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REPORT TITLE: Examination of a Bellcrank Assy-Roll Control p/n 6260347-12 and Box Assy-Spoiler Mixer p/n 6261282-1; 650-7063; N877G

REPORT #: 12-359-072 **DATE:** 3/19/12

TO: P. Basile **FROM:** Lyndon Isliefson

cc: D. Depew
B. Mallory
M. Morrison

Approved by: Bret Vogel

Restrictions: The export or deemed export of this technology contrary to U.S. law is strictly prohibited.

1.0 Summary

Cessna Air Safety Investigations requested an examination of a Model 650 Bellcrank Assy-Roll Control p/n 6260347-12 and Box Assy-Spoiler Mixer p/n 6261282-1 from aircraft 650-7063. Shortly after takeoff on 12-28-2011, the aircraft began rolling to the right and was difficult to control, necessitating a return to the airport. Upon landing, the aircraft was substantially damaged as it departed the runway. Subsequent on-site examination of the damaged aircraft showed that the outermost RHS roll spoiler became partially extended when 3000 psi was applied to the hydraulic system. On separate occasions, the bellcrank and the mixer box were brought to the M&P lab by representatives of FAA for examination.

The purpose of this examination was to assess the condition of the bellcrank and the mixer box from this aircraft.

Following the examination of the above-named parts, the following conclusions were reached:

1. The 6260347-12 Bellcrank Assy-Roll Control did not display any unusual wear or significant corrosion.
2. Rotation of the bellcrank bearings by hand in excess of 90° was not possible.
3. The 6261282-1 Box Assy-Spoiler Mixer did not display any usual wear. The internal mechanism of the mixer box moved easily by hand with no noticeable sticking or binding.

4. The examination of the Bellcrank Assy-Roll Control p/n 6260347-12 and the Box Assy-Spoiler Mixer p/n 6261282-1 did not reveal anything which could have led to unexpected partial extension of the right hand roll spoiler.

2.0 Introduction

The Bellcrank Assy-Roll Control p/n 6260347-12 was brought to the M&P lab for examination on 6-Mar-2012, and the Box Assy-Spoiler Mixer p/n 6261282-1 (hereafter referred to as 'mixer box') was brought to the M&P lab for examination on 12-Mar-2012. Present for these examinations were representatives of FAA as well as Cessna Material and Process Engineering, Air Safety Investigations, Utility Systems/Mechanical Systems, and Engineering/Product Design. At the conclusion of each examination, all parts were retained by FAA. For reference, a sketch showing the relative positions of the bellcrank and mixer box is given in Figure 1.

3.0 Examination of the Bellcrank Assy-Roll Spoiler p/n 6260347-12

The bellcrank was removed from the aircraft and was brought to Cessna 3-6-2012 in a sealed shipping carton by a representative of the FAA as shown in Figure 2. Views of the as-received bellcrank are shown in Figures 3 and 4. The bellcrank had a slightly dirty appearance, but did not display any visible damage or corrosion. Some slight wear of the cable groove was noted due to contact with the cable (Figure 5), but this did not appear to be excessive. Press fit into the upper and lower surfaces of the bellcrank were two KP3AL bearings. Both of these bearings had a somewhat greasy appearance with some dirt present, however the snap ring and bearing seals appeared to be intact, Figure 6. The lower bearing displayed the ball insertion grooves which are machined into the inner and outer bearing races, as shown in Figures 6b) and 7. The upper and lower KP3AL bearings appeared to rotate freely by hand through approximately 90 degrees of rotation, at which time they could not be made to rotate any further by hand, see Figure 8. No effort beyond manual hand pressure was applied to force bearing rotation. Rotation of the upper bearing coincided with rotation of the lower bearing, likely due to frictional contact of both bearing inner races with the NAS43HT3-125 spacer situated between the two bearings.

Supplied with the bellcrank was the AN3H27A bolt. The shank of the bolt did not display any significant wear damage, as shown in Figure 9. The bolt head displayed some scratching damage, as shown in Figure 10.

