File No. 3-1191

AIRCRAFT ACCIDENT REPORT

SPECTRUM AIR, INC.
Sabre Mark 5, N275X
Sacramento, California
September 24,1972
Adopted: March 28,1973

NATIONAL TRANSPORTATION SAFETY BOARD
Washington, D.C. 20591
Report Number: NTSB-AAR-73-6

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15. Supplementary Notes

Aircraft Safety Recommendations A-72-219 through A-72-223 are included in this report.

16. Abstract Spectrum Air, Inc., Sabre Mark 5, N275X, crashed during a rejected takeoff from Runway 30 at Sacramento Executive Airport, Sacramento, California, at approximately 1624 Pacific daylight time, on September 24, 1972. The aircraft collided with several automobiles and came to rest in an ice cream parlor across the street from the airport. Twenty-two persons on the ground were killed and 28 others, including the pilot, were injured. The aircraft was destroyed.

The aircraft became airborne twice during the attempted takeoff, but each time returned to the runway. The pilot reported that the aircraft acceleration and control response were normal until he felt a vibration shortly after initial liftoff. He did not recall if it persisted through the subsequent liftoff and the rejected takeoff.

The National Transportation Safety Board determines that the probable cause of this accident was the overrotation of the aircraft and subsequent derogation of the performance capability. The overrotation was the result of inadequate pilot proficiency in the aircraft and misleading visual cues.

Five recommendations were made to the FAA.

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SYNOPSIS

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The National Transportation Safety Board determines that the probable cause of this accident was the overrotation of the aircraft and subsequent derogation of the performance capability. The overrotation was the result of inadequate pilot proficiency in the aircraft and misleading visual cues.

As a result of this accident the Safety Board recommended major changes in the regulations and procedures governing certification of aircraft in the experimental category and the control of pilots who fly them. Recommendations were also made in regard to the safety of persons and property around airports.

1. INVESTIGATION

1.1 History of the Flight

Spectrum Air, Inc., Sabre Mark 5, N275X, was flown from Oakland to Sacramento, California, to be exhibited as a static display at the Sacramento Executive Airport on September 24, 1972. This was the final day of the 2-day Golden West Sport Aviation Show. The pilot used Runway 29 for takeoff from Oakland International Airport, at approximately 1000.1/ En route to Sacramento, he rendezvoused with a friend who was flying a Grumman F-8 Bearcat, and they proceeded to Sacramento as previously arranged. Approximately **30** miles from Sacramento, the Sabre pilot requested permission for a low pass over the runway, and the tower subsequently cleared him for a low approach to Runway **30.** The low pass was made at approximately 100 to 150 feet and 200 knots, in order to check the runway approach and landing area. During the low pass, the F-8 followed at a distance of approximately **3,000** feet. Normal landings were made and the Sabre was parked beside a Ford Trimotor. which was also owned by Spectrum Air, Inc. The Sabre remained parked in the roped static display area throughout the airshow.

During a break in the aerial display, at 1400, the pilot preflighted the Sabre in preparation for departure; however, an adequate starting unit was not found until about 1545. At this time the airshow was finished, and many aircraft were departing. Following a normal start and routine checking of various systems, the pilot requested, ". . . taxi VFR to Oakland. I'd like to use Runway two ah if the wind is right." The ground controller advised that Runway **30** was the active runway and that there would be a delay if he wanted Runway 2. The pilot advised that he couldn't wait too long because of fuel consumption. The ground controller then reported, ". . . Runway three zero, five thousand feet and the wind is three two zero at eight, can you handle that?" The pilot responded, "Yeah, as long as I don't have ***to*** wait for **an** hour out there." He was then given taxi instructions. As he approached the end of Runway **30,** he was cleared into position to hold. At 1623:40, the controller advised, "Sabre Liner Seven Five X-ray, observe the two aircraft at the ah northwest field boundary climbing out ahead of **you,** cleared for takeoff." The pilot acknowledged, "Okay, thanks a lot huh," This was the last transmission from the aircraft.

1/ All times herein are Pacific daylight, based on the 24-hour clock, unless otherwise noted.

The pilot stated that the flaps were in the takeoff position, and he completed the pretakeoff checklist. He checked throttle friction, emergency ignition, and engine instruments during the engine runup at the end of the runway. The exhaust gas temperature was 680° to 690° and the tachometer was indicating 97 to 98 percent r.p.m. He released the brakes and used nosewheel steering for directional control until his speed was approximately 60 knots. He then checked the engine instruments for the last time -- everything was normal. At 105 knots he applied sufficient back pressure to raise the nosewheel off the runway, and maintained that attitude. The aircraft became airborne within a few seconds. The takeoff roll and lift-off were normal in every respect. After a slight hesitation, preparatory to raising the landing gear, the pilot heard and felt an unusual vibration which startled him. The aircraft was no longer accelerating in a normal fashion, so he instinctively lowered the nose, confirmed that he still had full throttle, and was surprised that the aircraft settled back onto the runway. He did not recall whether the vibration ended, but acceleration seemed normal again so he dismissed a momentary thought of discontinuing, and resumed the takeoff attitude. The aircraft became airborne again; however, it was obvious to the pilot that the aircraft was not going to fly, and he began the rejected takeoff procedure. He closed the throttle, touched down, and continued straight ahead trying to slow the aircraft. Within a second he hit something and was airborne again. He shut off the "fuel switch" and shielded his face with his right arm. He was unable to control the aircraft as it continued across the street and into the building. The highest airspeed he observed at anytime was 120 knots.

The pilot stated that he rotated the aircraft on this takeoff the same as he always did. He established takeoff attitude by raising the nose until the farthest point on the runway disappeared. Although he looked to the right and to the left of the nose for reference, he did not use the horizon to establish the deck angle.

Statements were obtained from 18 eyewitnesses, and two 8-mm. movies of the takeoff were also received. The movies and witness information generally corroborated the takeoff as described by the pilot. The entire runway was used, and there were two separate lift-offs as the aircraft moved along the runway.

1.2 Injuries to Persons

Injuries	Crew	Passengers	Others
Fatal	0	0	22
Nonfatal	1	0	27
None	0	0	

1.3 Damage to Aircraft

The aircraft was destroyed by impact and subsequent fire.

1.4 Other Damage

The airport perimeter fence and a fire hydrant were broken, several cars were damaged, and an ice cream parlor was damaged by impact, fire, and water.

1.5 Crew Information

Richard L. Bingham, aged 37, held airline transport pilot certificate No. 1670088, with ratings for airplane multiengine land and DC-3, and commercial privileges for airplane single-engine land and CV-PBY (VFR only). He held a certificated flight instructor certificate with an expiration date of April 30, 1974, and flight engineer (reciprocating engine powered) certificate No, 2039643. He also held mechanic certificate No. 1987269, with an airframe and powerplant rating, and a first-class medical certificate issued September 7, 1972, with no limitations. He stated that at the time of the accident, he had accumulated approximately 2,500 total flying hours, of which 600 hours were in jet aircraft, and 7.5 hours were in the Sabre Mark 5. His logbook indicated a total of 2,085 flying hours, including 342 hours in jet aircraft, 3.5 of which were in the Sabre Mark 5. The last entry in the logbook was dated September 17, 1972.

Mr. Bingham received a letter of authority, dated June 2, 1972, to fly the Sabre Mark 5 for proficiency. This letter expired June 9, 1972, but was replaced on June 6, 1972, by a letter permitting flight for proficiency or exhibition at bona fide airshows (see Appendix B). The issuing Federal Aviation Administration (FAA) inspector verbally stipulated that his office should be advised verbally anytime the aircraft was going to be exhibited.

