NATIONAL TRANSPORTATION SAFETY BOARD
Public Meeting of August 27, 2012
(Information subject to editing)

Aircraft Accident Brief:
Pilot/Race 177, "The Galloping Ghost"
North American P-51D, N79111
Reno, Nevada
September 16, 2011

NTSB/WPR-11-MA-454

This is a synopsis from the National Transportation Safety Board's report and does not include the NTSB's rationale for the probable cause and safety recommendations. Safety Board staff is currently making final revisions to the brief from which the attached safety recommendations have been extracted. The final brief and pertinent safety recommendation letters will be distributed to recommendation recipients as soon as possible. The attached information is subject to further review and editing.

EXECUTIVE SUMMARY

On September 16, 2011, about 1625 Pacific daylight time, an experimental, single-seat North American P-51D, N79111, collided with the airport ramp in the spectator box seating area following a loss of control during the National Championship Air Races unlimited class gold race at the Reno/Stead Airport (RTS), Reno, Nevada. The airplane was registered to Aero-Trans Corp (dba Leeward Aeronautical Sales), Ocala, Florida, and operated by the commercial pilot as Race 177, "The Galloping Ghost," under the provisions of 14 Code of Federal Regulations Part 91. The pilot and 10 people on ground sustained fatal injuries, and at least 64 people on the ground were injured (at least 16 of whom were reported to have sustained serious injuries). The airplane sustained substantial damage, fragmenting upon collision with the ramp. Visual meteorological conditions prevailed, and no flight plan had been filed for the local air race flight, which departed RTS about 10 minutes before the accident.

The accident airplane was in third place during the third lap of the six-lap race and was traveling about 445 knots when it experienced a left roll upset. After the left roll upset, the airplane entered a right rolling climb maneuver during which the vertical acceleration peaked at 17.3 G, and a section of the left elevator trim tab separated in flight. The characteristics of the airplane's pitch changes during the upset were such that the pilot's time of useful consciousness was likely less than 1 second. As a result, the pilot soon became completely incapacitated, and the airplane's continued climb and helical descent occurred without his control.

The accident airplane had undergone many structural and flight control modifications that were undocumented and for which no flight testing or analysis had been performed to assess their effects on the airplane's structural strength, performance, or flight characteristics. The

investigation determined that some of these modifications had undesirable effects. For example, the use of a single, controllable elevator trim tab (installed on the left elevator) increased the aerodynamic load on the left trim tab (compared to a stock airplane, which has a controllable tab on each elevator). Also, filler material on the elevator trim tabs (both the controllable left tab and the fixed right tab) increased the potential for flutter because it increased the weight of the tabs and moved their center of gravity aft, and modifications to the elevator counterweights and inertia weight made the airplane more sensitive in pitch control. It is likely that, had engineering evaluations and diligent flight testing for the modifications been performed, many of the airplane's undesirable structural and control characteristics could have been identified and corrected.

The investigation determined that the looseness of the elevator trim tab attachment screws (for both the controllable left tab and the fixed right tab) and a fatigue crack in one of the screws caused a decrease in the structural stiffness of the elevator trim system. At racing speeds, the decreased stiffness was sufficient to allow aerodynamic flutter of the elevator trim tabs. Excitation of the flutter resulted in dynamic compressive loads in the left elevator trim tab's link assembly that increased beyond its buckling strength, causing a bending fracture. The flutter and the failure of the left elevator trim tab's link assembly excited the flutter of the right elevator trim tab, increasing the dynamic compressive loads in the right elevator trim tab's fixed link assembly beyond its buckling strength, causing a bending fracture. The investigation found that the condition of the trim tab attachment screws' locknut inserts, which showed evidence of age and reuse, rendered them ineffective at providing sufficient clamping pressure on the trim tab attachment screws to keep the hinge surfaces tight.