4.0 Examination of the Box Assy-Spoiler Mixer p/n 6261282-1

The Box Assy-Spoiler Mixer p/n 6261282-1 was removed from the aircraft and was brought to Cessna 3-12-2012 in a sealed shipping carton by a representative of the FAA as shown in Figure 11. Views of the as-received mixer box are shown in Figures 12 and 13. The mixer box had a slightly dirty appearance, with some grit material within. Visual inspection of the mixer box did not reveal any missing or loose component parts. Rotation of the 6261293-1 cam assembly was easily accomplished manually, with no perceived sticking or binding of the internal mechanism. Rotation of the 6261293-1 cam assembly resulted in the expected output movements of the 6261060-5, -6 quadrants. The nickel plated steel cam assembly (p/n

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6261293-1) showed some small areas of local corrosion, Figure 14. Wear of the cable grooves in the 6261060-5, -6 quadrant assemblies was noted due to contact with the cable (Figure 15). No disassembly of the as-received mixer box was done during this examination.

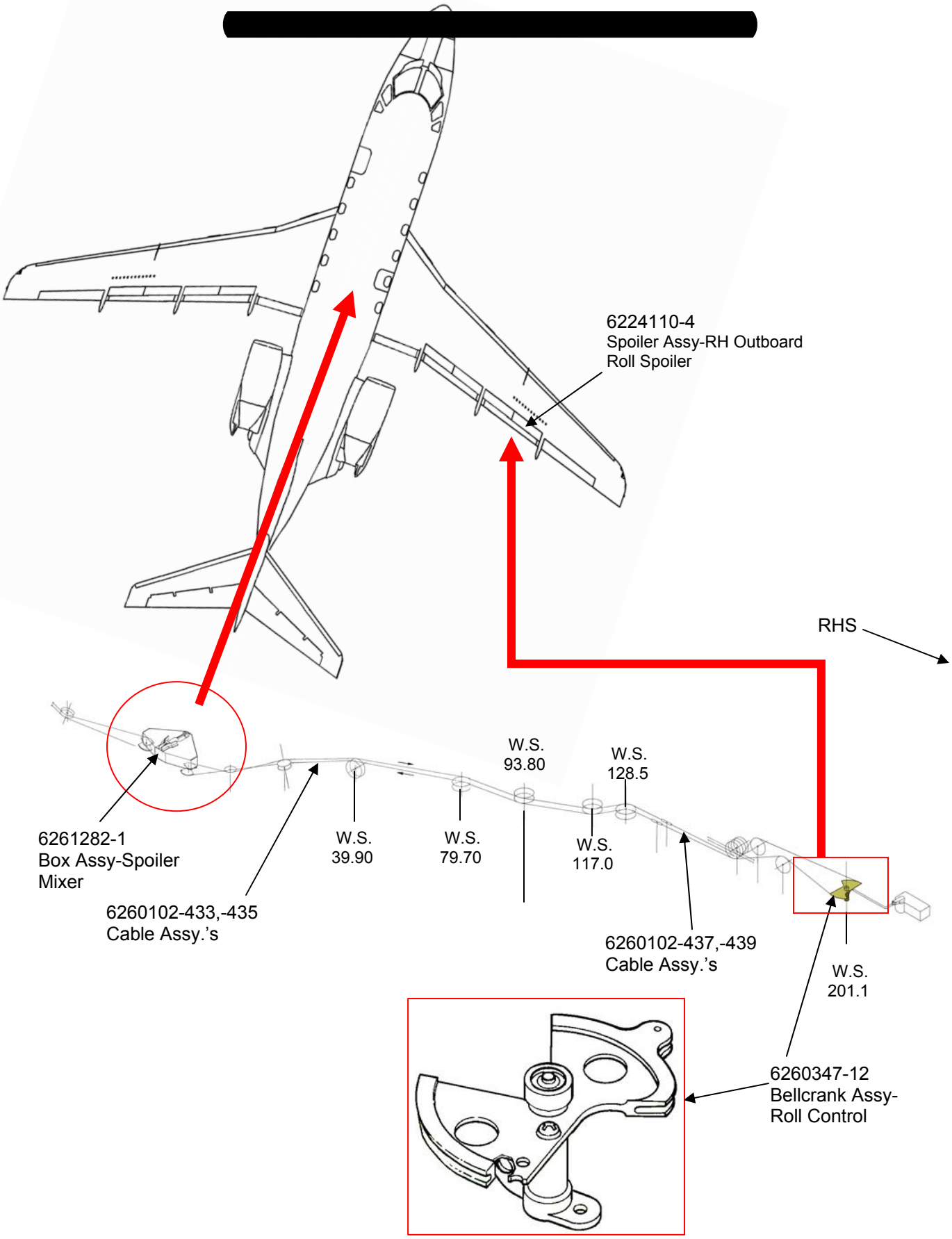

Figure 1. Sketch showing the arrangement of the 6261282-1 Box Assy-Spoiler Mixer and 6260347-12 Bellcrank Assy-Roll Control in Model 650 aircraft.

Figure 2. The bellcrank assembly was brought to Cessna by representatives of FAA in a sealed shipping carton.

Figure 3. View of the upper surface of the 6260347-12 bellcrank in the condition in which it was received.

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Figure 4 View of the lower surface of the 6260347-12 bellcrank in the condition in which it was received.

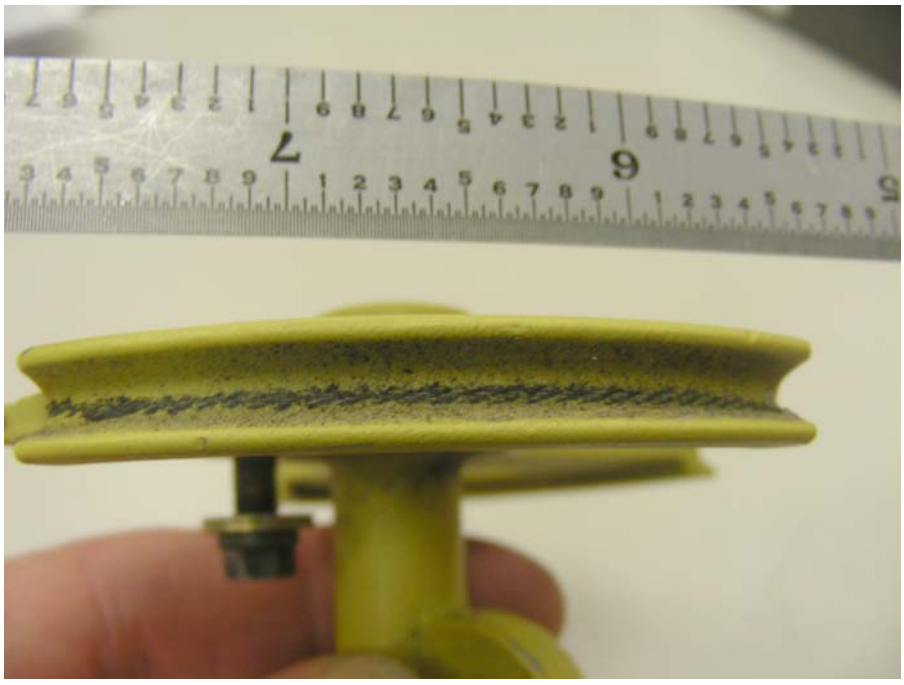

Figure 5 View of the cable groove on the bellcrank showing wear due to contact with the control cable.