Mr. Bingham was employed as General Manager of Spectrum Air, Inc., in September 1971. He participated in the negotiations to purchase N275X and attended the IO-hour formal ground school which was given by a former F-86 pilot in May 1972. He received an additional 2 hours of emergency procedures and 2 hours of flight procedures instruction on the day of his first flight, June 6, 1972.2/ All ground instruction was monitored by an FAA representative. The initial flight consisted of performing basic airwork maneuvers, including approaches to a stall. The instructor monitored the flight by radio in a P-51 "chase plane," but he did not see the Sabre or issue any instruction to the pilot during most of the flight.

All of Mr. Bingham's takeoffs in the Sabre Mark 5 were made on Runway 29 at Oakland International Airport, except the accident flight. Runway 29 is 10,000 feet long, 150 feet wide, and is bounded at both ends by San Francisco Bay. He testified that, ". . . the sight that you see is different between Runway 30 (and) Oakland." There are visible obstructions at the end of the runway in Sacramento whereas, The Oakland runway runs right in the water and it's unlimited out there." He stated that, "I was told that on normal reference, not necessarily straight ahead, but out to the sides as well, that as I got the proper angle for rotation that I would just not quite be able to see the runway."

Mr. Bingham stated that he had retired at 2300 the night before the accident, and awoke at 0600 on the day of the accident. He had a normal breakfast and a snack for lunch.

1.6 Aircraft Information

Canadair, Ltd., Sabre Mark 5, N275X, was manufactured on September 19, 1954, with serial no. 1054. The aircraft was flown by the Royal Canadian Air Force for 300 hours and then placed in long-term storage on October 31, 1961. Periodic inspections were accomplished through June 19, 1967. The aircraft was first registered in the United States in July 1971, and purchased by Spectrum Air, Inc., on November 4, 1971. During the next 3 months the aircraft was worked on in Syracuse, New York, to prepare it for a ferry flight to California where it would be based. Although the maintenance performed during this period is unknown, it was described as routine to the activation of an aircraft from long-term storage.

2/ Although his first flight was logged on June 2, the aircraft acceptance test hop was not flown until June 3, and Mr. Bingham's initial flight was several days subsequent to the acceptance check.

Special airworthiness certificates were issued to ferry N275X on January 5, February 2, and February 22, 1972. Each was valid for approximately 3 weeks. The aircraft was ferried to Napa County Airport (California) in February 1972, and subsequently flown to Oakland International Airport in March 1972, where the airworthiness inspection was conducted. On May 8, 1972, the Oakland General Aviation District Office (GADO) issued a special airworthiness certificate in the experimental classification for the purpose of exhibition. The operating limitations imposed for the 1-year period of the certificate were as follows:

THIS LISTING SHALL BE ACCESSIBLE TO THE PILOT

This aircraft must be operated in compliance with the following limitations:

1. Flights are authorized only for the purpose of exhibiting the aircraft at bona fide airshows and exhibits, movement of the aircraft to exhibit locations, and proficiency flights by persons so authorized.

2. Each person operating this aircraft shall comply with the operating limitations prescribed in Federal Aviation Regulation Part 91, Section 91.42, and shall conduct all flights in accordance with applicable FAA air traffic and general operating rules.

3. All flights shall be conducted in such a manner that the aircraft will not present a hazard to persons or property.

4. Aircraft and aircraft engine operations shall be conducted in compliance with the military and/or manufacturer's limitations issued for the aircraft.

5. All flights shall be conducted during daylight hours.

6. This aircraft may not be operated in weather conditions below the minimums prescribed for VFR flight. Operations in positive control areas and route segments shall conform to the equipment and operational requirements of FAR 91.97 and FAR 91.170.

7. Operations of this aircraft may be conducted only by a pilot authorized under a Letter of Authority issued by the Administrator.

8. Any major change, alteration, or change of owner of this aircraft renders this airworthiness certificate invalid.

1.7 Meteorological Conditions

The local surface weather observation, made by the National Weather Service observer following the accident was, in part, sky clear, visibility 30 miles, temperature 81° F., wind 320° at 7 knots, altimeter setting 29.87 inches.

1.8 Aids to Navigation

No aids to navigation were involved.

1.9 Communications

There was no difficulty with radio communication between the aircraft and the tower.

1.10 Aerodrome and Ground Facilities

Sacramento Executive Airport is located in a commercial/residential urban area approximately 3 miles southwest of Sacramento, California. There are three asphalt runways, each 150 feet wide. Runway 2, the instrument runway, is 6,003 feet long, and Runway 34 is 4,984 feet long. Runway 30 is 5,000 feet long, but the landing threshold for Runway 12, the reciprocal, is displaced 670 feet to meet approach slope criteria at the northwest end of the runway. The airport elevation is 21 feet, but the elevation at the northwest end of Runway 30 is 17 feet.

In January 1964, a shopping center was proposed for construction on commercially zoned property at the northwest corner of the airport. The FAA circulated particulars of the construction to various aeronautical interests in order to obtain their comments on the effect of the construction. There were four obstructions the height of which exceeded the then current standards of Section 77.27(b)(2)3/ by 9, 11, 13, and 14 feet.

3/ Part 77 is the Federal regulation governing "Objects Affecting Navigable Airspace." Part 77.27(b)(2) established an imaginary approach area surface for runways such as Runway 30 as follows: beginning at the end of the runway and extending 500 feet outward at the elevation of the approach end of the runway and then sloping upward at the ratio of 1 to 40, being 500 feet wide at the beginning and expanding uniformly to a width of 3,000 feet at the outer extremity, 10,000 feet from the end of the runway.

The airport manager and the California Aeronautics Commission objected to the construction on the basis that it would be a hazard not only to aircraft on approach to the runway, but also to persons on the ground who would be concentrated in the shopping center. The Air-Transport Association objected because it might result in a reduction of runway effective length, thereby forcing air carriers to operate at reduced gross weights. The construction proposal was discussed further at an informal meeting of all concerned. The FAA determined that the construction would not be a hazard to air navigation. The plans were modified so that the heights of only three points exceeded the standards by 11, 11 and 13 feet, and the shopping center was constructed.

On July 1, 1967, the County of Sacramento assumed operational control of the airport under a lease agreement. In October 1967 all air carrier operations were moved to the new Metropolitan Airport, and Executive Airport continued operation as a general aviation facility.

In December 1969, an addition to the shopping center was proposed, and the FAA again circulated the details for comment. It was noted that the proposed building, an ice cream parlor, exceeded the height standard by 5 feet. No objections were received, and the FAA determined that no hazard existed. However, the California Department of Aeronautics, in responding to a city zoning hearing, commented that the State's study indicated that other structures in the area of the new building were of equal height so that the addition had no substantive effect on the airport activity.

In January 1970, the FAA circulated another aeronautical study regarding the proposed construction of a sign for the ice cream parlor. The sign exceeded the standards of Part 77 by 26 feet, but this was later reduced to 21 feet. The California Department of Aeronautics indicated no objection if it was shadowed by other existing structures. The Director of Airports, on behalf of Sacramento County, objected to the construction because it was in the clear zone and exceeded the 40:1 slope by 14.5 feet. Also, the size of the sign (20 feet by 30 feet) would tend to confuse pilots during low visibility conditions. Once again, the FAA determined that no hazard existed because the sign had no greater adverse effect on aircraft operations than the existing obstructions, provided it had appropriate obstruction lighting. The California Department of Aeronautics also filed objection to the sign in the city's zoning variance process, and indicated that if the runway threshold was displaced sufficiently to eliminate the intrusion into the approach surface, they would withdraw their objection. As noted earlier, the threshold for Runway 12 was displaced.