PROBABLE CAUSE

The National Transportation Safety Board determines that the probable cause of this accident was the reduced stiffness of the elevator trim tab system that allowed aerodynamic flutter to occur at racing speeds. The reduced stiffness was a result of deteriorated locknut inserts that allowed the trim tab attachment screws to become loose and to initiate fatigue cracking in one screw sometime before the accident flight. Aerodynamic flutter of the trim tabs resulted in a failure of the left trim tab link assembly, elevator movement, high flight loads, and a loss of control. Contributing to the accident were the undocumented and untested major modifications to the airplane and the pilot's operation of the airplane in the unique air racing environment without adequate flight testing.

RECOMMENDATIONS

As a result of this investigation and the NTSB's January 10, 2012, investigative hearing on air race and air show safety, on April 10, 2012, the NTSB issued 10 safety recommendations to the Reno Air Racing Association (RARA), the National Air-racing Group Unlimited Division, and the Federal Aviation Administration (FAA) with the intent of improving the safety of air race operations.

To the Federal Aviation Administration:

Revise [FAA] Order 8900.1, Flight Standards Information Management System, volume 3, chapter 6, section 1, paragraph 3-151 and [AC] 91 45C, "Waivers: Aviation Events," to correct inaccurate and incomplete information and reconcile all differences and inconsistencies between the documents. (A-12-08) *[Safety Recommendation A-12-08 is classified "Open—Acceptable Response."]*

To the Reno Air Racing Association:

Require aircraft owners, as a condition of eligibility to participate in the Reno [NCAR], to provide an engineering evaluation that includes flight demonstrations and analysis within the anticipated flight envelope for aircraft with any major modification, such as to the structure or flight controls. (A-12-13) *[Safety Recommendation A-12-13 is classified "Open—Acceptable Response."]*

Evaluate the design of the unlimited class course and safety areas to minimize maneuvering near and potential conflicts with spectators; if warranted by the results of the evaluation, implement changes to the race course. (A-12-14) *[Safety Recommendation A-12-14 is classified "Closed—Acceptable Action."]*

Take the following actions to raise the level of safety for spectators and personnel near the race course: (1) relocate the fuel truck away from the ramp area and (2) in front of any area where spectators are present, install barriers more substantial than those currently in place. (A-12-15) *[Safety Recommendation A-12-15 is classified "Closed—Acceptable Action."]*

Provide [high-G] training to pilots, including techniques to mitigate the potential effects of [high-G] exposure, as part of preparations before the Reno [NCAR] and during daily briefs at the NCAR. (A-12-16) *[Safety Recommendation A-12-16 is classified "Closed—Acceptable Action."]*

Evaluate the feasibility of requiring pilots to wear [G] suits when racing at the Reno [NCAR]; if the evaluation determines it is feasible, implement a requirement. (A-12-17) *[Safety Recommendation A-12-17 is classified "Closed—Acceptable Action."]*

To the National Air-racing Group Unlimited Division:

Require aircraft owners in the unlimited class to provide an engineering evaluation that includes flight demonstrations and analysis within the anticipated flight envelope for aircraft with any major modification, such as to the structure or flight controls. (A-12-09) *[Safety Recommendation A-12-09 is classified "Open—Acceptable Response."]*

Develop a system that tracks any discrepancies noted during prerace technical inspections and verifies that they have been resolved. (A-12-10) *[Safety Recommendation A-12-10 is classified "Closed—Acceptable Action."]*

Provide [high-G] training to pilots, including techniques to mitigate the potential effects of [high-G] exposure, as part of preparations before the Reno [NCAR] and during daily briefs at the NCAR. (A-12-11) *[Safety Recommendation A-12-11 is classified "Closed—Acceptable Action."]*

Evaluate the feasibility of requiring pilots to wear [G] suits when racing at the Reno [NCAR]; if the evaluation determines it is feasible, implement a requirement. (A-12-12) *[Safety Recommendation A-12-12 is classified "Closed—Acceptable Action."]*