

Log 2002



National Transportation Safety Board

Washington, D.C. 20594
Safety Recommendation

Date: January 13, 1988

In reply refer to: A-87-122 through -124

Honorable T. Allan McArtor
Administrator
Federal Aviation Administration
Washington, D.C. 20591

On January 31, 1987, a Grob G103 Twin II sailplane, 1/ N429BG, was involved in a forced landing incident at Williamson, Georgia, 2/ after sustaining a failure of its spoiler bellcrank. The bellcrank was manufactured by welding annealed bearing housing sections to flattened steel tubes comprising the bellcrank arms. The National Transportation Safety Board's investigation of the incident disclosed that the bellcrank had separated through the center bearing housing at two locations as a result of high-cycle, low-stress fatigue. Both separations occurred at the edge of the fillet-welds in the relatively soft heat-affected zone (HAZ) in the center bearing housing portion of the bellcrank. The bellcrank was not subject to postweld heat treatment, and hardness tests disclosed a significant loss of hardness in the HAZ.

During the past several years, several other failures have occurred in the primary control circuits of Grob G103 Twin II sailplanes, notably those involving rudder control bellcrank/linkage assemblies. Comments included in the Federal Aviation Administration's (FAA) Service Difficulty Reports (SDR) relating to these failures include:

- o glider had in-flight rudder control failure; found bearing pulled out of bellcrank under rear instrument panel;
- o component stretched and broke during signal for aero-tow takeoff; probable cause is the stress incurred during front rudder pedal adjustment when both front pedals must be pushed forward to release adjustment stop;
- o tubing of the linkage broke around the edge of the weld to the attachment bracket; found after a control check before flight; to prevent recurrence, submitter recommends using tubing of a thicker wall or welding on an outside doubler by Grob-approved method.

1/ Grob sailplanes and motorgliders are manufactured in West Germany in accordance with JAR 22 European Airworthiness Requirements and imported to the United States under Title 14 CFR 21.29, "Issue of Type Certificate: Import Products."

2/ For more detailed information, read Field Accident Brief No. 5013 (attached).

Moreover, the latter failure was preceded by an in-flight failure of the aileron bellcrank in the same aircraft. The failures occurred at airframe total times of 318 hours and 291 hours, respectively. The submitter of the SDR relating to the aileron bellcrank reported:

Torque tube broke around edge of weld between the bearing support tube and the main torque tube in-flight with no accident or injury; probable cause could be weld not normalized or wall thickness of tubing inadequate to prevent recurrence. Part should be strengthened by welding a doubler or sleeve by approved method.

Several other control system failures in Grob aircraft have also been reported to Grob Systems, Incorporated, the United States distributor for Grob products. These failures include failure of a spoiler actuator tube completely around the periphery of the fillet-weld attaching it to the actuator assembly in a Grob G102 Club III aircraft (Grob part no. 102 C3-4266) and a similar failure in a spoiler actuator assembly installed in a Grob G103B aircraft (Grob part no. 103B-4401).

The several occurrences of control bellcrank and actuator/linkage failures in the primary control systems of Grob aircraft together with the discovery of high-cycle, low-stress metal fatigue in connection with the incident involving N429BG, are prima facie evidence of possible design or manufacturing inadequacy. As a result, the Safety Board believes that the FAA should conduct an engineering investigation to determine the adequacy of Grob's manufacturing/quality control processes and design strength specifications. The investigation should include a stress analysis of critical primary control system components, such as the bellcranks, and a metallurgical evaluation of Grob's welding and material/heat-treatment standards.

To prevent subsequent failures of rudder control bellcrank assemblies, Grob designed a stronger bellcrank (part no. 103B-4430/1) to replace existing assemblies. On August 3, 1987, Grob issued related Service Bulletin TM 315-33, "Checking And Replacing Rudder Lever 103B-4430 On The Aft Stick Bulkhead," applicable to G103 Twin II and G103A Twin II Acro sailplanes. The bulletin provides instructions for performing an immediate, detailed inspection of existing rudder control bellcranks and indicates that all of these bellcranks, irrespective of condition, should be replaced with the new, improved-design bellcranks by January 31, 1988. The West German Aviation Certification Authority, Luftfahrt-Bundesamt, has mandated compliance with the bulletin.

On August 19, 1987, Grob distributed the bulletin to U.S. owners of Grob G103 sailplanes. The letter of transmittal read as follows:

Dear GROB Twin II Owner:

We are forwarding on to you Grob TM 315-33 dealing with inspection and replacement of rudder lever P/N 103B-4430. There have been reported failures of this component in the field.

Please note that the service bulletin applies only to aircraft after serial no. 3730, but we are sending the bulletin to all G103A/B owners to distribute the information as widely as possible.

One additional recommendation from this office, is that during the inspections required in part 1 of TM 315-33, you also pay particular attention to all of the welded-steel control components throughout the fuselage. There have been failures reported of other components in the aircraft, but no one particular part. While the glider is disassembled, give a close inspection to all steel control components in the fuselage, paying particular attention to the areas around welds or mounted bearings. Look for any signs of deformation or cracks. Report any discrepancies immediately to both the FAA and this office.