1.11 Flight Recorders

There were no flight recorders installed, and none was required.

1.12 Wreckage

The aircraft skid marks began approximately 40 feet from the end of Runway 30 and continued 453 feet over a sod overrun and a 25-foot-wide perimeter roadway. At this point the aircraft became airborne again, crashed through a chain link fence and a fire hydrant, and skidded across a 112-foot-wide divided highway. The aircraft came to rest approximately 800 feet from the end of the runway, less than 25 feet to the left of the extended runway centerline.

Both wings separated from the aircraft fuselage. The right wing separated at the wing/center section attach fitting. This forging was fractured longitudinally through the ribs, but all attach bolts were tight and in place. The aileron and flap were still attached. The left wing and center section were still intact as one assembly. The left aileron and flap had separated from the wing.

The right wing leading edge was crushed back to the front spar in two places, near the wing root and 2 feet inboard from the tip. The Pitot mast was separated at the leading edge, and the Pitot head was missing. Wood splinters were jammed into one end of the mast. The Pitot and static lines were intact and unobstructed from the wingtip to the inboard end of the wing. The Pitot and static lines in the fuselage were destroyed.

The fuselage forward of the cockpit bulkhead was destroyed. The forward cockpit bulkhead and instrument panel was bent forward and down approximately 30". The fuselage skin on both sides was buckled, burned, and melted in several places, from the cockpit aft to the area of the speed brakes. The lower fuselage skin was gone, Both speed brakes were in the open position. The aft fuselage section was attached, but the skin and tailpipe were buckled, with three deep wrinkles just aft of the speed brakes. The lower aft end of the fuselage and tailpipe were both dented and buckled upward. The vertical stabilizer and both horizontal stabilizers were damaged but intact. The rudder and left elevator remained attached, but the right elevator was separated.

All three landing gear assemblies separated from the aircraft. The main landing gear tires were inflated and showed no flat spots. The wheels and brakes rotated freely. The brake discs showed no signs of overheat, and the pads were undamaged. The nosewheel tire was deflated. The rim was dented on both sides and slightly spread.

The right and left flap jackscrews were partially extended and required 7-1/4 and 7-1/2 turns, respectively, to reach full extension.

The first two compressor stages of the engine had light foreign object damage, but there was no evidence of overtemperature or foreign object damage in the turbine. The engine rotor rotated freely.

Samples of fuel, oil, and hydraulic fluid were examined, and there was no evidence of contamination other than that due to the fire and sampling conditions.

The engine fuel control, two engine driven fuel pumps, and the fuel distributor assembly were functionally tested at the facilities of Orenda, Ltd. All units were capable of supplying the required amount of fuel to develop maximum rated thrust for takeoff at sea level and standard temperature.

1.13 Fire

The aircraft external fuel tanks ruptured on the chain link fence, and other tanks failed as the aircraft continued skidding across the street into the ice cream parlor. The main fireball occurred on the airport side of the street, and the fire trail followed the aircraft into the building.

Airport fire and rescue units were located at the takeoff end and midpoint of Runway 30. Rescue 8, the pickup truck at the end of the runway, began moving down the runway in anticipation of the accident and crashed through the perimeter fence on the most direct route to the wreckage. All other vehicles also responded, and firefighting activity began within a highly commendable short period of time. Other units from the Sacramento Fire Department arrived at the site within 5 minutes. In addition, the sprinkler system in the ice cream parlor was activated by the fire.

1.14 Survival Aspects

This was a survivable accident. The pilot exited the aircraft unassisted and crawled to a window of the building. He was assisted from the building by bystanders. Approximately 100 to 150 people were in the ice cream parlor at the time of the accident. Most of the survivors escaped unassisted through large windows of the building; however, many were assisted or carried out by spectators and firemen.

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1.15 Tests and Research

The aircraft handbook for the Sabre Mark 5 contains the following performance data for the conditions at the time of the accident:

Nosewheel lift-off speed . . .	110 knots
Takeoff speed	130 knots
Takeoff distance	3,200 feet
Distance to clear 50-foot obstacle	4,600 feet

An 8-mm. movie of the takeoff was analyzed by making a series of 8 x 10 inch enlargments of every eighth frame, counting backward from the initial fireball. Various stationary landmarks in the background of each photograph were used to determine the angular displacement of the aircraft from the camera location, and also the distance the aircraft moved along the runway. The deck angle of the aircraft in each photograph was then measured and corrected for the distortion of that particular viewing angle. The groundspeed, based on camera frame speed and distance traveled, was calculated and the speeds were averaged for every three frames to minimize the effects of sighting errors, Finally, the height of the aircraft was established by calculation or estimated in relation to other photographs where calculations could not be made.

In summary, the initial lift-off occurred between 2,800 and 2,900 feet from the end of the runway at an airspeed of 124 knots. The deck angle was approximately 11° Aircraft Noseup (ANU), The airspeed and deck angle continued to increase to 130.5 knots and 15.5' ANU, respectively, At this time the deck angle kept increasing, but the acceleration stopped and the speed began decreasing. The aircraft was 2 feet above the ground, measured from the bottom of the main landing gear. The aircraft settled back to the runway at approximately 3,700 feet, as the nose attitude lowered to about 10° ANU and the velocity dropped to 128 knots. Within a few seconds the speed began increasing again and eventually reached a maximum of approximately 137 knots. However, the deck angle also increased markedly to over 16.5° ANU and remained in that attitude. During the same interval, the aircraft was approximately 5 feet above the runway. The aircraft touched down again 5,005 feet from the takeoff end of the runway and disappeared from the camera view.

The nose attitude of another Sabre Mark 5 aircraft was calculated from film made during a takeoff. Although the aircraft was not equipped with external fuel tanks, the initial lift-off attitude would not vary significantly from that of N275X, The attitude during the test takeoff was approximately 5° ANU.

1.16 Other

The Golden West Sport Aviation Show was a 2-day airshow sponsored by the Active 20-30 Club and Chapter 52 of the Experimental Aircraft Association, both of Sacramento. The purpose of the show was the static and aerial exhibition of "experimental and antique" aircraft. The proceeds were designated for charitable and aviation educational support. Preliminary planning for the airshow began in February 1972 with monthly meetings, and culminated in a formal Application for Certificate of Waiver or Authorization from the provisions of FAR 91.71(c) and (d)4/. The application, dated August 8, 1972, stipulated that all events would take place within the confines of Sacramento Executive Airport and listed three pilots with the aircraft that each would fly. The planned schedule of events, beginning at 0800, September 23, 1972, and ending at 1530, September 24, 1972, was attached.

On August 30, 1972. the Sacramento GADO issued a Certificate of Waiver or Authorization for "Acrobatic aerial demonstrations within the boundary of the Sacramento Executive Airport from the surface to 3,000 feet . . ." In addition to granting waivers from the provisions of FAR 91.71(c) and (d), the certificate also waived FAR 91.79(b) which establishes a minimum safe altitude over congested areas. Eighteen special provisions were listed for further compliance (see Appendix C) to promote safety, including authority for appropriate officials of the airshow or the FAA to stop the airshow for reasons of safety.

