maneuver of the integrated B-52H/KC-135A included the KC-135A flying at 500 feet above ground level. The SAC briefing documents prepared for Congressman Feighan stated that the planned KC-135A altitude was 500 feet above ground level, or alternatively 100 feet higher than the B-52H. The documents stated that the KC-135A could descend lower than 500 feet if the pilot could clearly see the B-52H smoke trail, but in no case could the pilot descend within 100 feet of the B-52H. With the use of the B-52H minimum altitude authorized by SAC, it would have been possible for the KC-135A to fly its initial maneuver at 300 feet above ground level, which is well below its planned 500-foot altitude.

DOD agreed that SAC did not issue specific written guidance for the integrated profile. It noted, however, that SAC did issue specific parameters to Fairchild for the development of the initial B-52H profile. We agree that SAC issued flight parameters to Fairchild for the initial B-52H profile. However, SAC did not issue any written guidance to the crews for the development of the integrated B-52H/KC-135A profile, and the initial B-52H parameters did not account for the integration of the two aircraft for the demonstration.

DOD also commented that the KC-135A aircraft portion of the profile did not require special study because it involved normal operational maneuvers and did not approach any flight manual limits. Our review of SAC documents and our discussions with SAC officials indicated that portions of the KC-135A profile did not involve normal operational maneuvers. SAC regulations limit multi-engine aircraft to 30 degrees of bank, compared to the 45 degrees of bank used in the Thunderhawks routine. Air Force officials at both the ICEVG and the Central Flight Instructors Course told us that although a 45-degree bank angle is not outside the performance parameters of the KC-135A aircraft, it is not a usual or required maneuver for the KC-135A. According to the Air Force officials, KC-135A pilots are not trained for 45-degree banks at 300 feet above ground level at 170 KIAS.

Integrated B-52H/KC-135A Profile Could Not Be Simulated Before Practice Flight

Preflight simulation of air show profiles in appropriate aircraft simulators can provide useful information on flight safety data such as air speed and altitude. The integrated B-52H/KC-135A profile was not simulated before practice flights, whereas the profiles of other aircraft involved in the air show were.

A KC-135A flight simulator with visual imagery is available at the Central Flight Instructors Course at Castle AFB, California, which we visited during our evaluation. At our request, personnel at the Central Flight Instructors Course simulated several versions of the initial portions of the KC-135A profile, which included the snake maneuver. Results showed that the initial portions of the profile could successfully be flown at 300 or 500 feet above ground level.

Air Force officials at Castle AFB told us that neither SAC Headquarters nor Fairchild AFB officials requested assistance with simulation or planning the KC-135A profile. SAC Headquarters officials told us they do not believe simulation was necessary because the profile was safe and was

initially flown at high altitudes and later brought down to lower altitudes. SAC Headquarters officials also told us that a key element in the integrated B-52H/KC-135A profile was maintaining distance between the aircraft, and this could not be done in a simulator. SAC officials told us that because the KC-135A simulator is incapable of simulating an integrated profile, actual in-flight practice was required.

DOD agreed with SAC officials that the KC-135A simulator at Castle AFB is unsuitable for practicing visual spacing and timing maneuvers with another aircraft. DOD also commented that the integrated B-52H/KC-135A profile required actual in-flight practice to perfect the timing and spacing required. We recognize that the KC-135A simulator is not capable of practicing visual spacing and timing maneuvers with another aircraft. However, KC-135A aircraft crews usually operate between 30,000 and 50,000 feet above ground level for refueling missions. We believe simulation could have provided the opportunity to obtain and evaluate information on aircraft performance capabilities in low level operations and could have helped to familiarize the pilots with these operations before actual flight.

Integrated B-52H/KC-135A Profile Not Validated by 1CEVG

SAC has within its command the 1CEVG located at Barksdale AFB, Louisiana. One of the missions of the 1CEVG is to evaluate and validate new combat profiles for SAC aircraft. SAC used 1CEVG's pilots to evaluate and validate the initial B-52H profile developed at Fairchild AFB. However, 1CEVG officials told us they were not consulted by SAC Headquarters or 92nd BMW officials for evaluation and validation of the integrated B-52H/KC-135A profile or any other planning assistance. The evaluation and validation of the integrated B-52H/KC-135A profile by 1CEVG pilots could have provided an opportunity to obtain useful information on appropriate altitudes, air speeds, and other flight safety issues. This information could then have been used to test and evaluate parameters for the integrated B-52H/KC-135A air show profile.

DOD commented that evaluation and validation by the 1CEVG was not necessary because the KC-135A profile basically included normal operational maneuvers flown at typical traffic pattern air speeds. DOD also noted that the KC-135A did not approach any flight manual limits and therefore did not require special study for safety. In addition, DOD commented that the integrated profile was validated by Fairchild AFB personnel. As discussed on page 23, our review showed that some of the KC-135A portion of the integrated profile did not involve normal operational maneuvers.

Limited Consultation With Aircraft Manufacturer

When the KC-135R profile was being developed, SAC officials held meetings with the aircraft manufacturers to obtain their views on proposed flight profiles. However, the only contact with the manufacturer on the KC-135A portion of the integrated B-52H/KC-135A profile was a telephone call on in-flight water augmentation of the KC-135A's engines. Usually, water augmentation is only used on takeoff to give the engines additional power.

We contacted Boeing Military Airplanes, the manufacturer of the KC-135A aircraft, for assistance in calculating the air speed flight parameter. Based on the aircraft's weight and technical manual information, Boeing officials suggested a maneuvering air speed of 195 KIAS for the initial portion of the KC-135A profile that involved the snake maneuver. According to Boeing officials, neither SAC nor the 92nd BMW requested their assistance to determine aircraft performance characteristics for the integrated B-52H/KC-135A profile.

Air Force regulations require fixed-wing aircraft performing in aerial events to establish minimum air speed as stall speed plus 30 percent. SAC Headquarters instructed the other teams involved in the air show program to adhere to a minimum air speed of stall speed plus 30 percent for the aircraft configuration. SAC documents issued during the crash investigation indicated SAC's approved air speed parameter for the KC-135A would also have been stall speed plus 30 percent for the aircraft configuration. According to Air Force documents, the KC-135A pilots at Fairchild AFB established a maneuvering air speed of 170 KIAS for the KC-135A. However, air speed of 170 KIAS did not meet the SAC standards of stall speed plus 30 percent.

Given the weight of the accident aircraft, the stall speed would have been about 148 KIAS at 45 degrees of bank. A 30-percent margin above stall speed would be about 44 KIAS. Therefore, stall speed plus 30 percent equals an air speed of about 192 KIAS. SAC Headquarters officials told us they believe the calculated air speed of 170 KIAS for the KC-135A was sufficient because it was 20 to 22 knots above stall speed.

DOD commented that none of the planned B-52H/KC-135A integrated profile maneuvers involved anything that approached or exceeded the aircraft flight manual limits. In addition, DOD noted that the planned maneuvers for the KC-135A did not approach or exceed any structural or aerodynamic aircraft limitations and were considered simple and safe enough not to require a re-evaluation by Boeing or ICEVG representatives. DOD commented that consultation with Boeing for these maneuvers

was not necessary. Air Force officials at the Central Flight Instructors Course and ICEVG told us that although the planned KC-135A profile was not outside of the performance characteristics of the aircraft, it was not a routine operational maneuver. There were differences of opinion regarding an appropriate profile air speed. We believe that consultation with Boeing should have been included as a necessary step in the development of the profile.

Pilot Selections Not Reviewed by Higher-Level Authority

According to the Air Force Aircraft Accident Investigation Report, SAC began its air demonstration program as a wing-level initiative, deferring the selection of KC-135A air show crews to the wing-level commander. In contrast, TAC pilot screening and selection procedures require wing commander and numbered Air Force command approval of demonstration pilot selections. We believe SAC should establish demonstration pilot screening and selection criteria and procedures. The procedures should provide for collaboration between the wings and the numbered Air Forces. This should increase command and control oversight to ensure selection of the best demonstration pilots available.

DOD noted that a December 1986 SAC message to the 92nd BMW on the B-52H aerial demonstration provided that demonstration crews should be comprised of the "...most skilled aviators available." DOD also noted that although no message specified the criteria for KC-135A pilot selections, the crew selection criteria used at Fairchild were the same as any other SAC base in the demonstration program. Although the criteria may have been to select the most skilled aviators available, SAC pilot selection procedures did not include wing commander and numbered Air Force command involvement in making those selections. TAC procedures, which were readily available to SAC, require wing commanders and numbered Air Force commander approval. DOD noted that SAC's draft instructions, which were sent to TAC for comment after the accident, also included this procedure.

SAC Did Not Issue a Waiver of Its Flight Operations Regulations for the KC-135A Aircraft

SAC's regulations governing SAC's participation in aircraft displays and aerial events provide specific guidance on air safety issues. For example, the regulations prohibit aerobatic maneuvers and low-altitutde aerial refueling demonstrations and limit multi-engine aircraft to a 30-degree bank angle.

SAC issued a written waiver of its flight operations regulations for minimum altitude and bank angles for the other aircraft involved in the air

demonstration. However, this waiver did not include the KC-135A aircraft. During the aircraft accident investigation, the investigating officer was unable to find documentary evidence authorizing the 92nd BMW KC-135A aircrews to deviate from the SAC regulations governing participation in the air show. SAC officials told the investigating officer that the original waiver was valid for flight crews from the bases involved in the air show but not for specific aircraft. Therefore, according to SAC, it was reasonable for Fairchild AFB officials to assume that the KC-135A was included in the original waiver. However, SAC issued a separate waiver for a B-1B aircraft at Dyess AFB, Texas, when it was later added to the air show program after the original waiver had been issued. SAC did not amend its original waiver or issue a separate waiver for the KC-135A aircraft, even though it was a part of the air show program.

