NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Western Pacific Region

February 10, 2022

SERVO EXAMINATION

WPR21FA283

This document contains 5 embedded photos.

A. ACCIDENT

Location:	Lewiston, Idaho
Date:	July 25, 2021
Aircraft:	N28U, SIAI-Marchetti, SM1019B
NTSB Investigator-in-Charge:	Andrew Swick

B. SUMMARY

Garmin GSA-28 Smart Autopilot Servo, 011-02927-00
SN: 2PG005438

C. EXAMINATION

Garmin sales literature stated the following:

"The GSA 28 smart servo features a gear train with engagement clutch and the ability to back drive the brushless DC motor, providing multiple levels of protection against servo overspeed or failure — without the need to use a shear pin to disable the servo. The engagement clutch also decouples the motor from the flight controls, which minimizes the friction a pilot will feel when hand-flying the aircraft with the autopilot off."

No product installation or maintence manuals were readily available on the Garmin website, and Garmin declined to provide direct examination support, or functionality testing, therefore the servo was disassembled and examined by the NTSB.

When questioned about the servo's operation, representatives from Garmin provided the NTSB with a general functional overview but declined to provide specific technical details regarding how the torque is electronically limited. Garmin representatives instead stated that the design is fail-safe such that if any part of the servo locks up, the system can be overridden by the pilot. According to Garmin representatives, the servo can produce a maximum of 60 inch-pounds of force.

The servo was removed from the airplane and appeared undamaged (photo 1). The drive coupling remained attached to the output shaft and could be rotated by hand with no binding or resistance.

With the mounting plate removed, the inside of the servo was examined. The clutch assembly, which included a pawl and linear actuator (solenoid) were intact (photo 2). The combination pawl and planetary output drive gear could be rotated by hand and would engage with the pawl upon movement of the linear actuator. The planetary gears were still coated in grease, intact and undamaged, and could be moved freely (photo 3).

To test geartrain continuity, the solenoid was held in the engaged position with tape, and the mounting plate reattached. The output shaft could be rotated by hand, and no binding was noted. To test the force required to override the servo, a torque wrench was connected to the output shaft, and set to its lowest setting (20 inch/lbs). It was found that the shaft could be rotated before the torque value was reached.

Within the servo case, the printed circuit control board was intact, there was no evidence of thermal damage, and all surface mount electrical components remained mounted to the printed circuit board (photo 2).

The drive gear centered in the board was intact and coated in grease. The gear could be rotated by hand, and resistance was felt consistent with gear train movement.

The gearbox case was removed. The reduction gears were coated in grease, intact and undamaged, and moved freely (photo 4). The brushless motor could be spun by hand and did not exhibit any indications of binding (photo 5).

Garmin Service Bulletin 2063, rev B addresses the need to replace any GSA-28 servos affected by a hardware fault. However, this servo did not fall within the applicable serial number range.

