

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: May 5, 1981

Forwarded to:

Honorable J. Lynn Helms
Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-81-48

On May 7, 1980, during a practice aerobatic flight, an Aerotek Pitts Special S2S crashed near Olathe, Kansas. Even though this investigation is still in process, the National Transportation Safety Board has reason to believe that the pilot may have experienced physiological incapacitation as a result of G forces encountered while performing aerobatic maneuvers.

The pilot had completed his "known" sequence of 18 maneuvers. At the suggestion of an observer, a regional aerobatic judge who was critiquing his maneuvers, the pilot decided to fly his "free" sequence, a series of 25 maneuvers. After a short rest, the pilot began these maneuvers which he had flown many times. He had completed maneuver number 19, two and one-half rolls from inverted to upright, which was preceded by an outside three-quarter loop. After completing the roll maneuver, the aircraft flew straight and level for a short time. The aircraft then started a short climb, then the nose dropped below the horizon and the aircraft departed the practice box in a 45° nosedown attitude. The aircraft impacted in a heavily wooded area and burned. The pilot did not survive.

During the entire practice flight, the pilot had been in radio contact with the observer on the ground. When the pilot appeared to break off his series of maneuvers and depart the practice box, he was asked his reasons for this but he did not reply. The investigation has not revealed any preimpact aircraft malfunctions; postmortem examination of the pilot disclosed no diseases.

The effect of aerobatic G forces, i.e., Gz or vertical axis forces, on human physiology is well stated in a Federal Aviation Administration (FAA) publication entitled "G Effects on the Pilot During Aerobatics," FAA-AM-72-28, July 1972, by Stanley R. Mohler, M.D. This report provides information relative to the nature of aerobatic G forces; human physiology in relation to G forces; human tolerances and exposure limits to G forces; and methods to increase tolerance to aerobatic G forces. Data in the report indicates that aerobatic pilots can expect to experience a variety of symptoms resulting from different levels of positive and negative G's over a wide

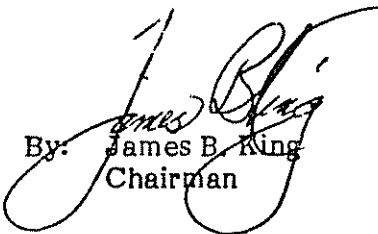
range of exposure times. Symptoms from gray-out to unconsciousness can occur during a positive G maneuver (referred to as an "inside" maneuver). A negative G maneuver (referred to as an "outside" maneuver) can result in discomfort, headaches, or unconsciousness. For the aerobatic pilot, the most significant finding in the report is the fact that loss of consciousness most likely will occur when high negative G maneuvers are followed by high positive G maneuvers such as a vertical "8" (i.e., an outside upper loop followed by an inside lower loop). Unconsciousness occurs due to the rapid swing from negative to positive G forces resulting in decreased blood circulation to the brain at G force levels of -3.5 to -4, and +4 to +4.5.

G forces sustained in aerobatic demonstrations and competitions today are more likely to be near -6.5 and +8 G's for some aerobatic aircraft. The pilot's last two maneuvers, mentioned previously, took him from a high negative G in the pullout from an outside loop into a sustained high positive G environment of two and one-half rolls. It is the Safety Board's opinion that, in the light of the evidence presented, physiological incapacitation of the pilot can not be ruled out.

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

Include in a future revision of the Airman Information Manual (AIM), Basic Flight Information and ATC Procedures, Chapter 7, Medical Facts for Pilots, a brief discussion of the physiology of aerobatic G forces as explained in FAA-AM-72-28. (Class II, Priority Action) (A-81-48)

KING, Chairman, DRIVER, Vice Chairman, McADAMS, GOLDMAN, and BURSLEY, Members, concurred in this recommendation.


By: James B. King
Chairman