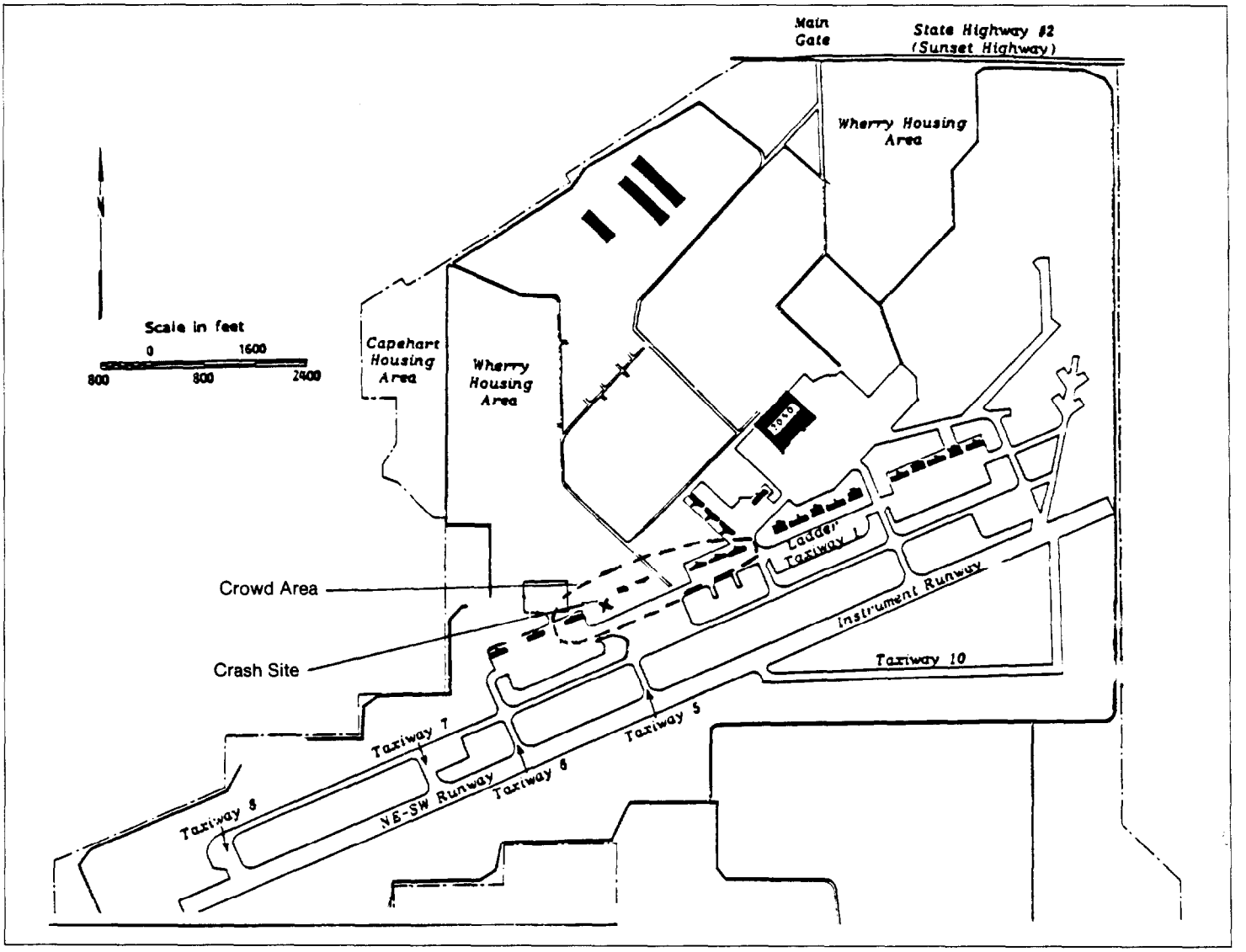
DOD agreed with our finding that there was no specific waiver message issued for the KC-135A. However, DOD noted that a waiver message sent to units participating in the air demonstration program included "...flight crews from Fairchild AFB who have been specifically directed to develop air demonstration profiles." According to DOD, the 92nd BMW was specifically directed orally on January 23, 1987, to develop the integrated profile. SAC Headquarters determined that an additional message was not needed because the KC-135A demonstration crew was located at Fairchild and thus was considered to be included in the original waiver.

The Air Force Aircraft Accident Investigation Report found the failure to obtain a written waiver a procedural deviation from Air Force regulations. As discussed earlier, we believe that verbal direction without follow-up written orders was inconsistent with the procedures used for other air show aircraft and indicated that the planning, direction, and oversight of the integrated B-52H/KC-135A profile were less thorough than they were for other aircraft in the air show. DOD emphasized in its comments that the entire air show development was an iterative process and was patterned after the TAC program. We agree that SAC's air show program was in its development stages and appeared to follow some TAC procedures initially. However, in the absence of formal SAC air show regulations, we believe it was particularly important for SAC to closely follow its existing operational regulations in developing the planned air show. We believe the failure to obtain a written waiver of these regulations for the KC-135A was an omission of an important planning step in the profile development.

Initial Integrated B-52H/KC-135A Profile Had Aircraft Flying Toward Crowd Location

The initial integrated B-52H/KC-135A profile developed by the 92nd BMW had the B-52H and KC-135A aircraft flying toward the crowd. We were told that the location where the plane crashed (see fig. 3.1) is an area where the public generally gathers to see Fairchild's annual air show. The crash is discussed in more detail in chapter 4.

Figure 3.1: Crash Site at Fairchild AFB and Crowd Area



In the interest of public safety, both the Air Force and the FAA have regulations prohibiting flight toward or over crowds. SAC was in the process of developing its own draft air show regulations at the time of the accident. SAC modeled its draft regulations after TAC's and it sent the draft regulations to TAC for comment after the crash. One informal TAC comment was that maneuvers should be flown away from the crowd. SAC officials told us that the B-52H/KC-135A profile had not yet been officially approved, and flying toward the crowd would have been eliminated before performance at an air show.

DOD did not agree with our finding that the integrated B-52H/KC-135A had the aircraft flying toward crowd locations. DOD commented that (1) the integrated profile was still being developed at the time of the crash and had not been finally approved by SAC, (2) the profile was not developed for any specific base, (3) FAA evaluation and approval would be required for each air show location, and (4) if the profile were to have been flown at Fairchild AFB, the crowd would have been relocated or the maneuver modified.

SAC Officials Believe Guidance for KC-135A Was Adequate

SAC Headquarters officials told us they did not establish separate profile planning instructions for the KC-135A model aircraft because it is identical to the KC-135R model except for the engine. According to SAC documents, each KC-135A model engine has up to 13,750 pounds of thrust per engine, whereas each KC-135R model engine has up to 22,000 pounds of thrust per engine. SAC Headquarters officials told us they believe their guidance to the aircrews was adequate and ensured flight safety. However, we could find no documents indicating that SAC had sent any guidance or profile development information to the KC-135A crew. SAC officials also told us that because the KC-135A and R models are the same, a separate profile workup for the KC-135A was not necessary. However, none of the KC-135R profile development information was sent to the KC-135A demonstration pilots at Fairchild AFB.

DOD expressed the view that SAC guidance for the KC-135A aircraft was adequate. It commented that planning activities for the KC-135A were coordinated through verbal communication between the Fairchild Wing Commander and the SAC ADO. DOD also said that the KC-135A profile included only normal operational maneuvers flown at typical traffic pattern air speeds.

SAC Did Not Apply TAC Procedures to Integrated B-52H/KC-135A Profile Development

SAC appeared to apply procedures similar to TAC's tight air show command and control procedures in its initial development of the SAC air show program. However, these procedures were not used for the development of the integrated B-52H/KC-135A profile.

In 1984, TAC established regulations for participation in air shows. The regulations established detailed guidelines for

- requesting, processing, and carrying out aircraft demonstrations;
- screening and selection procedures for pilots at the numbered Air Force command level;
- demonstrating pilot training procedures that include detailed information on practice altitudes, ground training, and minimum practice periods; and
- coordinating responsibilities among the command headquarters, sponsor, participants, and responsible civilian agencies before the air show.

As stated earlier, SAC Headquarters was aware of TAC's regulations and, at the time of the accident, was in the process of developing its own draft regulations modeled after TAC's. However, SAC did not use procedures similar to those of TAC in developing the integrated B-52H/KC-135A profile.

SAC Headquarters officials told us that they believe they used procedures similar to TAC's in developing the integrated B-52H/KC-135A air demonstration. SAC officials said that the crew members were hand selected at the local level from the most capable available. They added that the Aircraft Accident Investigation Report documents that a version of the profile was viewed by 15th Air Force officials on February 27, 1987. Also, according to SAC officials, the profile development was supervised by the SAC ADO, and all practice sessions were viewed by senior 92nd BMW staff members. However, we could find no documentation for the integrated B-52H/KC-135A profile or the level of supervision provided to the crews that developed the profile.

DOD agreed that written documentation was not available for the integrated B-52H/KC-135A profile. However, DOD emphasized that the entire air show development was an iterative process and was patterned after the TAC program. DOD noted that at the time of the accident the SAC regulations for air show participation had not been finalized. According to DOD, profiles for the air show were developed using a step-by-step iterative process.

We agree that the initial SAC air show program planning appeared to follow some TAC procedures. However, ideally air show development should have been accomplished by a documented review of the integrated B-52H/KC-135A profile by SAC Headquarters officials before actual in-flight practice.

Conclusions

SAC planning, direction, and oversight for the integrated B-52H/KC-135A air show profile were less thorough than they were for the other aircraft in the air show.

Our analysis indicated that SAC used several procedures to develop the profiles for other air show aircraft that it did not use in the development of the integrated B-52H/KC-135R profile. DOD believes that for some of these procedures, such as direction and oversight, adequate verbal direction was provided. For other procedures, such as development of profile parameters, independent evaluation of flight profiles, and consultation with the manufacturer, DOD believes that the procedures were not necessary. We believe that verbal direction was inconsistent with the procedures used for other air show aircraft and with TAC procedures which were readily available to SAC. Also, we believe that when safety is concerned, prudent management would dictate that thorough planning and documentation would be required for all of the steps in the profile development. Verbal direction, lack of documentation, and the omission of important planning steps indicates that the planning, direction, and oversight of the integrated B-52H/KC-135A profile were less thorough than they were for other aircraft in the air show.

We believe that if a decision is made to resume the air show program, SAC should establish regulations that provide for thorough planning and documentation and ensure that participating units follow the instructions.

Recommendations

SAC officials told us that no decision has been made on whether to continue the air show program. However, if a decision is made to continue the program, we recommend that the Secretary of the Air Force direct the CINCSAC to (1) establish official regulations for the air show program, (2) ensure that all participating units in its command are aware of the regulations and their specific responsibilities, and (3) ensure through documentation that its procedures are followed and that units are maintaining an adequate margin of safety for air show maneuvers. At a minimum, these regulations should include the following:

- Consultations with other Air Force commands, aircraft manufacturers, and SAC advisory units such as the ICEVG and Central Flight Instructors Course.
- Safety of flight issues such as aircraft attitude (angles at which the aircraft performs maneuvers), altitude, and air speed.
- Profiles that do not have aircraft flying toward or over the crowd.
- No practice flying until the profiles are completely simulated, validated, reviewed, and approved by SAC Headquarters.
- Procedures for pilot selection for practice flights as well as air show flights.
- Procedures and specific responsibilities for monitoring and approving all air show profile development and testing.