FAR 61.16(a) states that no person may act as pilot-in-command of turbojet aircraft unless he holds a type rating for the aircraft; however, an exception is granted when an authorization is issued by a Flight Standards District Office. Letters of authority are normally issued in the following circumstances:

(a) Practice in a single-control aircraft to qualify for a type rating.

(b) Ferry flight by a pilot who will not regularly fly the aircraft.

(c) Test flight in an aircraft repaired or modified by an approved repair station or manufacturer.

(d) Other specific flights considered safe under the existing circumstances if it is not practicable to require the type rating.

4/ FAR 91.71(c) prohibits acrobatic flight within a control zone or Federal airway. FAR 91.71(d) prohibits acrobatic flight below an altitude of 1,500 feet above the surface.

The inspector is cautioned to issue letters of authority only if the pilot is qualified to complete the flight safely. This evaluation should consider:

(a) Total pilot time.

(b) Type ratings or military experience in similar aircraft.

(c) Extensive pilot experience in aircraft with similar flight characteristics.

(d) Current flight experience and pilot competency.

FAR Part 21 prescribes procedures for certification of products and parts, and subpart H deals specifically with the issuance of airworthiness certificates. Standard airworthiness certificates are issued for type certificated aircraft in the normal, utility, acrobatic, and transport categories. Special airworthiness certificates are issued for other categories including, among others, special flight permits and experimental. Special flight permits, effective for the period of time specified on the permit, are issued for aircraft that may not meet applicable airworthiness requirements, but which are capable of safe flight.5/ Experimental certificates are issued, for a maximum of 1 year, for the following purposes:

(1) Research and Development.

(2) Showing compliance with regulations.

(3) Crew training.

(4) Exhibition.

(5) Air racing.

(6) Market surveys.

(7) Operating amateur-built aircraft.

An applicant for an experimental certificate must include in the application a statement of the purpose for which the aircraft will be used, enough data to identify the aircraft, and, upon inspection of the aircraft, any pertinent information found necessary to safeguard the general public,

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5/ Examples of special flight permits may include: 1) flying the aircraft to a base for repair or storage; 2) delivering or exporting the aircraft; 3) production flight testing; 4) evacuating aircraft from areas of impending danger, etc.

On November 9, 1972, the FAA issued a General Notice (GENOT) to all field offices on "future Civil Certification, Operation, and Maintenance of Military Surplus Jet Airplanes." The notice supplements applicable handbooks, in part, as follows:

(1) Surplus military jets will not take off or land over densely populated areas; deviations will be approved at regional level.

(2) Prior to participation in airshows with this type of aircraft, the pilot shall submit a resume of his participation in each exhibit. Flights for this purpose, including routes of flight takeoff. departure, approach and landing shall be approved by the FAA office involved.

(3) A pilot will not be authorized to operate a surplus military jet unless:

(a) He shows evidence of having completed a military or manufacturer's checkout in that aircraft.

(b) He has flown as pilot-in-command of jet aircraft within the preceding 3 months and as pilot-in-command in the particular type during the preceding 12 months.

(c) He successfully demonstrates his knowledge of the aircraft and his flight proficiency by making three takeoffs and landings observed by an FAA inspector.

2. ANALYSIS AND CONCLUSIONS

2.1 Analysis

The aircraft was certificated in accordance with existing procedures, and there is no evidence of malfunction or mechanical failure which would have prevented a normal takeoff. The pilot reported that he felt and heard a vibration shortly after initial lift-off. Apparently, he was not sufficiently concerned to reject the takeoff at that point. He stated that when he lowered the nose, acceleration seemed normal again and he continued the takeoff. The Board believes that the vibration experienced was precipitated by disturbed airflow, because of excessive nose-high attitude during lift-off. Documentation of the excessive attitude, and proper thrust development by the engine, was found in the testimony of witnesses and the analysis of the 8-mm. movies of the takeoff. The aircraft pitch attitude during the initial lift-off was more than

three times higher than that of the test Sabre Mark 5 aircraft, yet N275X reached a velocity of more than 130 knots in an exaggerated takeoff attitude twice on the 5,000-foot runway. Apparently, both times the aircraft remained airborne in ground effect as long as the pilot maintained the excessive noseup control input. Each time he relaxed the back pressure on the yoke the aircraft settled to the runway.

The overrotation was undoubtedly a function of (1) a lack of familiarity with the Sabre Mark 5 and (2) the effect of visual cues at Sacramento as opposed to Oakland. The pilot had logged a total of 3.5 flying hours in N275X, but claimed an additional 4 hours which were not logged. The only other "swept wing" experience he had was 31 hours logged as second-in-command in a Lockheed Jetstar. The remainder of his jet experience was accumulated in a Lear Jet as second-in-command. Although all jet experience provides a measure of exposure to the faster acceleration, and consequently to the quicker reactions required, very few models of aircraft are more sensitive to overrotation than Sabre-type aircraft. In this respect, the high thrust/weight ratio and relatively lower elevator power of the Lear Jet may have developed habit patterns which would increase the tendency of overrotation in the Sabre. For example, the Sabre Mark 5 has a lower thrust/weight ratio than the Lear Jet, but more effective elevator power at slow speeds. This combination results in the ability of the Sabre Mark 5 to achieve high angles of attack before flying speed is attained, with insufficient thrust to overcome the induced drag generated by the attitude. The application of excess noseup control in the Lear Jet, prior to reaching flying speed, generally does not result in an overrotated condition because the airspeed increases faster than the elevator effectiveness.

A second, and perhaps more significant factor, is the previously mentioned visual cues. The pilot was accustomed to establishing a takeoff attitude by reference to the environment around Runway 29 at Oakland, where the "wide open" expanse of San Francisco Bay creates a very indefinite horizon. This results in the visual impression of an "unlimited" runway. Actually the horizon would appear to recede as the aircraft moved along the runway. Under these circumstances, takeoffs by the inexperienced pilot were accomplished with little likelihood of overrotation. Although the pilot established a takeoff attitude by reference to the amount of runway remaining, the actual lift-off attitude was governed by the length of the runway and the sensory illusion that the end of the runway was still quite distant.

In contrast to the environment at Oakland, Runway 30 at Sacramento is closely surrounded by trees, buildings, water towers, and other objects which create a well-defined horizon. During this takeoff -- the pilot's first from another runway in the Sabre -- the short length of the

runway and the nature and proximity of the objects comprising the horizon would combine to accentuate the rate of closure. Additionally, the angular measurement from the pilot's eye level at a normal lift-off point to the apparent horizon of each runway would increase at a significantly greater rate at Sacramento. The rapid change in viewing angle would magnify the apparent height of the objects at the end of the runway and, in combination with the rate of closure, would result in a sense of urgency about becoming airborne as soon as possible. Considering his experience in the aircraft, and the very misleading but compelling visual cues, it is easily understood why the pilot rotated the aircraft to as much as 17° ANU.

Although this accident was a result of pilot technique, which has been discussed in detail, the catastrophic consequences resulted from two entirely separate circumstances: (1) inadequacies in the rules governing the operation of experimental aircraft; and (2) the location of the ice cream parlor.

The pilot was restricted from operating N275X from any airport other than Oakland or Sonoma County, except for exhibition. When the aircraft was exhibited at a bona fide airshow, the only airport restriction was that imposed by the performance capability of the aircraft. If there had been no airshow, N275X would not have been authorized to land or take off from Sacramento. Consequently, the rejected takeoff must be considered as directly related to the airshow, even though N275X was not specifically identified as part of the airshow.

