



National Transportation Safety Board

Washington, D.C. 20594
Safety Recommendation

Log 2596

Date: MAY 31 1996

In reply refer to : A-96-23 and -24

Honorable David R. Hinson
Administrator
Federal Aviation Administration
Washington, D.C. 20591

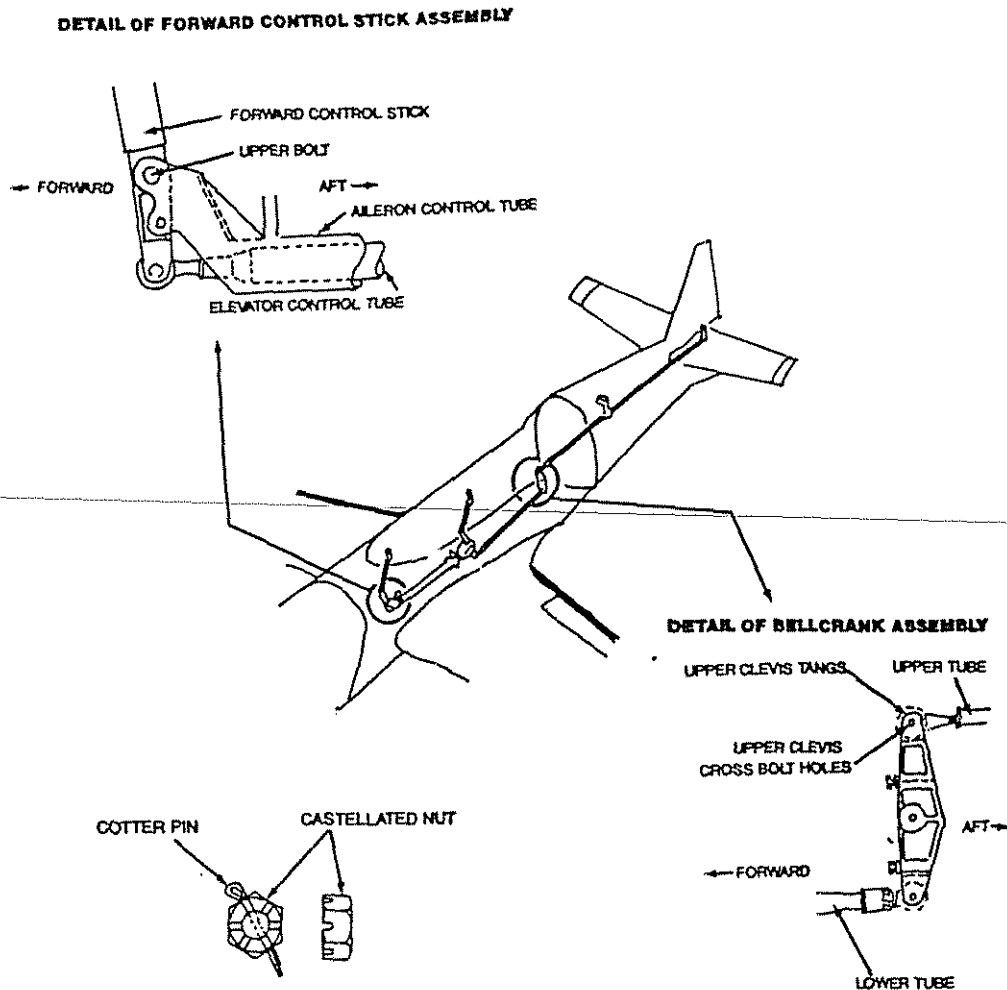
On March 21, 1996, a Sukhoi SU-29 high performance aerobatic airplane, N729SU, crashed near New Orleans, Louisiana. The pilot was killed, and the airplane was destroyed. Radar data indicate that the airplane was maneuvering in a manner consistent with the performance of aerobatics before the accident.

During the week of the accident, the pilot had gone to the local practice area to become more familiar with the aerobatic maneuvering abilities of the SU-29 and to prepare for an upcoming air show. Airplane records showed that the airplane's special airworthiness certificate¹ in the experimental category for the purpose of exhibition had been issued on October 19, 1995. The airplane had accumulated about 20 flight hours since new.