Agency Comments

DOD agreed with our recommendations and commented that, if a decision is made to continue the SAC air show program, before the decision is implemented, SAC would finalize and publish air show regulations. Also, if published, the regulations would detail specific responsibilities at all levels of SAC's command and would ensure documentary requirements and adequate safety margins are provided for and followed. We believe this is a prudent approach.

The Air Force Investigation of the Crash

The Air Force began its accident investigation process after the crash of the KC-135A. The process included (1) a safety mishap investigation directed toward mishap prevention and (2) an accident investigation designed to obtain and record evidence for possible claims, litigation, disciplinary, and administrative needs.

The Air Show Profile as Reconstructed by the Air Force

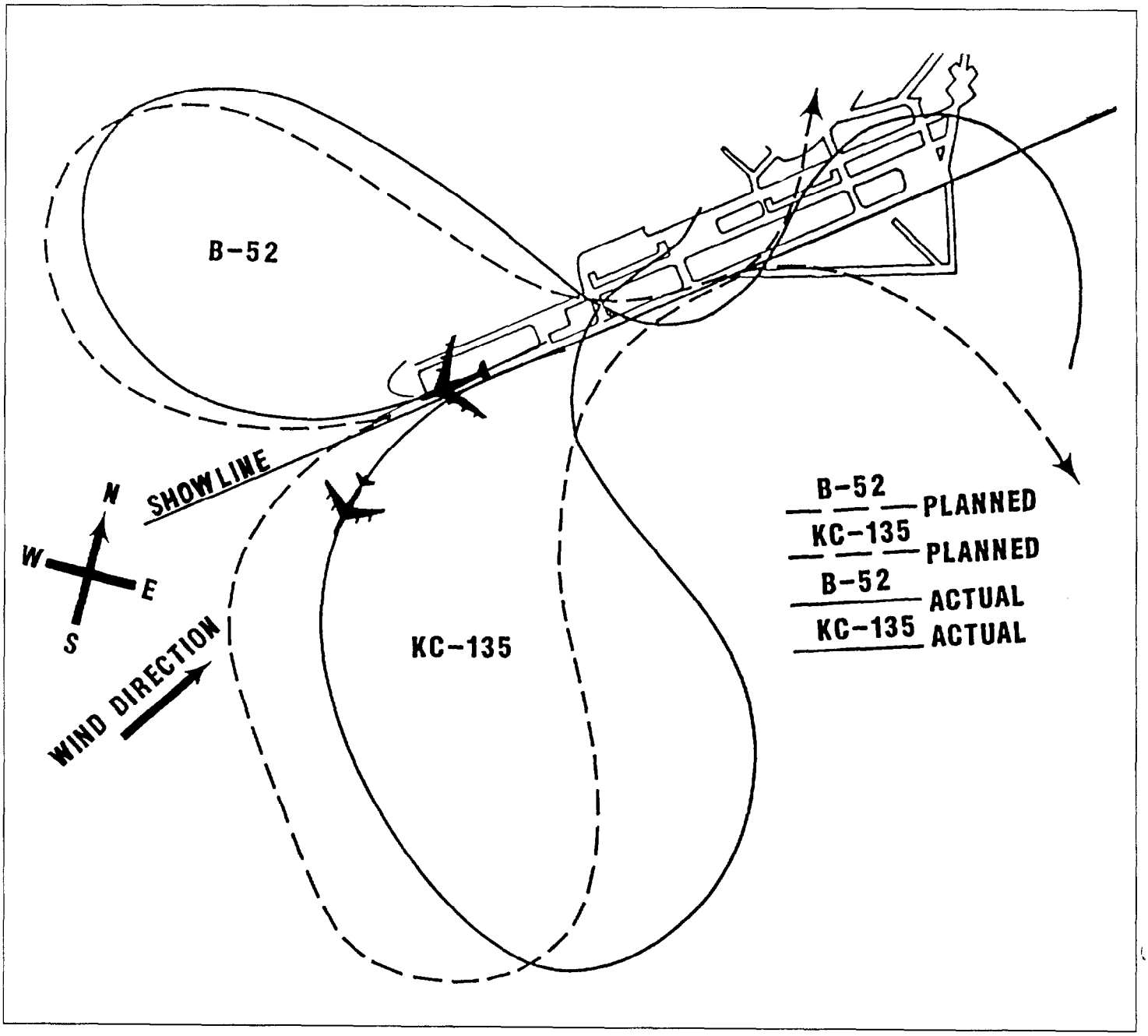
Radar readout plots from the FAA Air Route Traffic Control Center in Auburn, Washington, make it possible to determine the profiles of the KC-135A and B-52H as actually flown before the mishap. The radar plots showed position and altitude every 12 seconds throughout the flight path of the two aircraft. No other flight data are available because KC-135A aircraft do not carry flight data recorders.

According to the SAC briefing document prepared for Congressman Feighan, there were two interacting phenomena in the sequence of events that happened the day of the crash: wind and wake turbulence. The wind forecast for takeoff was out of the southwest at 12 gusting to 22 knots; the actual wind at the time of the takeoff was out of the southwest at 10 knots. Through analysis of the pressure gradient at the time of the accident, the Air Force calculated the winds at 18 to 23 knots between 200 and 1,500 feet above ground level.

The effect of the wind on the flight path of the aircraft is shown by the actual flight path superimposed on the planned track across the ground (see fig. 4.1). The SAC briefing states that the wind was pushing both aircraft to the northeast as each flew its profile. According to SAC, three actions were required to compensate for the effects of wind. First, the aircraft needed to decrease its bank angle as it turned into the wind so that it could fly the planned track. Second, when the wind was perpendicular to the flight path, the aircraft needed to turn its nose into the wind so that it could fly a straight line along its planned course. Third, the aircraft needed to steepen its bank angle as it turned away from the wind. According to SAC, it had already instructed the demonstration aircrews to limit the aircraft to a maximum bank angle of 45 degrees so that the last technique (increasing bank angle) was not an available option.

When the planned and actual flight paths for both aircraft are compared, it appears the B-52H was able to approximate its desired ground track more closely than the KC-135A. The KC-135A started its turn after takeoff slightly early. According to the SAC explanation, the KC-135A used the preplanned initial bank angle during the turn, causing it

Figure 4.1: Planned and Actual Flight Patterns for KC-135A and B-52H Aircraft



to be displaced to the northeast, or inside of its desired track. After turning 90 degrees it rolled out to wings level as planned, but it failed to

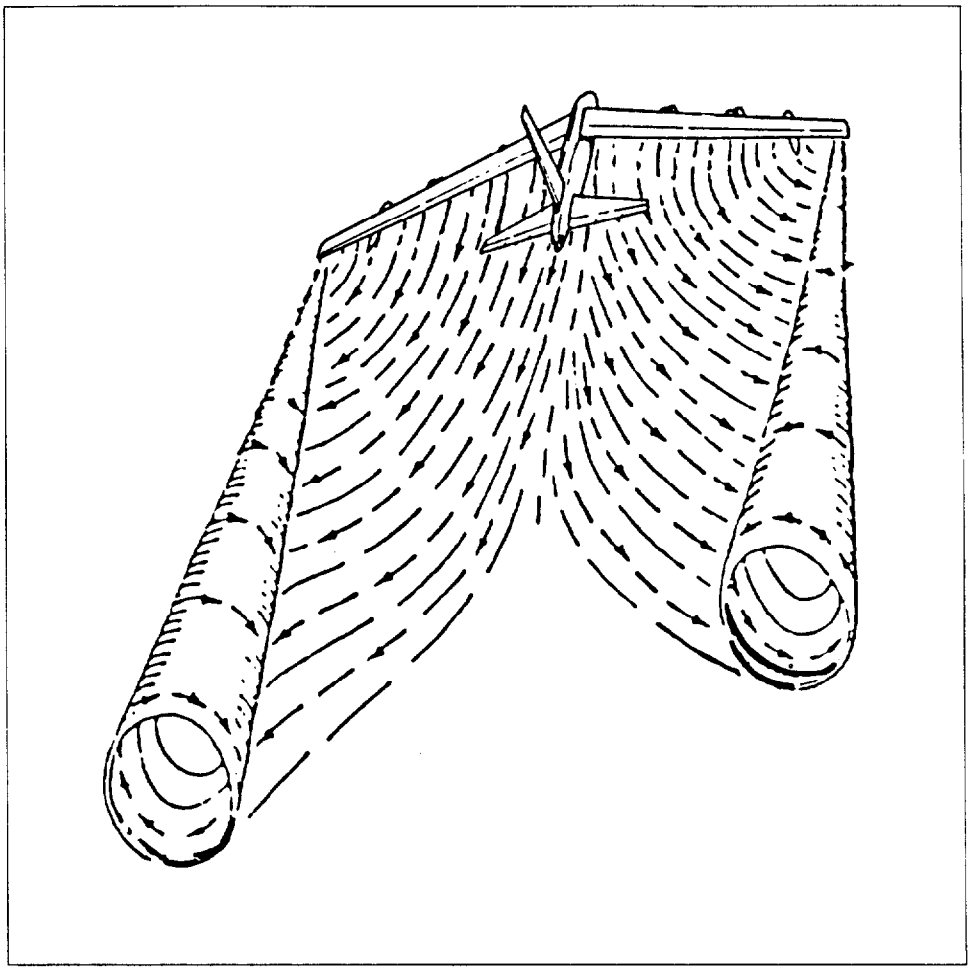
turn its nose toward the wind as compensation and was pushed further to the northeast. As it began its turn back to the showline, it was limited to 45 degrees of bank, so no further compensation could take place. The result was that the aircraft was forced to remain in its initial turn longer than planned.

The aircraft's displacement further to the northeast also affected its descent toward the runway. Because the KC-135A overshot its planned descent point of one-half of the way through its turn back to the runway, it actually began its descent two-thirds of the way through the turn. This caused it to make a steeper-than-planned descent, which called for a reduction in power or thrust.

According to SAC, the second phenomenon that was a factor in the mishap was a type of wake turbulence known as wing tip vortices. A Department of Transportation, FAA Advisory Circular on wake turbulence is cited in the SAC briefing for Congressman Feighan. According to the circular, wing tip vortices are created by air passing over and under the wing of an aircraft during flight. The circular also states that vortex circulation is outward, upward, and around the wing tips of the aircraft when viewed from either ahead of or behind the aircraft (see fig. 4.2).