The inadequacies of the rules governing operation of experimental aircraft are, perhaps, best demonstrated in a comparison of the provisions before and after the accident. The generalized statements concerning pilot qualification for a letter of authority were changed to reauire a military or manufacturer's checkout and recent pilot-in-command experience in jet aircraft. The previous certification requirement, for a statement of the purpose for which the aircraft will be used, is now expanded by a requirement to submit a resume each time the aircraft is to be exhibited. The resume must include all routes of flight, arrival, and departure, which must be approved by the FAA office involved. Takeoffs or landings over densely populated areas must now be approved at the regional level. It is obvious that the pilot of N275X could not qualify for a letter of authority under the new directive because he had not completed the appropriate training and because he lacked the pilot-in-command experience. Additionally, there is a possibility that the proposed exhibition might have been rejected if a resume had been presented to the FAA Western Region, as now required. Even assuming that the region approved the flight into Sacramento Executive Airport, some runway restriction would have been imposed because of the

populated areas surrounding certain runways, The Safety Board supported the FAA in the remedial action accomplished by the GENOT, issued November 9, 1972, and formally recommended that the provisions governing pilot qualifications be expanded to include pilots of any high-performance surplus military aircraft.

The second circumstance which added to the catastrophe was the location of the ice cream parlor. The construction of the shopping center was accomplished in accordance with existing statutes of the various jurisdictions. Although some of the structures exceeded the height standards of Part 77, the FAA determined that the obstructions did not constitute hazards to air navigation. The city, county, and State governments all generally agreed that once the shopping center was built, the subsequent addition of the ice cream parlor and sign had little effect on aircraft operations. This conclusion was an obvious extension of the initial rationale that "... the construction (of the shopping center) would affect operations no differently than other existing structures such as a gasoline sign, television antennas, traffic signal standards, etc." Additional aspects of this accident were discussed in the Board's recommendation to the Federal Aviation Administration (see Appendix E).

2.2 Conclusions

(a) Findings

1. The aircraft was certificated in accordance with existing regulations.

2. The pilot was certificated and held a valid letter of authority for the flight.

3. The regulations and procedures concerning certification of experimental aircraft, and issuance of letters of authority for pilots, were inadequate.

4. The aircraft was capable of taking off from Runway 30 without incident, under the conditions at Sacramento.

5. The differences between the horizon and runway length at Oakland and Sacramento created visual illusions that induced an apparent need for rapid lift-off at Sacramento.

6. The pilot did not have sufficient experience in the Sabre Mark 5 to enable him to compensate for the misleading visual cues. March 28

7. The catastrophic consequence of this accident is directly attributed to the proximity of the shopping center to the runway.

(b) Probable Cause

The National Transportation Safety Board determines that the probable cause of this accident was the overrotation of the aircraft and subsequent derogation of the performance capability. The overrotation was the result of inadequate pilot proficiency in the aircraft and misleading visual cues.

3. RECOMMENDATIONS

As a result of the investigation of this accident, the Safety Board on December 28, 1972, issued five recommendations (Nos. A-72-219 through 223) directed to the Administrator of the Federal Aviation Administration. Copies of the recommendation letter and the Administrator's response thereto are included in Appendices E and F, respectively.

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ JOHN H. REED
Chairman

/s/ FRANCIS H. McADAMS
Member

/s/ LOUIS M. THAYER
Member

/s/ ISABEL A. BURGESS
Member

/s/ WILLIAM R. HALEY
Member

March 28, 1973

APPENDIX A

INVESTIGATION AND HEARING

1. Investigation

The Board received notification of this accident at approximately 1800 on September 24, 1972, from the Federal Aviation Administration. An investigating team was dispatched to the scene of the accident. Working groups were established for Operations, Maintenance Records and Performance, Human Factors, Airworthiness, and Airport Environment. The Federal Aviation Administration and Spectrum Air, Inc., participated in the investigation as interested parties. The on-scene investigation was completed on October 4, 1972.

2. Hearing

A public hearing was held at Sacramento, California, on October 16, 1972. Parties to the hearing included the Federal Aviation Administration and Spectrum Air, Inc.

3. Reports

There was no preliminary report on this investigation.

APPENDIX B

General Aviation District Office
P. O. Box 2397 - Airport Station
Oakland, California 94614

6 June 1972

Letter of Authority

Mr Richard L. Bingham
575 Arthur Street
Novato, California

Dear Mr Bingham:

This letter authorizes you to serve as pilot-in-command of Canadair MK-5 N275K for the purpose of pilot proficiency and exhibition of the aircraft. The following limitations, in addition to those outlined in the operating limitations of the aircraft, will apply:

1. All pilot proficiency operations will be limited to an area within 100 miles of the Metropolitan Oakland International Airport or the Sonoma County Airport, and takeoffs and landings for such operations will be limited to these airports, other than for emergency reasons. If an emergency landing is required at another airport, a full written report of the facts and circumstances must be submitted to this office within 48 hours of its occurrence.

2. All flights from the Metropolitan Oakland Airport and the Sonoma County Airport must be approved by their respective airport managers.

3. All flights shall be conducted to avoid areas having heavy air traffic, and when operating in the vicinity of cities, towns, villages and congested areas, conducted in a manner that the aircraft will not create a hazard to persons or property on the ground.

4. No persons other than the pilot shall be carried.

This authorization will expire upon written notification, but in no case later than December 1, 1972.

Sincerely,

JOHN S. ZENTNER
Chief

TGS:wp

FAA

APPENDIX C

FEDERAL AVIATION AGENCY

CERTIFICATE OF WAIVER OR AUTHORIZATION

ISSUED TO
Jerry L. Worthington, Chairman
Golden West Sport Aviation Show

ADDRESS
701 Wales Drive
Folsom, California 95630

This certificate is issued for the operations specifically described hereinafter. No person shall conduct any operation pursuant to the authority of this certificate except in accordance with the standard and special provisions contained in this certificate, and such other requirements of the Federal Aviation Regulations not specifically waived by this certificate.

OPERATIONS AUTHORIZED

Acrobatic aerial demonstrations within the boundary of the Sacramento Executive Airport from the surface to 3,000 feet mean sea level.

Area of operation: Sacramento, California

LIST OF WAIVED REGULATIONS BY SECTION AND TITLE

FAR 91.71(c) - Acrobatic flight within a control zone or Federal Airway.
FAR 91.71(d) - Acrobatic flight below an altitude of 1,500 feet above the surface.
FAR 91.79(b) - Altitude over congested areas.

STANDARD PROVISIONS

1. A copy of the application made for this certificate shall be attached to and become a part hereof.
2. This certificate shall be presented for inspection upon the request of any authorized representative of the Administrator of the Federal Aviation Agency, or of any State or municipal official charged with the duty of enforcing local laws or regulations.
3. The holder of this certificate shall be responsible for the strict observance of the terms and provisions contained herein.
4. This certificate is nontransferable.

NOTE.—This certificate constitutes a waiver of those Federal rules or regulations specifically referred to above. It does not constitute a waiver of any State law or local ordinance.

SPECIAL PROVISIONS

Special Provisions Nos. _____ to 19, inclusive, are set forth on the attached pages.