As noted in the TM attachment, only limited numbers of the modified bellcranks are available. We will ship parts as soon as they are available.

Grob Service Bulletin TM 315-33 is applicable to 94 of the 108 Grob G103 series sailplanes currently operating in the United States. Fortunately, no accidents have been attributed to failure of the rudder bellcranks originally installed in any of these aircraft. However, the new stronger rudder bellcranks are clearly a safety-related design improvement which, in view of the aforementioned failures, should be incorporated in these aircraft. As a result, the Safety Board believes that the FAA should issue an airworthiness directive requiring compliance with this service bulletin.

The design and construction of the welded-steel, primary control system components in Grob G103 series sailplanes, such as bellcranks and linkage/actuator assemblies, are similar to those installed in Grob G102 series, single-seat sailplanes and Grob G109 series, two-seat motorgliders. Thus far, most failures of these components, as indicated by Grob have occurred in the Grob G103 series, two-seat sailplanes, since these aircraft are used more frequently in instructional and/or flying club activities. However, in view of the documented specific types of failures, it would be prudent to perform a directed, detailed, and periodic inspection of the welded-steel, primary control system components installed in all of these aircraft, particularly in the fillet-weld HAZs and around mounted bearings for evidence of cracks, control deformation, or widened or cracked bearing rings. Although the Safety Board is aware that Grob has initiated the development of a detailed inspection format and will issue a service bulletin early in 1988, the Safety Board believes that the FAA should issue an airworthiness directive requiring the inspection. Any cracked or otherwise defective parts discovered as a result of the inspection should be replaced before further flight.

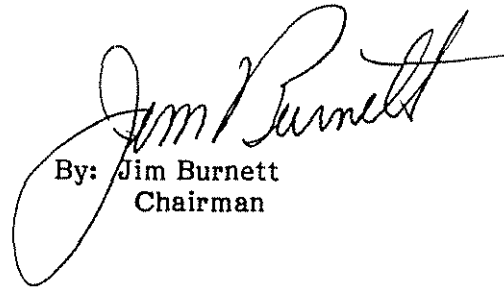
Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

Conduct a design-engineering investigation of the primary control systems installed in Grob G102 and G103 series sailplanes and G109 series motorgliders to determine the adequacy of Grob's manufacturing/quality control processes and design strength specifications. The investigation should include a stress analysis of critical components such as bellcranks and a metallurgical evaluation of Grob's welding and material/heat treatment standards. Any deficiencies discovered in the design or manufacturing processes should be corrected. Any component part affected by such deficiencies that does not conform to the type certificate design standards should be redesigned and/or remanufactured and, when available, installed in all applicable Grob aircraft operating in the United States. (Class II, Priority Action) (A-87-122)

Issue an airworthiness directive applicable to Grob G103 Twin II and G 103A Twin II sailplanes requiring compliance with Grob Service Bulletin TM 315-33 concerning the inspection and replacement of rudder bellcrank assemblies. (Class II, Priority Action) (A-87-123)

Issue an airworthiness directive applicable to Grob G102 and G103 series sailplanes and G109 series motorgliders requiring a directed, detailed, and periodic inspection of the welded-steel, primary control system components installed in these aircraft such as bellcranks and linkage/actuator assemblies. Particular attention should be given to the fillet-weld heat-affected zones and mounted bearings for evidence of cracks, control deformation, or widened or cracked bearing rings. Any cracked or otherwise defective parts discovered as a result of the inspection should be replaced before further flight. (Class II, Priority Action) (A-87-124)

BURNETT, Chairman, GOLDMAN, Vice Chairman, LAUBER, NALL, and KOLSTAD, Members, concurred in these recommendations.



By: Jim Burnett
Chairman

Print of Incident (Continued)

File No. - 5013 1/31/87 WILLIAMSON, GA A/C Reg. No. N429RG Time (Lcl) - 1225 EST

Occurrence #1 AIRFRAME/COMPONENT/SYSTEM FAILURE/MALFUNCTION
Phase of Operation APPROACH

Findings(s)

1. FLT CONTROL SYS, WING SPOILER SYSTEM - FATIGUE
2. AIRCRAFT/EQUIPMENT, INADEQUATE DESIGN (STANDARD/REQUIREMENT), AIRCRAFT COMPONENT - PRODUCTION/DESIGN P9NL
3. MATERIAL DEFECT (INADEQUATE QUALITY CONTROL) - MANUFACTURER
4. FLT CONTROL SYS, WING SPOILER SYSTEM - FAILURE, TOTAL
5. SPOILER RETRACTION - NOT POSSIBLE -

Occurrence #2 FORCED LANDING
Phase of Operation MANEUVERING - TURN TO LANDING AREA (EMERGENCY)

Findings(s)
6. PLANNED APPROACH - NOT POSSIBLE -

-----Probable Cause-----

The National Transportation Safety Board determines that the Probable Cause(s) of this incident is/are findings(s) 1,2,3,4