Vortices are generated from the moment the aircraft leaves the ground until the aircraft touches down to land. According to the Air Force Aircraft Accident Investigation Report, the KC-135A was behind the B-52H by approximately 30 seconds when it began the snake maneuver. As the KC-135A crossed the demonstration area, it descended below the B-52H flight path (approximately 200 feet above ground level). According to the SAC briefing document prepared for Congressman Feighan, the KC-135A flew through the right wing tip vortex of the B-52H while in its 45-degree left bank turn. The strength of the vortex exceeded the roll capability of the KC-135A and forced it to a near-wings vertical bank position at which point the aircraft stalled. The plane crashed approximately 1,800 feet from the runway centerline in a nearby field. According to SAC Headquarters officials, the aircraft descended below its 300 foot minimum altitude (100 feet above the flight path of the B-52H) for a reason that cannot be determined. SAC officials told us they believe the flight crew allowed the aircraft to fly to an altitude that was not planned or approved. According to SAC officials, this placed the aircraft in a position that it could not recover from when it encountered the wingtip vortex of the B-52H aircraft.

Figure 4.2: Aircraft Wing Tip Vortices



Air Force Investigation of the KC-135A Aircraft Crash

The Air Force aircraft accident investigation process includes a safety mishap investigation and an accident investigation. These investigations are discussed below.

Air Force Policy on Aircraft Accident Investigations

Air Force regulations establish the investigating and reporting requirements for all U.S. Air Force mishaps. The regulations also outline restrictions on the release and dissemination of information about mishaps and mishap investigations to DOD and non-DOD agencies. The Air

Force Inspection and Safety Center manages the Mishap Investigation and Reporting Program.

The Air Force investigates aircraft and missile accidents to determine their probable and contributing causes, so it can prevent accidents from reoccurring, and to obtain and preserve available evidence for claims, litigation, disciplinary, and administrative actions and for any other purpose. The Air Force accomplishes these objectives by conducting two separate investigations for the same accident: the safety mishap investigation and the accident investigation. The findings from these investigations appear in two different reports.

Air Force safety mishap investigations and accident investigations are conducted completely apart from each other. A safety mishap investigation takes priority over the accident investigation in interviewing witnesses, obtaining and analyzing evidence, and inspecting the scene of the accident. An accident investigation is conducted at the same time only if it does not interfere with the safety mishap investigation.

Air Force Safety Mishap Investigation Report

According to Air Force regulations, the sole purpose of the safety mishap investigation is mishap prevention. The investigation depends upon candid statements and observations of personnel involved in the mishap. To ensure full disclosure, safety investigators promise witnesses that their testimonies will be confidential, even though the testimonies may be incriminating or against their personal interests.

The Air Force restricts the disclosure of the following confidential information contained in Part II of the safety investigation report from release outside command and safety channels: (1) witness testimony and inputs from contractors received under a promise of confidentiality, (2) the safety investigator's opinions, deliberations, and communications, (3) life science reports, and (4) other nonfactual portions of Part II of the report. All Air Force military and civilian personnel are prohibited from using, permitting the use of, or allowing access to these reports for other than safety purposes outside the Air Force, unless specifically authorized. Violations of these prohibitions are punishable under the Uniform Code of Military Justice and may also be grounds for disciplinary action under civilian personnel regulations.

Air Force Aircraft Accident Investigation Report

According to Air Force regulations, an aircraft accident investigation report is required when it is reasonably clear from the circumstances involved that (1) claims against the U.S. government will exceed $50,000, (2) litigation against the United States or any third party, including present and former government contractors, is anticipated, or (3) the accident has caused or is likely to cause a fatal or permanently disabling injury to any person. The report is not intended to determine cause; rather, it serves claims, litigation, disciplinary, and administrative needs. The Air Force does not assert any privilege to restrict the disclosure of factual information collected for the aircraft accident investigation report. The Air Force provided us with a copy of the this report early in our evaluation.

Independent Review of the Aircraft Accident Investigation Report

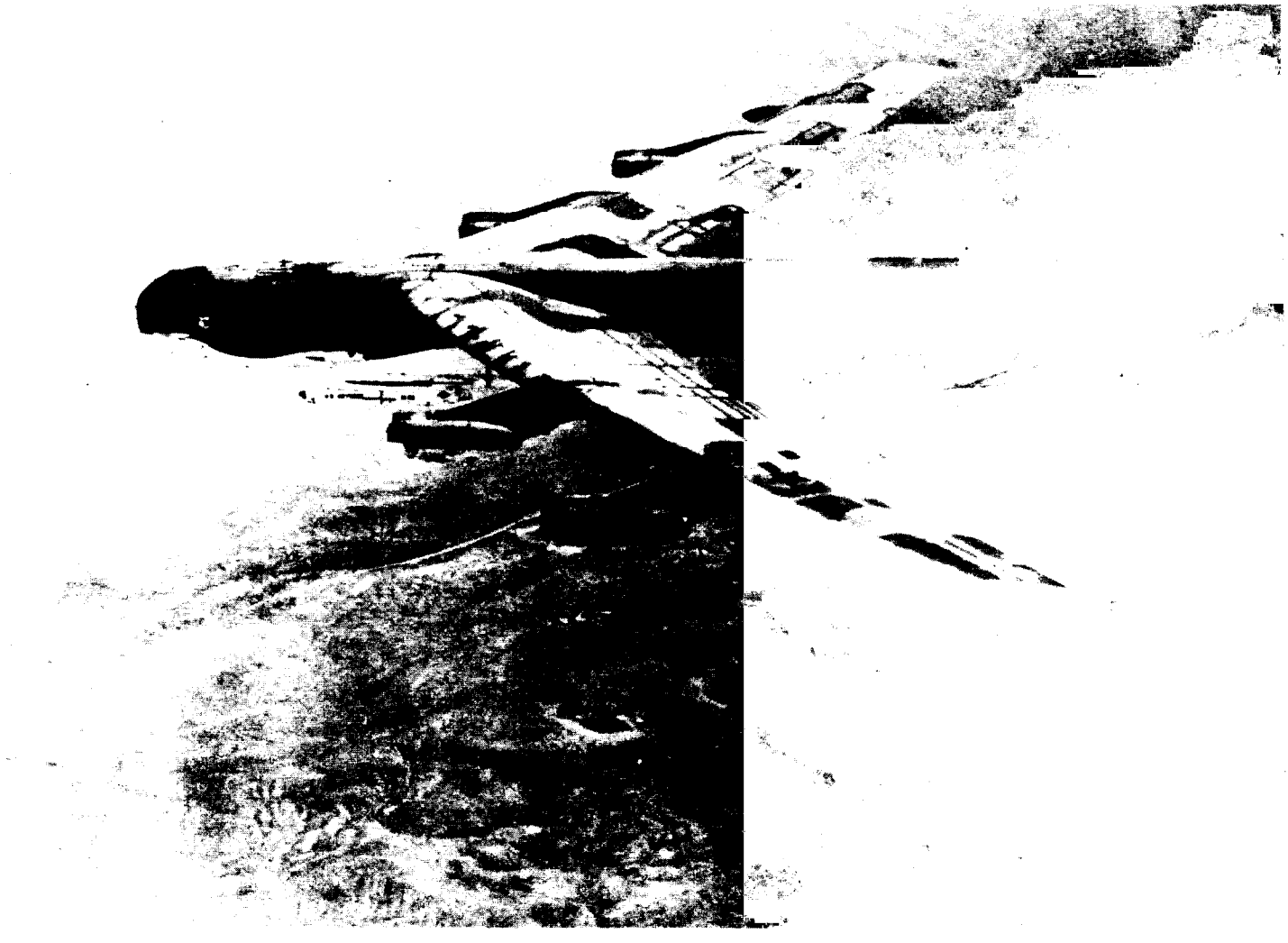
We requested a technical opinion from NTSB officials on the methodology and thoroughness of the Air Force Aircraft Accident Investigation Report. We also requested that they comment on the objectivity and reasonableness of the summary of evidence included at the beginning of the report. The NTSB reviewed the report and found it thorough and complete. In addition, they found the report reflected an objective and accurate investigation, with conclusions supported by the evidence presented.

Air Show Aircraft

B-52H Stratofortress Aircraft

The B-52 aircraft is capable of high subsonic speeds and can fly at altitudes above 50,000 feet (see fig. I.1). SAC received the eighth version of the aircraft, the H model, in October 1962. SAC currently has 264 B-52G and B-52H aircraft. The 92nd BMW completed its conversion from the G model to the newer H model on June 2, 1986.

Figure I.1: B-52H Aircraft



KC-135 Stratotanker Aircraft

The KC-135 tanker provides jet-to-jet refueling capability for SAC (see fig. I.2). The KC-135's primary mission is to refuel long-range strategic bombers. SAC has approximately 595 operational KC-135s with both active and reserve crews; a portion of these are maintained on 24-hour ground alert.

The KC-135 being flown by the active force is being modified with new engines that increase fuel offload capability by 50 percent. The reengined plane, the KC-135R, costs 25 percent less to operate, is 25 percent more fuel efficient, and is 96 percent quieter than the KC-135A. The KC-135R is also more powerful: its engines produce 22,000 pounds of thrust per engine, whereas the KC-135A engines produce 13,750 pounds of thrust.

Figure I.2: KC-135A Aircraft

Comments From the Department of Defense

Note: GAO comment supplementing those in the report text appears at the end of this appendix.

ASSISTANT SECRETARY OF DEFENSE
WASHINGTON, D.C. 20301-4000

FORCE MANAGEMENT
AND PERSONNEL

22 April 1988

Mr. Frank C. Conahan
Assistant Comptroller General
National Security and
International Affairs Division
U.S. General Accounting Office
Washington, D.C. 20548

Dear Mr. Conahan:

This is the Department of Defense (DoD) response to the General Accounting Office (GAO) draft report, "STRATEGIC AIR COMMAND: KC-135A Crash Shows Need for SAC Air Show Regulations," dated March 17, 1988 (GAO Code 392355/OSD Case 7564). With two exceptions, the DoD concurs or partially concurs with the findings and concurs with the three recommendations. It is important to note that the GAO reported that the National Transportation Safety Board found the Air Force Accident Investigation Report and briefing materials on this accident to be thorough and complete, reflecting an objective and accurate investigation.

Much attention has been focused on the "snake maneuver," a simple series of banked turns over the runway designed to show the top and bottom of the aircraft. The ground track of the profile looked like an "S" pattern and was locally nicknamed the "snake maneuver" because of this. In fact, the profile involved normal operational maneuvers flown at typical traffic pattern airspeeds and did not in any way approach the limits of the aircraft or the crew. No simulations of the profile were attempted prior to practicing the maneuvers because the KC-135A Weapons System Trainer cannot simulate another aircraft out the cockpit window. Rather, actual in-flight practice was required to perfect the timing and spacing required for the aircraft. These maneuvers were first flown at high altitudes and then gradually flown at lower altitudes more than 20 times prior to the mishap.

The detailed DoD comments on the report findings and recommendations are provided in the enclosure. The Department appreciates the opportunity to review and comment on the draft report.

Sincerely,

Grant S. Green, Jr.