This certificate is effective from 12:30 8-23-72 to 15:30 8-24-72, inclusive, and is subject to cancellation at any time upon notice by the Administrator or his authorized representative. Coordinated with: SAC FSS, SAC TWR

BY DIRECTION OF THE ADMINISTRATOR:

Western
(Region)

George J. Schwab
(Signature)

8-30-72
(Date)

Chief, General Aviation District Office
(Title) WE-GADO-12

FAA Form 663 (12-64) USE PREVIOUS EDITION

0052-035-4000

(7711)

SPECIAL PROVISIONS

1. Acrobatic aerial demonstrations shall not be conducted over congested areas of cities, towns, or settlements. This does not prohibit normal flight of aircraft conducted in accordance with Section 91.79 of the Federal Aviation Regulations. Abnormal break maneuvers (rolls exceeding 90°) are considered acrobatic.

2. All acrobatic aerial demonstrations by aircraft operating at speeds in excess of 130 knots shall be conducted at least 1,500 feet horizontally from the designated spectator area. All acrobatic aerial demonstrations by aircraft operating at speeds of 130 knots or less shall be conducted at least 500 feet horizontally from the designated spectator area. Normal takeoffs and landings shall not be considered as part of the demonstrations; however, no takeoff or landing shall be made toward or over the designated spectator area.

3. Federal Aviation Regulations, Section 91.79(b), is waived only with respect to open air assembly of persons and only to the extent authorized in Special Provision No. 2 of this Certificate.

4. All acrobatic maneuvers shall be conducted in a direction which will most nearly parallel the boundaries of the designated spectator area or in a direction away from such area.

5. Acrobatic aerial demonstrations are not authorized if the visibility is less than five (5) miles and the ceiling is less than 2,500 feet at the time of the demonstration. Acrobatic maneuvers shall be conducted at least 1,000 feet below the ceiling. These minimums may be modified by the Federal Aviation Administration (FAA) monitor within the limitations set forth by established FAA policy.

6. Adequate oral or visual communications capability shall be provided to advise spectators and participants that the aerial demonstration has been halted or canceled, or to otherwise communicate with these parties as required to maintain a safe operation.

7. A physical barrier and adequate policing shall be provided to confine spectators to designated areas.

8. The demonstration shall be halted when unauthorized persons or aircraft enter the operations area, or for any other reason, in the interest of safety.

9. All participants shall attend the pre-demonstration briefing, that will be conducted by the holder, and acknowledge in writing that they understand the Certificate of Waiver or Authorization, including the Special Provisions and location of all deadlines.

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10. Deadlines, man-made or natural, readily visible to the participant, **shall** be provided by the holder to ensure that aircraft remain the approved distance from the spectators. Such deadlines shall be agreed upon by the FAA representative prior to any demonstrations.

11. Aircraft shall not be taxied nor their engines started in designated spectator or static display areas, unless appropriate measures are taken to preclude creating a hazard to spectators.

12. The holder shall establish a central control point from which he or his representative shall direct the demonstrations and be immediately available during the demonstrations for coordination with the FAA representative.

13. The holder shall notify the Sacramento Flight Service Station Telephone No. 916/449-3234/3176 of the date, time, place, altitudes, nature and direction of the operations, and request that a Notice to Airmen be disseminated. Such action shall be accomplished at least 48 hours prior to the demonstration time.

14. The holder shall have the responsibility to temporarily halt or cancel the authorized operations if at any time the safety of persons or property, on the ground or in the air, is in jeopardy or if there is a contravention of the terms or conditions of the Waiver.

15 The FAA representative designated to monitor the demonstration shall have the authority to temporarily halt or cancel the authorized operations if he finds that the holder has failed to do so, and the safety of persons or property, on the ground or in the air, is in jeopardy, or if there is a contravention of the terms or conditions of the Waiver.

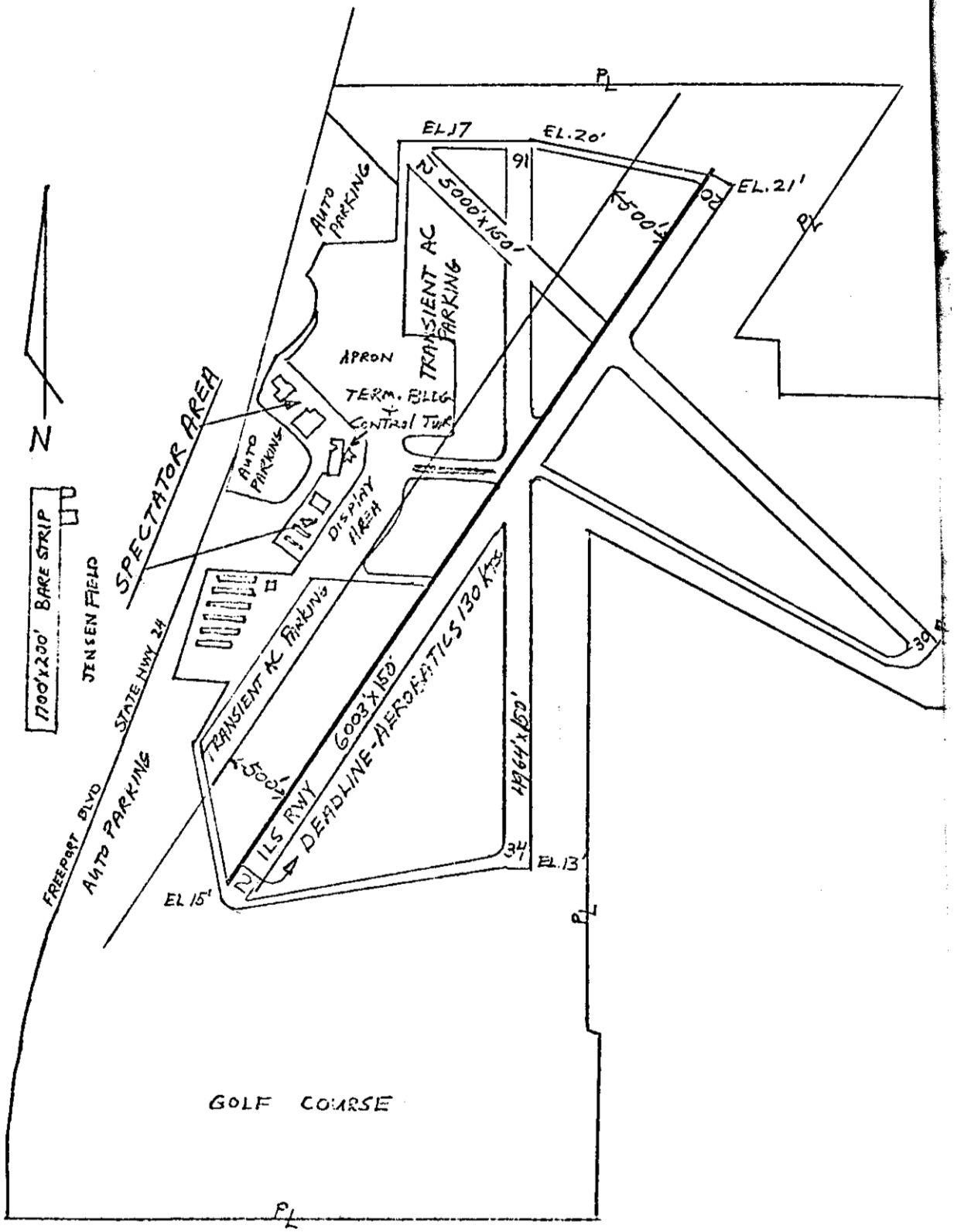
16. **All** civil aircraft and pilots scheduled for participation in the events shall be made avilable for FAA inspection prior to the event. If, in the opinion of the FAA representative, pilot competency or airworthiness of an aircraft is unsatisfactory, such pilots or aircraft shall not be permitted to participate.