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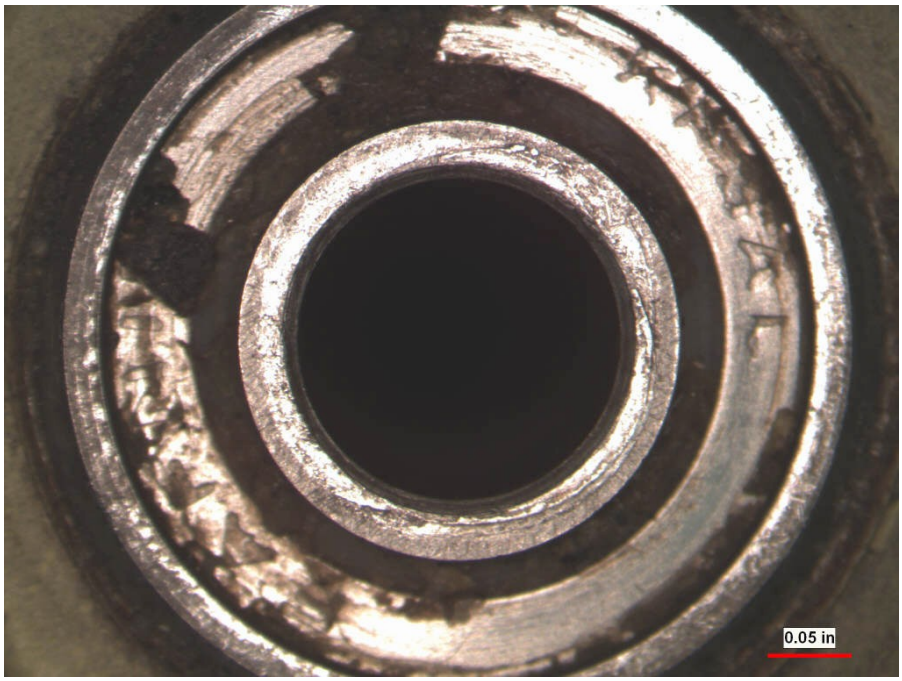
a)



b)

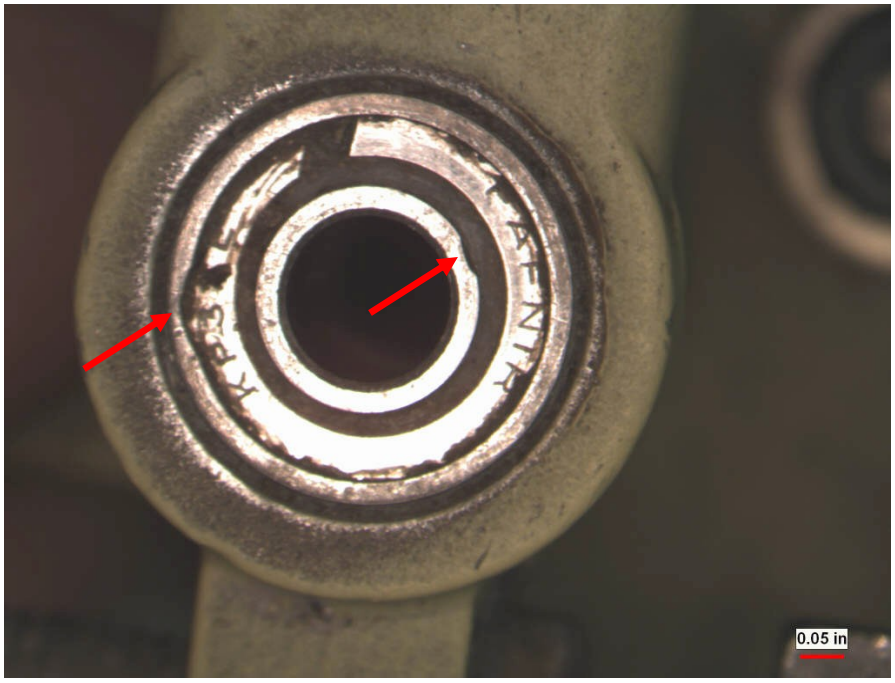
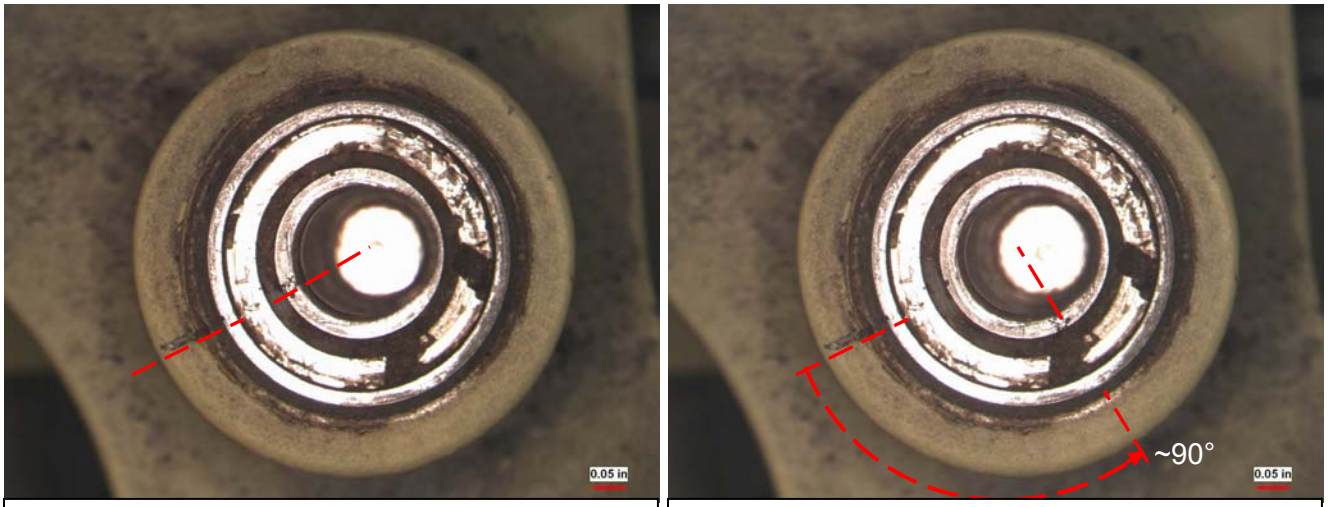