D. EXAMINATION PHOTOS

Photo 1 – Servo assembly

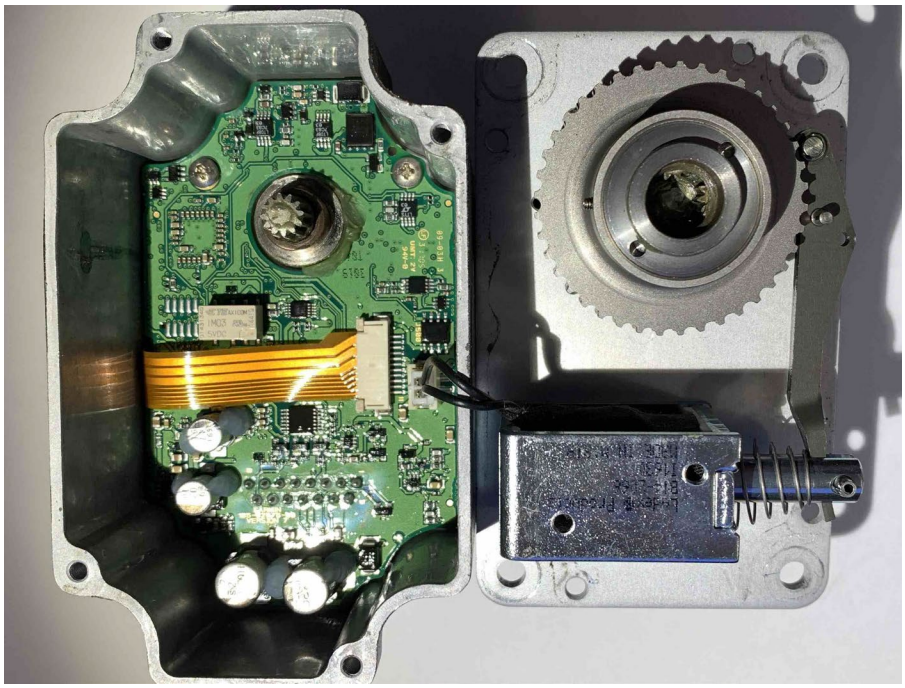

Photo 2 – Servo circuit board and pawl assembly

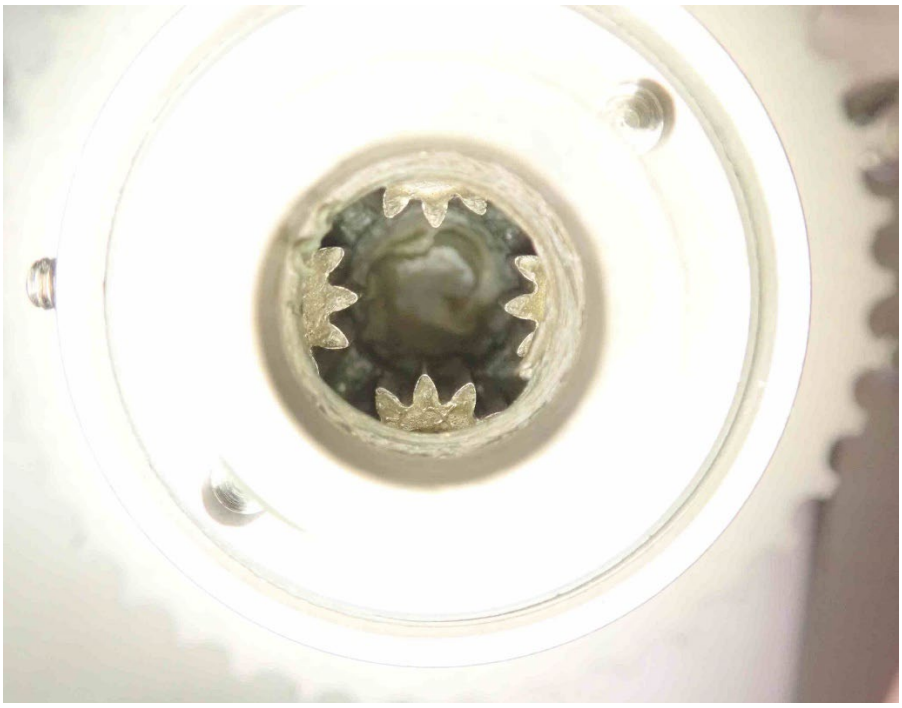

