NATIONAL TRANSPORTATION SAFETY BOARD
South Central Regional Office
Arlington, Texas

Investigator's Statement
Piper PA-32-260; N7701J
Autopilot S-55 System Examination
S-TEC Corporation
Mineral Wells, Texas
March 21, 2002

Examination Observers

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Examination Notes

On March 21, 2002, NTSB investigators observed the examination of a S-TEC autopilot S-55 system that was removed from a Piper PA-32-260 airplane, N7701J. The system components were comprised of a control module and three remote servos. The following information was recorded from the components:

Pitch servo * – P/N: 0107-P2
S/N: 9182A

Pitch Trim servo * – P/N: 0105-T8
S/N: 11393A

Roll servo – P/N: 0105-R9
S/N: 11392A

Control Module – P/N: 01192-0-15
S/N: 733 F/E

• It was noted that the pitch and pitch trim servos were misidentified as received, then corrected upon examination by S-TEC personnel (the pitch trim servo was the pitch servo and vice versa).

The components were photographed and external physical observations were as follows:

1. All three servo control connections were free to rotate and free of obstructions.
2. The roll servo mounting plate displayed minimal deformation with a portion of airframe structure still attached.
3. The servo control cables and connectors were intact.
4. The autopilot control module case displayed dents and damage on top, bottom, and face surfaces.
5. The autopilot module bezzle (face assembly) display screen was damaged and some control mode buttons were missing.
6. The module connections appeared to be undamaged.

The three servos were connected to a test module in order to complete a functional test.

Roll Servo Assembly

The roll servo was powered by test equipment and did not operate during the initial test. It was determined that one of the two motor brushes had been dislodged from the retaining spring. The brush placement was adjusted, and the servo operated. While the servo was operating, it was noted the motor output drive shaft was bent; however, the servo unit operated in clockwise (CW) and counterclockwise (CCW) directions. The capstan slip clutch assembly (manual override) was tested and functioned according to manufacturing specifications. The torque setting on the clutch was recorded as 42.0 inch lbs CW, and 42.0 inch lbs CCW. The minimum and maximum clutch torque settings at 34 – 35 inch lbs and 55 – 56 inch lbs, respectively. The servo is also equipped with a disconnect solenoid that allows the pilot to electrically disconnect the autopilot using a disconnect switch on the control wheel. The disconnect solenoid assembly functioned. It was determined that the roll servo was capable of operation at the time of the accident.

Pitch Servo Assembly

The servo was also powered through test equipment and functionally tested in both clockwise and counterclockwise directions. No anomalies were noted during the test with the servo or its operation. The capstan slip clutch assembly was tested and functioned according to manufacturing specifications. The torque setting on the clutch was recorded as 48.0 inch lbs CW, and 48.0 inch lbs CCW. The minimum and maximum clutch torque settings at 34 – 35 inch lbs and 60 – 61 inch lbs, respectively. The servo is also equipped with a disconnect solenoid that allows the pilot to electrically disconnect the autopilot using a disconnect switch on the control wheel. The disconnect solenoid assembly

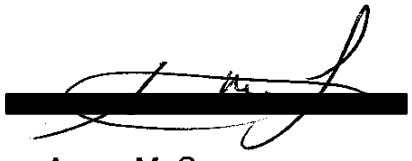
functioned. It was determined that the pitch servo was capable of operation at the time of the accident.

Pitch Trim Servo Assembly

The servo was also powered through test equipment and functionally tested in both clockwise and counterclockwise directions. During operation, it was noted that the motor output drive shaft was bent. The capstan slip clutch assembly was tested, however, the motor assembly started to smoke due to the bent output drive shaft. The torque setting on the clutch was recorded as 16.5 inch lbs. This measurement was determined unreliable due to the bent drive shaft. It was determined that the pitch trim servo was capable of operation at the time of the accident.

Autopilot Control Module

The module bezzle was removed due to damage to the display and control buttons. The installation mounting case was removed to access the control module identification and hardware. The three control boards were removed and damage was noted on all boards. The top (microprocessor) board (P/N: 03578) was unable to be functionally tested due to damage. The middle board (P/N: 03576), which controls the glide slope, roll, left and right functions was unable to be tested due to damage. It was determined that the pitch and trim control functions were operational; one of two roll systems was operational. The bottom board (P/N: 03575), which contains the servo amps and other circuitry, was damaged and unable to be tested. No anomalies were noted with the control module, other than damage associated during the impact sequence.



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