Enclosure:
As Stated

GAO DRAFT REPORT DATED MARCH 17, 1988
(GAO CODE 392355) OSD CASE 7564

"STRATEGIC AIR COMMAND: KC-135A CRASH SHOWS NEED FOR SAC AIR SHOW REGULATIONS"

DEPARTMENT OF DEFENSE COMMENTS

* * * * *

FINDINGS

- FINDING A: Development of SAC Air Show Program: KC-135A Aircraft Added At Fairchild AFB. The GAO pointed out that Air Force regulations establish procedures for Air Force participation in aerial events, which apply to all major commands. According to the GAO, all Air Force major commands are authorized to participate in air shows, the primary purpose of which is to keep the public and the military informed of U.S. preparedness, demonstrate modern weapon systems, promote community and international relations and enhance recruiting and retention. The GAO noted that, until August 1986, Strategic Air Command (SAC) participation in these shows was limited to static displays of aircraft and high-level aircraft flyovers. At that time, however, the SAC decided to develop an air show program to enhance morale and increase pilot retention. The GAO observed that SAC operates bombers, such as the B-52, and a fleet of aerial/refueling planes, such as the KC-10, KC-135A and KC-135R, the latter of which is a more powerful version of the KC-135A. According to the GAO, SAC air show plans began in November 1986, with a KC-135R based at McConnell Air Force Base (AFB) that was going to be used to demonstrate the performance characteristics of the aircraft, such as maximum climb capability, high speed maneuvering and low-altitude simulated refueling. The GAO noted that, in December 1986, a B-52H, based at Fairchild AFB, Washington, was added to the air show program and a profile designed that included several high performance maneuvers. Documents also indicate that the SAC intended to develop a B-52H and KC-135R simulated low-level aerial refueling demonstration fly-by as a portion of the air show demonstration. The GAO further reported that, in January 1987, it was decided the simulated aerial refueling flyover with the KC-135R from McConnell AFB could not be practiced because of the distance from Fairchild AFB, so a substitute KC-135A aircraft located at Fairchild AFB would be used (instead of the KC-135R). The GAO found that, following a January 23, 1987 demonstration for Strategic Air Command officials, the SAC approved the use of the KC-135A for the development of an integrated B-52H/KC-135A profile, to include several different maneuvers. The GAO noted that, following a February 13, 1987 presentation of an integrated

Enclosure

B-52H/KC-135A profile for SAC officials, the air teams were instructed to change the profile before a second SAC review scheduled for March 1987. According to the GAO, at this time a new maneuver, "the snake," was introduced to the demonstration profile--i.e., a maneuver designed to show the top and underbelly of the KC-135A aircraft (and which would be in addition to the simulated low-level aerial refueling demonstration directed by SAC Headquarters). The GAO reported that, as scheduled, on March 3, 1987, SAC officials reviewed the integrated profile (including the snake maneuver) and approved continued practice. (pp. 2-5, pp. 19-23/GAO Draft Report)

Now on pp. 2-4, 14-16.

DoD RESPONSE: Concur. When reviewing the Fairchild AFB air demonstration program, it must be emphasized that two separate and distinct phases of development occurred. Initially (prior to January 23, 1987), Fairchild was tasked by the SAC to develop a single-ship B-52H demonstration profile. This profile was developed using inputs from HQ SAC, Boeing and SAC 1st Combat Evaluation Group (1CEVG). From December 1986 to January 23, 1987, the B-52H profile was developed and practiced at Fairchild. It included a number of passes over the runway at low and high speeds. The final portion of the B-52H profile also included a simulated aerial refueling with a tanker aircraft. This included the two aircraft participating in a straight and level flyover down the runway. Because McConnell AFB was developing a KC-135R single-ship routine, the SAC suggested that for the upcoming January 23, 1987, demonstration at HQ SAC, the KC-135R would be the tanker used for the simulated refueling formation flyover. This would require some practice between the two aircraft, which scheduling problems made difficult. Therefore, Fairchild suggested that one of its own KC-135A aircraft be used solely for the purpose of providing the refueling platform for the January 23, 1987 demonstration. At that point, the KC-135A was not considered to be part of the air demonstration program involving the B-52H or the KC-135R. The KC-135A was only being used for the simulated straight and level air refueling formation flyover. During the review of the B-52H profile by senior SAC officials on January 23, 1987, the Fairchild Wing Commander was verbally directed to develop an "integrated" profile using the KC-135A and the B-52H. An integrated profile would have the aircraft flying individual maneuvers separated by time and distance. On January 23, 1987, the KC-135A was included in the evolving SAC air demonstration program for the purpose of developing an integrated profile with the B-52H. Between January 23, 1987 and the next demonstration before the Commander-in-Chief, Strategic Air Command (CINCSAC), on March 3, 1987, the

92nd Bombardment Wing (92 BMW) developed and validated the integrated B-52H/KC-135A profile. The integrated profile included a minimum interval takeoff designed to show how SAC aircraft would launch following an order to go to war. Minimum interval takeoffs are routinely practiced by SAC aircrews. The first maneuver after the initial takeoff was designed to space the aircraft so that the bomber and tanker would alternate their position in front of the crowd approximately every 40 seconds. The maneuver eventually evolved so that the aircraft would initially maneuver on separate sides of the runway, flying a modified traffic pattern that resembled a "tear-drop." As the aircraft maneuvered separately over the runway, they made a series of banked turns to show the top and bottom of the aircraft. The ground track of the profile looked like an "S" pattern. It was locally nicknamed the "snake manuever" because of this "S" pattern. The snake manuever was the initial maneuver performed directly over the runway. During the integrated profile development and validation process, the Fairchild Wing Commander verbally reported progress to the SAC Assistant Deputy Chief of Staff for Operations (SAC ADO). Practices were flown at high altitudes first and gradually to lower and lower traffic pattern altitudes at Fairchild AFB and Malmstrom AFB, Montana. All flights were supervised by the 92 BMW staff. Flights were videotaped and critiqued so that lessons learned from each flight could be applied to the next flight. Practice flights were also reviewed by senior SAC officials. The date the B-52H/KC-135 demonstration crews traveled to Malmstrom AFB, Montana, to perform the B-52H/KC-135A integrated profile for the SAC ADO was actually February 13, 1987, not February 23, 1987 (see pp. 22, GAO Draft Report). On this date, the ADO watched the Fairchild integrated profile flown three times. He then met with the B-52H/KC 135-A crew members, the 92 BMW commander, and others. He reviewed and discussed the development of the profile and authorized continuation of the profile development for review by the senior SAC staff on March 3, 1987. The 15th Air Force Commander reviewed the flown integrated profile on February 27, 1987, and approved it to be flown for the senior SAC staff on March 3, 1987.

Now on p. 16.

- **FINDING B: March 13, 1987 KC-135A Flight**. The GAO reported that the plan for the March 13, 1987, practice flight of the snake maneuver called for the B-52H to pass the demonstration area first. According to the GAO, the KC-135A maneuver was to be flown at 170 knots indicated air speed (KIAS), 500 feet above ground level or 100 feet higher than

the B-52H, and with a 45 degree maximum bank angle. The GAO reported that the Aircraft Accident Investigation of the crash indicated that the KC-135A took off first, made a left climbing turn to a level-off altitude of about 1,100 feet, then started a left turn position toward the departure end of the runway. About two thirds of the way through the turn, the KC-135A started to descend to its level-off altitude above the runway. Just short of the runway the plane began a descending right turn to parallel the runway, straightened out to a wings-level position and then immediately went into a left bank turn. The GAO observed the radar plots indicate that, as the KC-135A crossed the demonstration area, it descended to the same altitude as the B-52H (approximately 200 ft above ground level). This was below the 92 BMW altitude parameter of 500 ft above the ground level or 100 ft above the flight path of the B-52H (i.e., minimum 300 ft above ground level). The aircraft then stabilized at about 45 degrees of bank, abruptly rolled left with the wings nearly vertical, decelerated and descended rapidly. The aircraft corrected its roll to almost wings-level but continued its rapid descent, slightly nose high and crashed approximately 1800 ft from the runway centerline. Seven Air Force personnel (six in the aircraft and one on the ground) died in the accident. The GAO reported that, according to SAC officials, it is not known why the flight crew allowed the aircraft to descend to 200 feet above ground level where SAC officials believe it encountered turbulence created by the wing-tip of the B-52H and rolled to almost 90 degrees of bank. The SAC officials told the GAO that they believe the crew flew the aircraft into a position from which it could not be recovered. (p. 7, pp. 24-28, pp. 45-49/GAO Draft Report)

Now on pp. 4, 16-18, 33-35.

DoD RESPONSE: Concur.

- **FINDING C: SAC Planning, Direction And Oversight For The Integrated B-52H/KC-135A Profile Less Thorough Than That Used For Other Air Show Aircraft.** The GAO found that SAC planning, direction and oversight for the development of the integrated B-52H/KC-135A part of its air show were less thorough than that used for the other SAC aircraft included in the show. The GAO concluded that the primary differences were, as follows:

  - Headquarters SAC did not issue written orders to include the KC-135A when it was first added to the air show program by the 92 BMW (although SAC Headquarters did verbally approve including the KC-135A aircraft at a demonstration flown for SAC officials approximately two weeks later).

- Although early in the development of the SAC air show program SAC officials directed that there be no practice flight of profiles until they were reviewed and approved by SAC Headquarters, the 92 BMW developed and flew potential profiles in the B-52H and the KC-135A aircraft before they were approved, including a profile that had the B-52H and the KC-135A fly toward the crowd.

- While flight parameters (i.e., specific guidance on items such as speed and altitude) were established by SAC Headquarters for other air show aircraft, for the KC-135A maneuver, the crews at the 92 BMW established their own parameters.

- Although flight profiles for other air show aircraft were simulated before they were flown in actual aircraft, there was no simulation of the integrated B-52H/KC-135A profile developed by the 92 BMW.

- Flight profiles for other air show aircraft were evaluated and validated by SAC pilots from the 1st Combat Evaluation Group; however, there was no evaluation and validation of the integrated B-52H/KC-135A profile developed by the 92 BMW.

- Except for a telephone call to discuss a planned maneuver, there were no meetings with the manufacturer of the KC-135A to discuss the proposed integrated profile and the parameters being developed by the 92 BMW.

- No specific SAC criteria were sent to the 92 BMW for the KC-135A pilot selection.

- Although waivers were required for such items as air speed, altitude, and bank angles, according to the Air Force Aircraft Accident Investigation Report, no waiver was issued for the KC-135A aircraft that was included in the integrated B-52H/KC-135A profile.