Photo 3 – Planetary gear

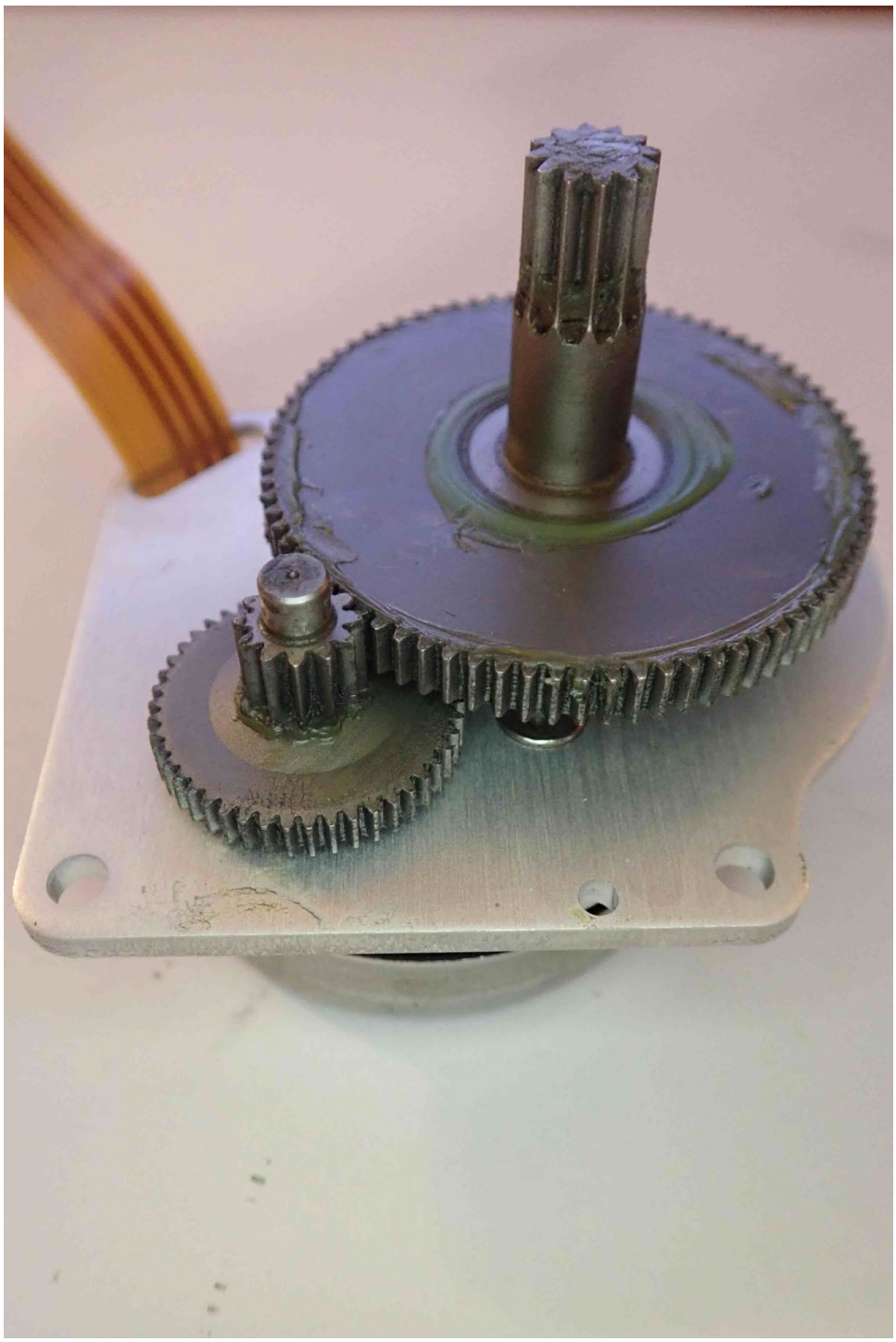

Photo 4 – Reduction gear train

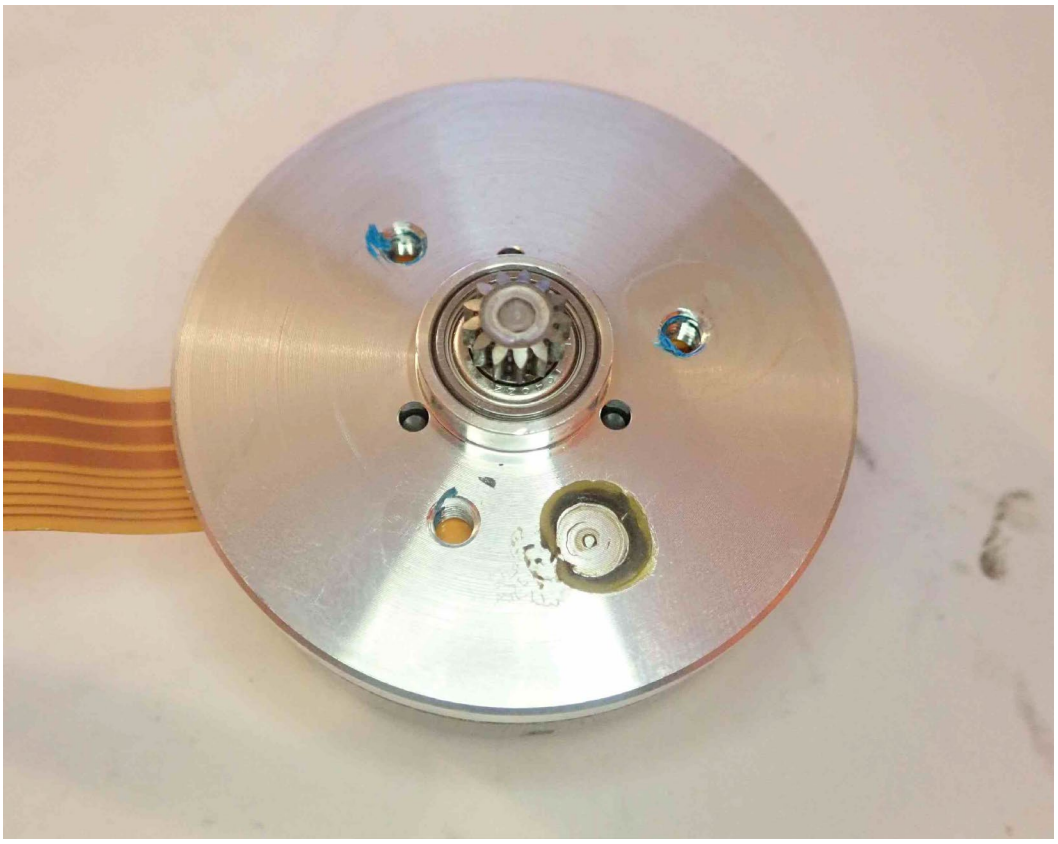

Photo 5 – Drive motor

Submitted by: Eliott Simpson