The Sukhoi SU-29 is a single-engine tandem two-seat aerobatic airplane manufactured by Advanced Sukhoi Technologies (AST), Moscow, Russia. The SU-31, which is a single-engine, single-seat aerobatic airplane, is similarly designed and manufactured. The airplanes are assembled and test-flown in Russia, then partially disassembled (empennage, wings, and landing gears) for the purpose of shipping. The disassembled airplanes are shipped to the Pompano Air Center (PAC), Pompano Beach, Florida, which is the worldwide distributor of Sukhoi aerobatic airplanes. At PAC, each airplane is reassembled and application is made to the Federal Aviation Administration (FAA) for a special airworthiness certificate in the experimental category for the purpose of exhibition. At present, the total number of SU-29 airplanes flying in the United States and abroad is 27 and 13, respectively. The total number of SU-31 airplanes flying in United States and abroad is 4 and 8, respectively.

¹Special airworthiness certificates are issued for aircraft other than those considered "standard." These are restricted, limited, provisional, special flight permit, and experimental certificates. Experimental certificates are issued for the purpose of research and development, crew training, exhibition, air racing, market surveys, and amateur-built aircraft.

The elevator control system of an SU-29 consists of tubes, a bellcrank, and a few intermediate joints that connect the control sticks to the elevator for pitch control (see Figure 1). The bellcrank is oriented vertically, and tubes are attached to the bellcrank in the fore and aft direction by threaded spherical rod end bearings. The spherical rod end bearings are connected to the bellcrank's clevis tangs by bolts that are secured with castellated nuts and flared cotter pins. The forward end of the lower tube (forward of the bellcrank) is connected to the aft cockpit control stick and serves as the only pitch control input to the bellcrank. The forward end of the upper tube (aft of the bellcrank) connects to the bellcrank's upper clevis tangs at the upper clevis crossbolt holes. The upper tube and other control system components actuate the elevator. The bellcrank reverses the motion of the lower and upper control tubes and slightly alters the leverage ratio. With an aft movement of the pilot's control stick, the lower elevator tube moves forward, causing aft movement of the upper tube.



The wreckage of N729SU was found in a swamp with the wings, fuselage, and empennage fragmented. The elevator and aileron control system tubes were broken in numerous places. The elevator upper tube was detached from the bellcrank, but the bellcrank's upper clevis tangs were undamaged. The upper clevis cross bolt holes contained bushings that were round and undistorted, and the bolt, castellated nut, and cotter pin were missing.

The Safety Board's material laboratory measured the upper clevis cross bolt holes of the bellcrank from the accident airplane using an optical comparator and video measurement system and confirmed that the bolt holes were not distorted. Examination of the upper clevis cross bolt holes under higher magnification revealed that a bolt had been previously installed, but that the bolt was not present when the plane crashed. This suggests that the bolt migrated out of the clevis holes of the bellcrank during the flight, causing the loss of control. Loss of the cotter pin would have allowed the castellated nut, if installed, to back off the bolt and the bolt to migrate from the clevis holes thus allowing the upper tube to disengage from the bellcrank.

Following the accident, the Safety Board examined three partially assembled SU-29 airplanes at PAC and found inconsistency in the assembly of bolts, castellated nuts, cotter pins, and elevator control tubes on these airplanes. On one airplane, the cotter pin on the upper bolt, which attaches the forward control stick to the aileron control tube, was installed but not flared. Proper installation includes flaring the cotter pin. An unflared cotter pin can easily fall out in flight, allowing the castellated nut to migrate off the bolt and the bolt to fall out. Aileron and elevator control operation from the forward control stick would be lost. Some of the other cotter pins in the fuselage frame were partially flared, providing less security than intended in the airplane's design.

Because the evidence strongly suggests that a bolt migrated out in flight in the accident involving N729SU, and because a cotter pin in the control system of an unassembled SU-29 was not flared when examined at PAC, the Safety Board believes that the FAA should require an immediate inspection on the entire fleet of SU-29 and SU-31 airplanes to ensure that the flight controls are properly assembled and, specifically, that all cotter pins are properly installed.

On April 5, 1996, a letter was issued by AST to all SU-29 and SU-31 owners, recommending "inspection of ailerons, elevator, rudder, and rudder trimmer controls" to ensure "connections reliability and presence of locking devices." On April 23, 1996, a letter was issued by PAC to all SU-26, SU-29, and SU-31 owners providing preliminary accident findings and forwarding the AST letter to advise Sukhoi owners to recheck proper cotter pin installation and safety wiring of bolts and nuts.