The GAO further concluded that better planning, direction and oversight could have provided the opportunity to obtain and evaluate information on aircraft performance capabilities and helped to determine how B-52H/KC-135A profile integration impacted upon the individual aircraft before performing demonstration maneuvers in flight. (pp. 7-10, pp. 28-30/GAO Draft Report)

Now on pp. 5-6, 19, 20.

DoD RESPONSE: Nonconcur. Positive SAC supervision existed at every level of command and the Fairchild program was under tight control at all times. The DoD agrees that SAC planning, oversight, and direction were not as well documented for the integrated B-52/KC-135A profile as they were for the other aircraft, which may tend to give the appearance of less thorough planning, direction and oversight. Tasking for the development and revisions to the program were verbal and not followed up with written documentation. The DoD disagrees, however, that this indicates less thorough planning, oversight and direction. Even though verbal, the tasking came directly from the senior SAC staff to the Fairchild Wing Commander. Profiles were developed in detail by highly experienced instructor pilots at Fairchild AFB for the KC-135A aircraft for the revised and modified parameters, as set forth in the verbal orders communicated to them. They evaluated the profile at high altitude many times prior to actual flight at traffic pattern altitude. The practice sessions were videotaped and supervised by the Fairchild Wing Commander or members of his staff. Practice flights were critiqued and the lessons learned were applied to each successive flight. The 15th Air Force Commander and the SAC Assistant Deputy Chief of Staff for Operations, viewed the Fairchild profiles before they were viewed by the Commander in Chief, Strategic Air Command, on March 3, 1988. In addition, the DoD takes exception to many of the observations cited by the GAO in support of the finding that SAC planning, direction, and oversight were less thorough than that used for other aircraft. (These are reflected in DoD responses to Findings D, E, H, I, K, and L.)

- **FINDING D: No Written SAC Orders Adding KC-135A To Air Show.** The GAO found that the SAC did not issue written orders for adding the KC-135A to the air show, although it had done so for other air show aircraft. According to the GAO, Air Force documents indicate the KC-135A was added to the air show based on a decision made at Fairchild AFB. Originally, the SAC had intended for a simulated aerial refueling demonstration, using a B-52H from Fairchild and a KC-135R from McConnell AFB. The GAO noted that Air Force documents indicated that, subsequently, Air Force officials from Fairchild determined it would not be possible to develop the joint profile because of the distance between the bases and, initially, included the KC-135A as a simulated refueling platform for the B-52H profile. The GAO reported that Air Force officials at Fairchild then decided to add the KC-135A aircraft and developed an integrated B-52H/KC-135A demonstration locally. The GAO further

Now on pp. 5, 19, 21.

reported that, according to SAC officials, the decision to include the KC-135A was coordinated verbally between the Fairchild Wing Commander and senior SAC officials, including the SAC Assistant Deputy Chief of Staff for Operations (ADO). The GAO noted, however, that Air Force records indicate that the SAC gave verbal approval to add the KC-135A about two weeks after the 92nd Bombardment Wing had actually added the aircraft. (p. 7, p. 28, pp. 30-31/GAO Draft Report)

DoD RESPONSE: Partially concur. It is not clear if the GAO is refering to the initial B-52H routine flown before January 23, 1987, or the integrated B-52H/KC-135A profile tasked to Fairchild on January 23, 1987. No practice sessions for the integrated B-52H/KC-135A profile were flown without SAC knowledge. Air Force officials at Fairchild did not develop an integrated B-52H/KC-135A demonstration profile locally without SAC approval. The DoD agrees that no written orders were issued adding the KC-135A to the demonstration program. As indicated, during the initial development of the B-52H profile (prior to January 23, 1987), the SAC had planned to include a simulated straight and level refueling formation flyover with the KC-135R from McConnell AFB. Due to scheduling, maintenance and logistics difficulties, Fairchild suggested that its KC-135A be included, but only to participate in the simulated refueling demonstration flyover. This was approved verbally by the SAC ADO. After the January 23, 1987, demonstration at Offutt AFB, the Senior SAC Staff verbally tasked the Fairchild Wing Commander to develop an integrated B-52H/KC-135A demonstration profile.

- **FINDING E: 92nd Bombardment Wing Developed Integrated B-52H/KC-135A Air Show Profile.** According to the GAO, although SAC officials knew that the B-52H/KC-135A demonstration was being developed at Fairchild AFB, they did not provide scenario guidance (i.e., the maneuvers the aircraft was to fly during the air show) for the integrated B-52H/KC-135A profile as they had for the other aircraft involved in the show. The GAO noted that, early in the show development, the SAC required that no practice flying be done until the profiles were approved. The GAO concluded, however, that according to Air Force documents, the B-52H/KC-135A profile was developed and flown by the crews at Fairchild AFB before SAC Headquarters approval was given. The GAO noted that, according to SAC officials, verbal approval was given by SAC directly to the Fairchild Wing Commander. (p. 28, pp. 31-32/GAO Draft Report)

Now on pp. 5, 19, 21-22.

DoD RESPONSE: Partially concur. The airshow profile was developed at Fairchild with HQ SAC approval to Fairchild given orally, directly from the SAC Assistant Deputy Chief of Staff, Operations (ADO) to the Fairchild Wing Commander's staff. The SAC did not issue specific documents to Fairchild outlining the maneuver parameters. However, the profiles were developed under the direct supervision of the Wing Commander's staff, consistent with the direction to develop the B-52H/KC-135A integrated profile. Progress on profile development was coordinated with the SAC in communications between the Fairchild Wing Commander and the SAC Assistant Director for Operations throughout January and February 1987. The SAC ADO personally met with the respective aircrews on February 13, 1987, to review and discuss the profiles. The 15th Air Force Commander reviewed the flown profile on February 27, and the CINCSAC reviewed it on March 3, 1987.

- **FINDING F: Integrated B-52H/KC-135A Flight Parameters Not Established Or Approved By The SAC**. The GAO found that, although flight parameters (i.e., specific guidance on such items as air speed and altitude) were established by the SAC, the 92 BMW established its own parameters for the integrated B-52H/KC-135A maneuver. According to the GAO, these locally established parameters called for 170 knots minimum air speed, 45 degrees maximum bank angles, and an altitude of 500 feet above ground level or 100 feet above the B-52H (which was authorized to fly at 200 feet above the ground). The GAO did conclude, however, that while the 92 BMW changed the B-52H profile several times, it appeared to retain some of the parameters SAC headquarters originally established for the aircraft (before development of the integrated profile), such as air speed of 170 knots indicated air speed and minimum altitude of 200 feet above ground. (p. 29, pp. 32-33/GAO Draft Report)

Now on pp. 19-20, 22-23.

DoD RESPONSE: Partially concur. The SAC did not issue specific written guidance for the integrated profile. However, the SAC did issue specific parameters to Fairchild for the development of the B-52H profile. When the KC-135A was later added to the demonstration, the same project officer at Fairchild for the B-52H profile was responsible for coordinating the development of the KC-135A profile. In addition, the requirements of Air Force Regulation (AFR) 60-18, Air Force Participation in Aerial Events, the directive that governs airshows, applied throughout. The development of the Fairchild integrated profile was carefully done to insure flight safety. The profile developers included both altitude and distance separation

between the aircraft. The planned profile called for the KC-135A to descend to 500 ft above ground level and in no case lower than 100 ft above the smoke trail of the B-52H. In addition, the airspeed flown during the maneuver was controlled in order to insure a separation of approximately 1.4 miles between the aircraft. Unlike the other demonstration profiles, the planned KC-135A profile involved normal operational maneuvers flown at typical traffic pattern airspeeds (170 knots indicated air speed). The maneuver was first practiced at high altitude and then gradually flown to and practiced at lower altitudes. The aircraft did not approach any flight manual limits and, therefore, did not require special study for safety. The instructor pilots who developed and flew the Fairchild integrated profile were highly qualified and thoroughly familiar with KC-135A flight characteristics and aircraft limits. The integrated profile and flight parameters were viewed and approved by the SAC ADO on February 13, 1987.

- **FINDING G: Integrated B-52H/KC-135A Profile Could Not Be Simulated Before Practice Flight**. The GAO reported that the integrated B-52H/KC-135A profile was not simulated before practice flights, although the profiles of other aircraft included in the show were. A KC-135 flight simulator with visual imagery was available at one of the sites visited and, at the request of the GAO, several versions of the initial portions of the KC-135A profile (including the snake mneuver) were simulated. According to the GAO, the results showed that the initial portions of the profile could be successfully flown at either 500 or 300 fleet above ground level. Noting neither SAC Headquarters nor Fairchild AFB officials had requested simulation or assistance in planning the KC-135A profile, the GAO reported that SAC Headquarters personnel advised simulation was not needed because the profile was safe and was initially flown at high altitude and gradually brought down to lower altitudes. The GAO also reported that, according to SAC officials, a key element in the integrated B-52H/KC-135A profile was maintaining distance between the aircraft, and this could not be done in a simulator; therefore, actual flight practice was required. (pp. 8-9, p. 29, pp. 33-34/GAO Draft Report)

Now on pp. 5, 20, 23-24.

DoD RESPONSE: Concur. The only visual simulator for the KC-135A is the Weapons Systems Trainer (WST) at Castle AFB. The simulator cannot, however, simulate another aircraft outside the cockpit window and, therefore, is unsuitable for practicing visual spacing and timing maneuvers with another aircraft. The integrated B-52H/KC-135A profile required

actual inflight practice in order to perfect the timing and spacing required. Prior to the accident, the planned demonstration profile, including the "snake maneuver," had been safely flown over 20 times. The instructor pilots who developed, flew and validated the profile were highly qualified and thoroughly familiar with KC-135A flight characteristics and aircraft limits.

- **FINDING H: Integrated B-52H/KC-135A Profile Not Validated.** The GAO reported that the 1CEVG, which is part of the SAC, has as one of its missions the evaluation and validation of new combat profiles for SAC aircraft. According to the GAO, the 1CEVG did evaluate and validate the initial B-52H profile developed at Fairchild AFB, but was not consulted for evaluation and validation of the integrated B-52H/KC-135A profile. (pp. 29-39, p. 34/GAO Draft Report)

Now on pp. 5, 20, 24.

DoD RESPONSE: Partially concur. Evaluation and validation by the 1CEVG was not necessary. There was a significant distinction between the profile for the KC-135A and the profiles for the other aircraft. Unlike the demonstration profiles for the other aircraft, the planned KC-135A profile basically included normal operational maneuvers flown at typical traffic pattern airspeeds (170 Knots Indicated Air Speed. The profile was flight validated by experienced instructor pilots selected to develop the profile at Fairchild. The maneuvers were first practiced at high altitude and then gradually flown to and practiced at lower altitudes. They did not approach any flight manual limits and, therefore, did not require special study for safety. The instructor pilots who developed, flew and validated the Fairchild integrated profile were highly qualified and thoroughly familiar with KC-135A flight characteristics and aircraft limits.