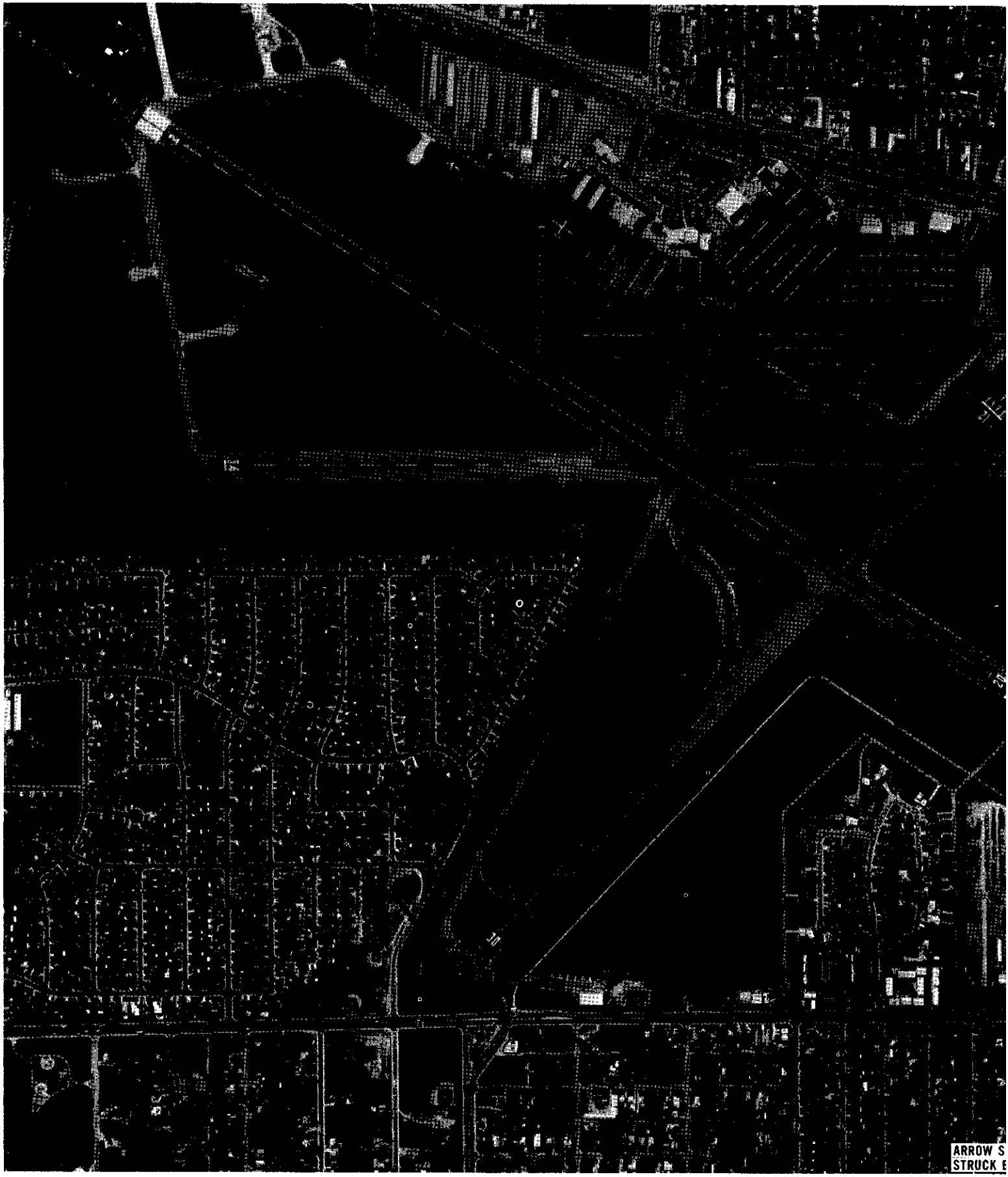
17. Contravention of any provision of this certificate will constitute a violation of Section 610(a)(5) of the Federal Aviation Act of 1958 as amended.

18. **All** participants in aerobatic demonstrations must hold a currently effective Letter of Competence issued by an FAA General Aviation Operations Inspector. Participants will perform only those maneuvers listed in their preplanned routine and no substitutions will be permitted without prior approval of the Flight Standards Service Inspector.

APPENDIX D

Sacramento Executive Airport
Sacramento, California





ARROW S
STRUCK E

APPENDIX D

ARROW SHOWS BUILDING STRUCK BY AIRCRAFT

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D. C.

SACRAMENTO EXECUTIVE AIRPORT
SPECTRUM AIR, INC.
SABRE MARK 5, N275X
SACRAMENTO, CALIFORNIA
SEPTEMBER 24, 1972

UNITED STATES OF AMERICA
NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: December 28, 1972

Adopted by the NATIONAL TRANSPORTATION SAFETY BOARD
at its office in Washington, D. C.
on the 13th day of December 1972

FORWARDED TO:
Honorable John H. Shaffer
Administrator
Federal Aviation Administration
Department of Transportation
Washington, D. C. 20591

SAFETY RECOMMENDATION A-72-219 thru 223

In the course of the investigation of the September 24, 1972, accident in Sacramento, California, involving Canadair Ltd., Sabre Mark 5, N275X, the National Transportation Safety Board examined the pilot's proficiency for the operation, the certification of experimental aircraft, and the associated regulatory provisions. The airport's environmental aspects, which had a direct bearing on the catastrophic consequences of this accident, were also considered.

The aircraft was operated under a Special Airworthiness Certificate with an experimental classification for exhibition purposes. The operating limitations stipulated, among other things, that the aircraft could be operated only by a pilot authorized under a letter of authority issued by the Administrator. The pilot involved held such a letter, which authorized him to operate this aircraft for the purpose of pilot proficiency and exhibition flying. The letter limited his proficiency operations to an area within 100 miles of two specified airports and limited the takeoffs and landings for proficiency flights to those airports, except for emergency reasons.

The restrictions imposed upon the pilot in connection with his proficiency flying contrasted strongly with the lack of restrictions on his operation of the aircraft for exhibition purposes. Part 21 of the Federal

Honorable John H. Shaffer

APPENDIX E

Aviation Regulations defines exhibition, in part, as "exhibiting the aircraft's flight capabilities, performance, or unusual characteristics at airshows." Testimony during the public hearing in Sacramento on October 16-18 revealed that neither the pilot nor the operations inspector of the General Aviation District Office involved were aware of the extent of the flying activities covered by this definition. The operations inspector who prepared the pilot's letter of authority stated that the pilot could legitimately have flown this aircraft to a bona fide airshow for exhibition purposes following his first flight in it.