Discussions with an executive at PAC revealed that a detailed inspection is not

performed before an airplane is reassembled at PAC. PAC normally inspects only the work that it performs during reassembly of the wing, empennage, and landing gear. An airframe and powerplants (A&P) mechanic certifies in the aircraft log that the airplane's flight controls rigging has been checked and that the airplane has been inspected and is in a condition for safe operation. The mechanic does not perform an inspection of the work performed at AST in Russia. The PAC executive informed the Safety Board staff that the SU-29 and SU-31 airplanes are assembled at PAC without checklists, process sheets, or any other guidelines to help them in the assembly and inspection of the airplane. The FAA inspector who approved the special airworthiness certificates did not require evidence of a detailed inspection of the airplanes by PAC.

FAA Order 8130.27 provides guidance to FAA aviation safety inspectors (ASIs) about the issuance of special airworthiness certificates and operating limitations for experimental aircraft certificated for the purpose of exhibition. Appendix 1, paragraph b. (7), of this order requires ASIs to verify that the applicant has made an entry in the aircraft records to certify that an appropriately rated FAA-certificated mechanic has accomplished the applicable inspection (as defined in paragraph 8 of this order) within 30 days before submitting the application for a special airworthiness certificate. The applicable inspection requirements state that the airplane must be inspected each year in accordance with an inspection plan that contains the scope and detail of 14 CFR Part 43, Appendix D, called a "condition inspection."² This condition inspection is equivalent to an annual inspection and includes a detailed inspection of the engine, airframe, and control systems of the airplane.

The FAA airworthiness inspector responsible for issuance of the special airworthiness certificates for the SU-29 and SU-31 airplanes certificated in the United States revealed that only a general inspection of the control surfaces and control stick movements is performed before he issues each applicable special airworthiness certificate. He advised the Safety Board staff that he examines the log book for the signed statement by the FAA-certificated A&P mechanic certifying the airplane's condition for safe operation. The mechanic's signed statement does not describe a detailed inspection, or reference 14 CFR Part 43, Appendix D. The FAA inspector's interpretation of FAA Order 8130.27 and the FAA notice that preceded it was that the condition inspection for a newly manufactured airplane is not applicable at the time of the issuance of a special airworthiness certificate in the experimental category for the purpose of exhibition.

The requirement in FAA Order 8130.27, Appendix 1, paragraph b.(7) is not clearly stated and can be misinterpreted, resulting in an inspection that may not meet the requirements of 14 CFR Part 43, Appendix D, before issuance of a special

² Condition inspection is defined in the Airworthiness Inspector's Handbook, FAA Order 8300.10, Chapter 25.

airworthiness certificate. The Safety Board believes that a condition inspection, equivalent to a 14 CFR Part 43, Appendix D annual inspection, should be required before the issuance of the special airworthiness certificate. An appropriately detailed condition inspection could have detected the control system discrepancies discovered by the Safety Board in SU-29 airplanes. Therefore, the Safety Board believes that FAA Order 8130.27, Appendix 1, paragraph b.(7) should be amended to clarify the requirements of the inspection of new airplanes, like the SU-29 and SU-31, that are initially certificated in the United States following manufacture in other countries. Also, the Safety Board believes that the written statement signed by FAA-certificated mechanics who inspect the airplanes before a special airworthiness certificate is issued should note whether the inspection performed satisfies the requirements of 14 CFR Part 43, Appendix D.

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

Issue a telegraphic airworthiness directive to the owners of all U.S.-registered Sukhoi SU-29 and SU-31 airplanes requiring immediate inspection to ensure that the flight control systems are properly assembled and that all control system cotter pins are properly installed. (Class I, Urgent Action) (A-96-23)

Amend Federal Aviation Administration Order 8130.27, Appendix 1, paragraph b.(7), to specify that applicable airplanes must be inspected in accordance with an inspection plan that contains the scope and detail of 14 CFR Part 43, Appendix D, before the issuance of special airworthiness certificates. Also, ensure that the aircraft record entry made by the FAA-certificated mechanic, before issuance of a special airworthiness certificate, indicates that the aircraft meets the inspection standards of 14 CFR Part 43, Appendix D. (Class II, Priority Action) (A-96-24)

Chairman HALL, Vice Chairman FRANCIS, and Members HAMMERSCHMIDT, GOGLIA, and BLACK concurred in these recommendations.


By: Jim Hall
Chairman