- **FINDING I: Limited Consultation With Aircraft Manufacturer.** The GAO found that, in developing the KC-135R profile, SAC officials met with the aircraft manufacturers; however, the only contact with the manufacturer on the KC-135A portion of the integrated profile was a telephone call concerning inflight water augmentation (which is usually only used on takeoff to give the engines additional power). According to the GAO, neither the SAC nor the 92 BMW requested Boeing assistance in determining aircraft performance characteristics to be used for the integrated profile. The GAO observed that Air Force Regulations required fixed wing aircraft performing in aerial events to establish minimum

air speed as stall speed plus 30 percent, and that the SAC instructed the other teams involved in the air show to adhere to the regulation. The GAO noted that the SAC-approved air speed parameter for the KC-135A would also have been stall speed plus 30 percent, which equals an airspeed of about 192 knots indicated air speed when flying the aircraft at 45 degrees of bank; however, SAC officials held that the calculated air speed of 170 knots for the KC-135A was sufficient because it was 20-22 knots above stall speed. The GAO contacted Boeing for assistance in calculating the air speed flight parameter and learned that the manufacturer suggested a 195 knots indicated air speed for the snake maneuver. The GAO concluded that, because of the differences of opinion on appropriate air speed parameters, SAC officials should have consulted with Boeing officials prior to actual practice flying. (p. 9, p. 30, pp. 35-36/ GAO Draft Report)

Now on pp. 5-6, 20, 25-26.

DoD RESPONSE: Partially concur. Boeing was consulted in the development of the KC-135R profile because of the high-speed and pitch attitudes involved with the original version of the air show's planned maneuvers. None of the planned B-52H/KC-135A integrated profile maneuvers involved anything that exceeded or approached the aircraft flight manual limits. Maneuvers such as the "snake maneuver," were considered simple and safe enough not to require a re-evaluation by Boeing or 1CEVG representatives. The planned maneuvers for the KC-135A did not approach or exceed any structural or aerodynamic aircraft limitations. They were basic, sound maneuvers that had been validated by actual flight many times. Therefore, consultation with Boeing for these maneuvers was unnecessary.

See comment 1.

- **FINDING J: The SAC Did Not Have Pilot Selection Criteria.** The GAO noted that the SAC began its air demonstration program as a wing-level initiative, deferring the selection of KC-135A air show crews to wing-level commanders. The GAO reported that limited pilot selection criteria was developed by the SAC for other aircraft, including the B-52H; however, selection criteria for KC-135A pilot selection was not provided to the 92 BMW. (The GAO observed that, in contrast, the Tactical Air Command pilot screening and selection procedures are established at the Numbered Air Force command level.) The GAO concluded that the SAC should establish demonstration pilot screening and selection criteria, which should provide for collaboration between the wings and the Numbered Air Forces and should increase command and control oversight to ensure selection of the best demonstration pilots available. (p. 30, pp. 35-37/GAO Draft Report)

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DoD RESPONSE: Nonconcur. In August 1986, a HQ SAC message to all units titled, SAC Flight Demonstration Crews, stated "... highly experienced crews will be selected by the unit to perform at air shows..." A December 1986, HQ SAC message to the 92 BMW titled, B-52H Aerial Demonstration Aircrew, Scenario and Ground Rules, provided that demonstration crews should be comprised of "...the most skilled aviators available." Both the B-52H squadron and the KC-135A squadron are under the command of the 92 BMW. The project officer responsible for development of the B-52H profile at Fairchild was also the project officer responsible for the development of the integrated profile when the KC-135A was added. While no message specified the criteria for KC-135A pilot selection, the crew selection criteria used at Fairchild was the same as any other SAC base in the demonstration program. Wings were tasked to select their most highly qualified and experienced crew members. The three instructor pilots on board the aircraft totaled almost 6,000 combined hours of KC-135 flying experience. These were the pilots responsible for teaching others in the wing, and were known for their exceptional ability to fly the aircraft safely. The TAC aircraft demonstration program, described in Tactical Air Command Regulation (TACR) 55-47, The TAC Participation In Aircraft Demonstrations, is an on-going, mature program. At the time of the accident, the SAC was still engaged in the iterative process of developing its program. The SAC was, however, patterning its crew selection procedures after the TAC program. In both the TAC and SAC programs, the selection of demonstration pilots begins with the wing commander. The TAC regulation states, "... Wing Commanders will nominate to NAF/CC (Numbered Air Force Commander) highly qualified and mature instructor pilots for screening and selection as a TAC demonstration pilot. Screening and selection procedures are as established by the NAF/CC." At the time of the KC-135A accident, the draft SACR 55-87 had been completed. It stated, "Wing Commanders will nominate to the NAF/CC highly qualified and mature instructor crews for screening and selection as a SAC demonstration crew. Screening and selection procedures are as established by the NAF/CC." The draft SAC regulation places final selection authority at the Numbered Air Force level as is done in the TAC. However, the initial selection of SAC demonstration crews at Fairchild was essentially the same as the TAC program. The SAC tasked the wing commander to choose "highly experienced crews" and the "most skilled aviators available."

- **FINDING K: The SAC Did Not Issue A Waiver Of Its Flight Operations Regulations For The KC-135A Aircraft.** The GAO observed that SAC regulations governing SAC participation in aircraft displays and aerial events provide specific guidance on air safety issues. The GAO cited for example, that the regulations prohibit aerobatic maneuvers, limit multi-engine aircraft to a 30-degree bank angle, and prohibit low-altitude aerial refueling demonstrations. The GAO found that, although the SAC issued a written waiver of its flight operations regulations for minimum altitude and bank angle for the other aircraft involved in the air demonstration, this waiver did not include the KC-135A aircraft. The GAO reported that during the aircraft accident investigation, the investigating officer was unable to find documentory evidence authorizing the 92 BMW KC-135A air crews to deviate from SAC regulations to participate in the air show. Although SAC officials advised the original waiver was valid for flight crews from the bases involved in the air show rather than for specific aircraft, the investigating officer concluded that failure to obtain a written waiver was a procedural deviation from Air Force regulations. The GAO stated that, according to SAC officials, however, it was reasonable for Fairchild AFB officials to assume that the KC-135A was covered by the original message. (p. 30, pp. 37-38/GAO Draft Report)

Now on pp. 6, 20, 26-27.

DoD RESPONSE: Partially Concur. What is at issue here is the interpretation of the SAC waiver message. The DoD agrees there was no specific waiver message issued naming the KC-135A. However, to permit air demonstration profile development by crews participating in the demonstration program, a waiver message was sent to the participating units. The message stated, "This waiver is valid only for flight crews from McConnell, March, Plattsburgh, Fairchild and 1CEVG who have been specifically tasked to develop air demonstration profiles." When the KC-135A was later added, Headquarters SAC determined that an additional message was not needed because the KC-135A demonstration crew was located at Fairchild and was, therefore, considered to be included in the original waiver. The 92nd Bombardment Wing was specifically tasked orally on January 23, 1987, to develop the integrated profile, and had the only KC-135A crew members developing a profile.

- **FINDING L: Integrated B-52H/KC-135A Profile Should Have Been Flown Away From Crowd Location.** The GAO observed that the integrated B-52H/KC-135A profile developed by the 92 BMW had both aircraft flying toward the crowd. The GAO observed that, in the interest of public safety, both Air Force and Federal Aviation Administration (FAA) regulations prohibit flight toward or over crowds. (The GAO reported that SAC officials maintained that at the time of the accident the B-52H/KC-135A profile had not been officially approved and flying toward the crowd would have been eliminated prior to actual performance of the profile at an air show.) (p. 28, pp. 39-40/GAO Draft Report)

Now on pp. 19, 28.

DoD RESPONSE: Nonconcur. The integrated B-52H/KC-135A profile was still being developed at the time of the accident and had not been finally approved by the SAC for public air show performance. In addition, the 92 BMW did not plan an integrated profile that was to be flown over the crowd. As indicated, crowd overflight is specifically prohibited by the Federal Aviation Administration and Air Force regulations. In addition, Air Force Regulation 60-18 states that no part of the spectator area is to be located closer than 1,500 feet from the extended showline. The planned profile called for the KC-135A to maneuver the aircraft toward the extended showline and to roll out over the runway. The GAO states the aircraft crashed in an area where the public generally gathers for an air show at Fairchild. This is true, but extremely misleading as it incorrectly infers that this profile was being flown in a manner which would have endangered a crowd at Fairchild. Three things must be emphasized:

- This profile was not being developed for any specific airfield. Consequently, crowd location was not a factor at this point in the profile development. Before the profile could be flown at any airfield, it would have to be modified for the specific airfield.

- The profile development was not completed when the crash occurred.

- If the profile were to have been flown for an air show at Fairchild, the crowd would have been relocated or the maneuver modified.

Before this profile could or would have been flown at a public air show at Fairchild AFB (or anywhere else), FAA evaluation and permission would be required. To obtain FAA

evaluation and approval, for each air show location, the maneuver would be adjusted to conform to individual airfield requirements, such as obstacle hazards, showline and crowd placement. The FAA and AF directives take into consideration the establishment of showlines, crowd separation, and other factors.

- **FINDING M: SAC Officials Believe Guidance For The KC-135A Was Adequate.** The GAO reported that, according to SAC officials, separate profile planning instructions for the KC-135A model aircraft were not established because SAC officials believed it was identical to the KC-135R model, except for the engine. (The GAO noted that the KC-135R plane has up to 22,000 pounds of thrust per engine as compared to 13,750 pounds per engine for the KC-135A.) While SAC officials contended guidance to the air crews was adequate to ensure flight safety, the GAO reported that it could find no documentary evidence indicating that profile development information was sent to the KC-135A demonstration pilots at Fairchild AFB. The GAO further noted that SAC officials advised they consider the KC-135A and KC-135R models are the same and a separate profile workup for the KC-135A was, therefore, unnecessary. (p. 10, pp. 40-41/GAO Draft Report)

Now on pp. 6, 29.

DoD RESPONSE: Concur. The KC-135R profile was designed to be flown single-ship and display selected capabilities of this reengined tanker. In contrast, the KC-135A profile was designed to be integrated with the B-52H. The KC-135A profile included only normal operational maneuvers flown at typical traffic pattern airspeeds. Therefore, sending the KC-135R profile development information to Fairchild was not necessary. The KC-135R profile was not applicable to the KC-135A. Planning activities for the KC-135A were coordinated through communication between the Fairchild Wing Commander and the SAC ADO.