Based on this and similar testimony, the Board concludes that the guidelines dealing with the issuance of authorization to operate this type aircraft were too broad to provide adequate guidance for General Aviation District Office inspectors with regard to pilot qualification and proficien and the formulation of safeguards in the special conditions and limitations

The Board is aware of the GENOT (General Notice) distributed to your regional, district, and field offices on November 9, 1972, entitled: "Future Civil Certification, Operation, and Maintenance of Military Surplus Jet Airplanes." These supplemental guidelines should help in the interpretation of existing instructions with regard to the safe utilization of surplus military jets. However, the Board is of the opinion that similar consideration should be given to all high-performance military surplus airplanes, reciprocating as well as turbine engine powered. Unless a pilot receives his transition training from an organization or club that imposes its own safeguards, there appear to be no constraints on a private pilot with minimum experience who wishes to operate an F-51, for example. The establishment of reasonable minimum standards in this area would serve to promote aviation, rather than inhibit it.

In view of the variety of purposes for which experimental certificates can be issued, it appears that separate classification of those activities which are not truly experimental would facilitate the exercise of more selective regulatory control for the benefit of the operator as well as the general public.

The Board is also concerned about the airshow waiver provisions, although they did not have a bearing on this accident. The special provisions dealing with the separation criteria between spectator areas and aircraft performing acrobatic maneuvers took into consideration only the safety of designated spectator areas. At Sacramento Executive Airport, residential encroachment extended to within about 500 feet of the demonstration runway. In addition, the Board questions the adequacy of the

guidelines in the General Aviation Operations Inspector's Handbook that use a cruising speed of 130 knots as a criterion for "Dead Line" separation from spectator areas during airshows; in excess of 130 knots, the minimum is 1,500 feet and at lower speeds it is 500 feet. Although this rule may be suitable for the protection of designated spectator areas that parallel the demonstration runway, it does not take into account the potential trajectory of disassociated aircraft parts and their hazard to persons and property in the line of flight, near the airport boundaries.

The built-up area around the Sacramento Executive Airport raises serious questions with regard to the suitability for airshows of this and similar airports, especially when one considers the practicability of applying the following sample of a special provision from the pertinent handbook: "The holder of the airshow waiver shall insure that roads adjacent to the airport, as specified below, are devoid of vehicular traffic and the property adjoining the airport shall be free of spectators." This provision was not incorporated in the certificate of waiver for the Sacramento airshow; if it had been, it would have been very difficult to implement. In this respect, it is of interest to note that the 92 accidents that occurred during airshows or air racing in a recently researched 8-year period (1964-1971) did not result in injuries to other than aircraft occupants. The Board is of the opinion that open space around most of the airports involved played a predominant role in protecting public and property beyond the designated spectator areas.

With regard to the catastrophic consequences of this accident, the public hearing produced no evidence of specific regulatory provisions, or firm guidelines, at the Federal, State, or local level, that would have precluded the construction of public or private facilities in such close proximity to the departure end of Runway 30. The Board is unable to find any direct reference to the safety of persons or property on the ground in Part 77 (Objects Affecting Navigable Airspace) or in Advisory Circular 150/5190-3 (Model Airport Zoning Ordinance). This does not imply that such consideration is not given during aeronautical studies and hearings, or that this accident was typical in its environmental impact of the approximately 25,780 takeoff and landing accidents that occurred on, or in the immediate vicinity of U. S. airports during the earlier-mentioned 8-year period. The Board also recognizes that the responsibility for prudent restrictions on the use of land around airports, and construction thereon, rests with local jurisdictions. However, advisory guidance, and the judicious use of controls in the fund allocations under the Airport Development Aid Program, could be influential in convincing the jurisdictions involved that the compatibility considerations of airports and surrounding environment should not only include noise, pollution, and similar factors, but also a practical regard for the safety of people and property on the ground.

Honorable John H. Shaffer

APPENDIX E

With regard to existing hazardous situations around certain airports, the Board believes that there is a need to issue guidelines restricting the use of specific runways to specific aircraft or operations, based on such factors as the aircraft's accelerate-stop distance, runway length, engine-out capability, and the proximity of urban congestion to the runway involved; this would assist airport managers in securing or implementing the authority to offset the hazards inherent in the environmental encroachment that has been allowed to develop near some airports.

In view of the foregoing, the National Transportation Safety Board recommends that the Federal Aviation Administration:

1. Limit the issuance of experimental certificates to those aircraft and operations that are truly experimental in nature and reclassify the other activities listed in FAR 21.191 in a manner that will permit more selective regulatory control without unduly inhibiting the promotion of aviation.

2. Establish pilot experience, transition, and proficiency standards applicable to the operation of all high-performance surplus military aircraft, reciprocating as well as turbine engine powered.

3. Establish additional airshow separation criteria applicable to persons and property in other than designated spectator areas to insure that the overall suitability of an airport for airshows is taken into account.

4. Include in the guidelines dealing with compatible land use planning around airports, consideration for the safety of persons and property on the ground, and use the controls available in the Airport Development Aid Program to insure compliance.

5. Establish guidelines that will assist airport managers in setting limitations on the utilization of runways where existing environmental encroachment and runway length combine to create a high-risk level for certain aircraft operations.

These recommendations will be released to the public on the issue date shown above. No public dissemination of the contents should be made prior to that date.

Reed, Chairman, McAdams, Burgess, and Haley, Members, concurred in the above recommendations. Thayer, Member, was absent, not voting.

By: John H. Reed
Chairman

APPENDIX F

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20590

OFFICE OF
THEADMINISTRATOR

26 JAN 1973

Honorable John H. Reed
Chairman, National Transportation
Safety Board
Department of Transportation
Washington, D. C. 20591

Dear Mr. Chairman:

This in response to NTSB Safety Recommendations A-72-219 thru 223.

1. A regulatory project is underway to separate exhibition, air racing and amateur-built aircraft from the experimental category and to specify appropriate operating restrictions for each. We expect to issue a Notice of Proposed Rule Making in the near future,

2. We are considering including all high performance military surplus aircraft in the recently established pilot competency requirements. We expect a policy to be established on this in the near future.

3. Action is underway to update air show guidelines and policy. We fully recognize that every airport environment is not suitable for air shows. This will be given special emphasis.

4. The Airport and Airway Development Act, which is the basic authority for the Airport Development Aid Program (ADAP), provides, among other things, that no airport development project shall be approved unless sponsor submits satisfactory assurances that appropriate action has been or will be taken, to the extent reasonable, to restrict the use of land adjacent to or in the immediate vicinity of the airport to activities and purposes compatible with normal airport operations, including the landing and takeoff of aircraft.

This provision of the Act is implemented by section 152.35 of the FAR which requires the sponsor of an ADAP project to state in its application the action it has taken to restrict the use of land adjacent to or in the immediate vicinity of the airport to activities and purposes compatible with normal airport operations.

Additional guidance on compatible land use is provided for field personnel in Order 5100.18, paragraph 277. This paragraph suggests various means of achieving compatible land use "such as promoting and fostering the development of open air areas, recreational areas, and other uses and activities that do not generate assemblies of people. Federal assistance programs that will preserve open land

uses around an airport should be used to the extent possible. These programs include the Department of Housing and Urban Development Open Space Land Program and recreation and conservation land grants of the Bureau of Outdoor Recreation, Department of the Interior." We list in this order as constituting incompatible land uses, such uses as residential development, and places of public assembly including schools, hospitals, churches, and similar institutions.

On the basis of the above requirements and guidance, we believe we are already in conformance with recommendation 4.

5. The FAA will look into the possibility of revising our publication 150/5190-3A, "Model Airport Hazard Zoning Ordinance," to include guidance of the type stated in recommendation 5. Also, we will consider this recommendation in the development of our new Advisory Circular on airport design considerations of obstruction, obstacles, and objects around the airport,

Sincerely,

J. H. Shaffer
Administrator