- **FINDING N: Tactical Air Command (TAC) Procedures Not Applied To The Integrated Profile Development.** The GAO noted that, in 1984, the TAC issued regulations establishing detailed guidelines for participation in air shows. According to the GAO, these guidelines include:

  - requesting, processing, and carrying out aircraft demonstrations;
  - screening and selecting pilots at the Numbered Air Force command level;
  - demonstration pilot training procedures addressed to practice altitudes, ground training, and minimum practice periods; and

- coordinating responsibilities among the command headquarters, sponsor, participants, and responsible civilian agencies before the air show.

According to the GAO, the SAC was aware of the TAC regulations and was in the process of drafting similar regulations, but did not use procedures similar to TAC procedures in developing the integrated B-52H/KC-135A profile. According to SAC officials, profile development was supervised by the SAC Assistant Director for Operations and all practice sessions were viewed by senior 92nd BMW staff members. The GAO indicated, however, that it could find no documentation for the integrated B-52H/KC-135A profile or level of supervision provided to the crews that developed the profile. (p. 10, pp. 41-42/GAO Draft Report)

Now on pp. 6, 30-31.

DoD RESPONSE: Partially Concur. The DoD agrees that written documentation is not available. It must be emphasized, however, that the entire air show development was an iterative process and was, in fact, patterned after the TAC program. The draft Strategic Air Command regulation (SACR) 55-87, SAC Participation In Aircraft Demonstrations, was modeled, almost paragraph-for-paragraph, after the TACR 55-47. At the time of the accident, the SACR 55-87 had not been finalized and the SAC demonstration program was still being developed. On March 3, 1987, the Commander in Chief, Strategic Air Command, in preparation for final review and approval of the SACR 55-87, orally directed an independent review of the program by the TAC, as well as an end-to-end review of the program by the SAC Inspector General. The draft regulation, SACR 55-87, was forwarded to the TAC following the crash. The SAC IG did not conduct its review, however, because the program was suspended. Development of the Fairchild integrated profile followed basically the same procedures as the other aircraft. Crew members were hand picked by the wing commander from the most highly experienced and capable in the wing. Profiles were developed using a step-by-step iterative process.

- **FINDING O: The Air Show Profile As Reconstructed By The Air Force**. The GAO reported that readout plots from the Seattle Air Route Traffic Control Center in Auburn, Washington, make it possible to determine the profiles of the aircraft as actually flown before the mishap. According to the GAO, the radar plots show position and altitude every 12 seconds throughout the flight path of the two aircraft. (The GAO noted that no other flight data are available because

KC-135A aircraft do not carry flight data recorders.) The GAO further noted that, according to a SAC briefing document, there were two interacting phenomena in the sequence of events that happened the day of the crash; wind and wake turbulence.

- **Wind**: The GAO found that through analysis of the pressure gradient at the time of the accident, the Air Force calculated the winds at 18 to 23 knots between 200 and 1,500 feet above ground level, pushing both aircraft to the northeast as each flew its profile. The GAO observed that, according to the SAC, three actions were required to compensate for the effects of wind--(1) the aircraft needed to decrease its bank angle; (2) when the wind was perpendicular to the flight path, the aircraft needed to turn its nose into the wind; and (3) the aircraft needed to steepen its bank angle as it turned away from the wind. The GAO reported that, according to SAC officials, because the SAC had already instructed the demonstration aircrews to limit the aircraft to a maximum bank angle of 45 degrees, the last technique (increasing bank angle) was not an available option for the KC-135A crew. The GAO observed that, also according to SAC officials, when the planned and actual flights for both aircraft are compared, it appeared the B-52H was able to approximate its desired ground track more closely than the KC-135A.

- **Wake Turbulence**: The GAO noted that the Department of Transportation FAA Advisory Circular on Wake Turbulence is cited in the SAC briefing on the accident. According to this circular, wing tip vortices are created by air passing over and under the wing of an aircraft during flight. The GAO reported that, according to SAC officials, during its performance of the snake maneuver, the KC-135A flew through the right wing tip vortex of the B-52H, while in its 45-degree left bank turn. The GAO observed that the Air Force concluded the strength of the vortex exceeded the roll capability of the KC-135A and forced it to a near-wings vertical bank position, at which point the aircraft stalled, causing the plane to crash. The GAO further observed that, also according to SAC officials, for a reason that cannot be determined, the KC-135A aircraft descended to the same altitude as the B-52H (approximately 200 feet above ground level). This was below its 300 foot minimum altitude (100 feet above the flight path of the B-52H) and was an altitude

Now on pp. 4, 33-35.

that was neither planned nor approved. The GAO reported that SAC officials concluded this placed the aircraft in a position from which it could not recover when it encountered the wing-tip vortex of the B-52H aircraft. (pp. 6-7, pp. 45-49/GAO Draft Report)

DoD RESPONSE: Concur. As noted in Finding P, the GAO requested the National Transportation Safety Board (NTSB) officials to do an independent assessment of the Aircraft Accident Investigation Report and related briefing materials and to provide a technical opinion on their adequacy. The NTSB officials found that the report and briefing materials were thorough and complete, and reflected an objective and accurate investigation.

- **FINDING P: Air Force Investigation Of The KC-135A Aircraft Crash; Air Force Policy On Aircraft Accident Investigations**. The GAO reported that Air Force Regulations establish the investigating and reporting requirements for all U.S. Air Force mishaps and outline restrictions on the release and dissemination of information about mishaps and mishap investigations to DoD and non-DoD agencies. According to the GAO, the Air Force investigates aircraft and missile accidents to determine their probable and contributing causes so accidents can be prevented; and to obtain and preserve available evidence for claims, litigation, disciplinary, and administrative actions. The GAO added that, as a result of these two different objectives, the Air Force conducts two separate investigations on the same accident: the Safety Mishap Investigation and the Accident Investigation.

  - **Air Force Safety Mishap Investigation Report**: The GAO reported that the purpose of the Air Force Safety Mishap Investigation is prevention; therefore, candid statements and observations are essential. According to the GAO, witness testimonies are confidential even though possibly incriminating or contrary to personal interests. The GAO reported that the Air Force asserts Governmental privilege to information contained in Part II of the safety investigation report.

  - **Air Force Accident Investigation Report**: The GAO observed that the Accident Investigation Report is not intended to determine cause; instead, it serves claims, litigation, disciplinary, and administrative needs. At the request of the GAO, the National Transportation Safety Board personnel reviewed the Air Force Aircraft

Now on pp. 6, 36-38.

Accident Investigation Report on the KC-135A crash and found it to be thorough and complete, reflecting an objective and accurate investigation with evidence supported conclusions. (pp. 10-11, pp. 45-50/GAO Draft Report)

DoD RESPONSE: Concur.

RECOMMENDATIONS

Now on pp. 6-7, 31.

- **RECOMMENDATION 1**: If a decision is made to continue the SAC air show program, the GAO recommended that the Secretary of the Air Force direct the Commander-in-Chief, U.S. Strategic Air Command, to establish official regulations for the air show program. (p. 11, pp. 43-44/GAO Draft Report)

  DoD RESPONSE: Concur. The DoD agrees that, if a decision is made to continue the SAC air show program, before that decision is implemented the SAC would finalize and publish its regulation.

Now on pp. 6-7, 31.

- **RECOMMENDATION 2**: If a decision is made to continue the SAC air show program, the GAO recommended that the SAC ensure all participating units in its Command are aware of the regulations and their specific responsibilities. (pp. 43-44/GAO Draft Report)

  DoD RESPONSE: Concur. If published, the SAC regulation would detail specific responsibilities at all levels of command.

Now on pp. 6-7, 31.

- **RECOMMENDATION 3**: If a decision is made to continue the SAC air show program, the GAO recommended that the SAC ensure, through documentation, that its procedures are followed and that units are maintaining an adequate margin of safety for air show maneuvers. (pp. 43-44/GAO Draft Report)

  DoD RESPONSE: Concur. If published, the SAC regulation would ensure documentary requirements and adequate safety margins are provided for and are followed.

The following is GAO's comment on the Department of Defense letter dated April 22, 1988.

GAO Comment

1. A draft of this report stated that SAC did not have pilot selection criteria for the KC-135A. DOD commented that SAC did have criteria and it was to select the best aviators available. We have changed this section of the report to state that SAC did not use readily available pilot selection procedures that require wing commander and numbered Air Force command approval of pilot selections.

Glossary

Aerial Event/ Demonstration	An aerial activity by Air Force aircraft or personnel while participating in public events and community relations programs. An aerial demonstration of the operational capabilities of an aircraft not constituting an officially designated flight demonstration team.
Air Speed	The speed of an aircraft relative to its surrounding air mass.
Aircraft Accident Investigation Report	A report containing evidence gathered during an accident investigation conducted under Air Force regulations.
Altitude	The vertical distance of an aircraft measured from mean sea level.
Attitude	The position of an aircraft determined by the inclination of the aircraft to the earth.
Bank Angle	The lateral incline of an aircraft as measured from the horizon.
Command and Control	The orderly distribution of authority and responsibility designed to accomplish a mission systematically and the continuous feedback loop communications network connecting all levels of command so that decisions can be made, efforts coordinated, and discipline maintained.
Flight Profiles	The flight path of an aircraft expressed in terms of altitude, speed, range, and maneuver.
Flyover	A straight and level flight of no more than four aircraft of the same type, making one pass over a fixed point at a specified time and not involving aerobatics or aircraft demonstration.
Knots Indicated Air Speed (KIAS)	The air speed shown by an air speed indicator measured in knots. A knot is equivalent to one nautical mile per hour.

Maneuvers	An element of flight described by the sequence of tasks required to perform the event (i.e., turn out of traffic, descend to landing, etc.).
Parameter	One item in a set of physical properties whose values determine the characteristics or behavior of a system. In aviation, items such as altitude, air speed, attitude, and range determine the flight path of an aircraft.
Safety Mishap Investigation	An investigation to develop findings and conclusions pertaining to a mishap.
Scenario	An outline of a mission flight plan that gives the particulars of each mission phase.
Simulator (Simulation)	A mechanical representation of an aircraft system used in training and the maintenance of pilots' skills.
Static Display	The ground display of any aircraft and its related equipment, not involving flight, taxi, or engine start.
Waiver	A certificate issued by either the FAA or an Air Force Major Command authorizing the operation of an aircraft that deviates from an established flight rule or regulation.
Wake Turbulence	Phenomena resulting from the passage of an aircraft through the atmosphere. Various forms include vortices, thrust stream turbulence, jet blast, jet wash, propeller wash, and rotor wash.
Wing Tip Vortices	A form of wake turbulence generated by air flowing over and under the wing surface of an aircraft. The airflow generates vortex circulation outward, upward, and around the wing tips when viewed from in front of or behind the aircraft (see fig. 4.2).

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