Figure 6 Magnified views showing the bellcrank upper bearing (a) and lower bearing (b). The snap ring and seal appear to be intact on both bearings. Note the presence of grooves on the lower bearing races (arrows). Magnification: x8.5 at (a) and x4.7 at (b).

Figure 7. High magnification view of ball insertion groove on the inner race of the lower bellcrank bearing (Figure 6 b). Magnification: x17.3.



Extreme clockwise position of inner bearing race with respect to the outer race.

Extreme anti-clockwise position of inner bearing race with respect to the outer race.

Figure 8 Views of the upper KP3AL bearing demonstrating the limits of manual rotation of the bearing, as indicated by the pencil marks scribed across the inner and outer races and highlighted by the red dashed lines. The extent of rotation was approximately 90 degrees. The lower KP3AL bearing displayed similar results. Magnification: x3.3.

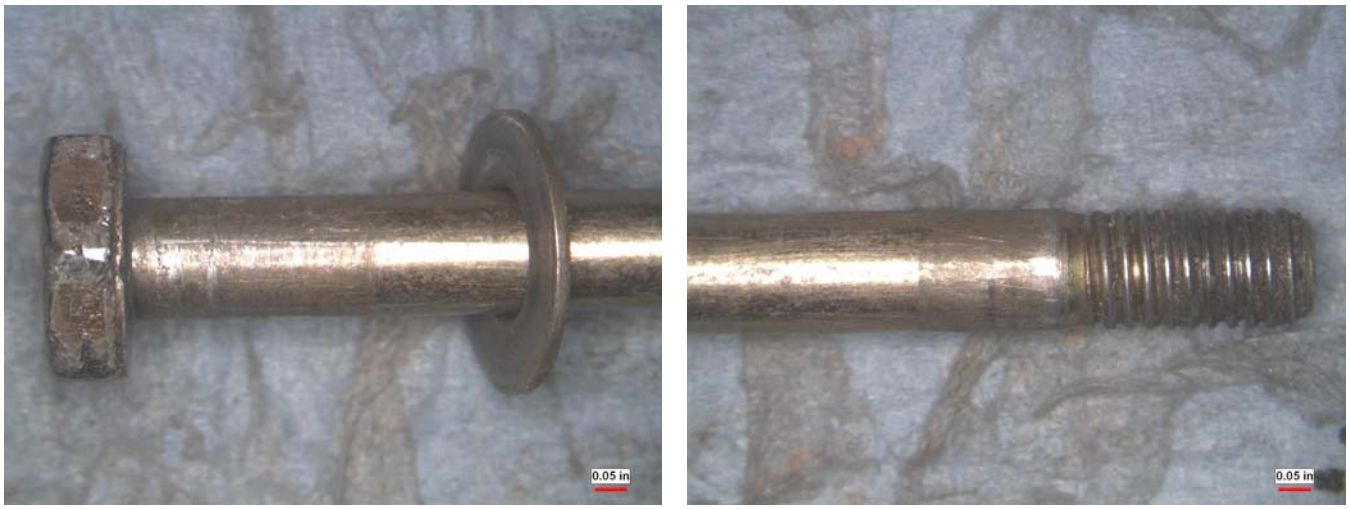


Figure 9. Magnified views showing both ends of the AN3H27A bolt. No significant wear damage was found on the bolt shank. Magnification: x3.3.

Figure 10. Magnified view showing scratching damage on the head of the AN3H27A bolt. Magnification: x9.

Figure 11. The mixer box assembly was brought to Cessna by representatives of FAA in a sealed shipping carton.

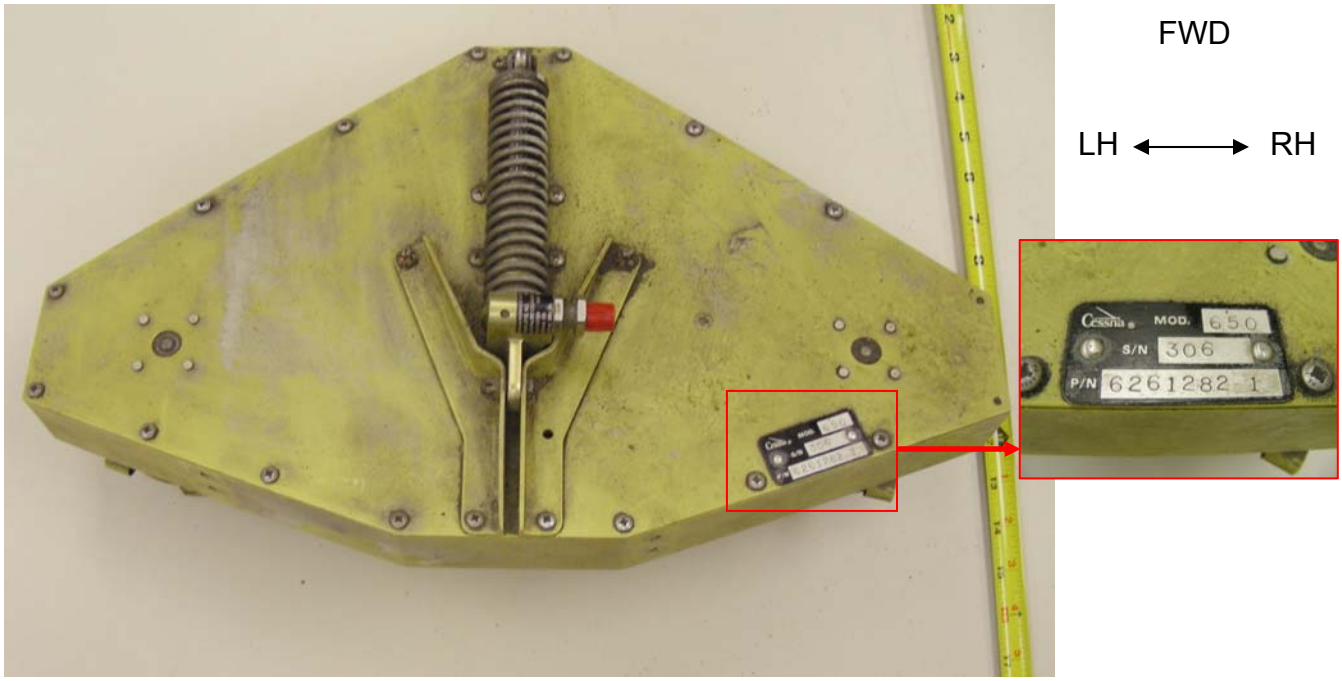


Figure 12. View of the upper surface of the 6261282-1 Box Assy-Spoiler Mixer, s/n 306 in the condition in which it was received.

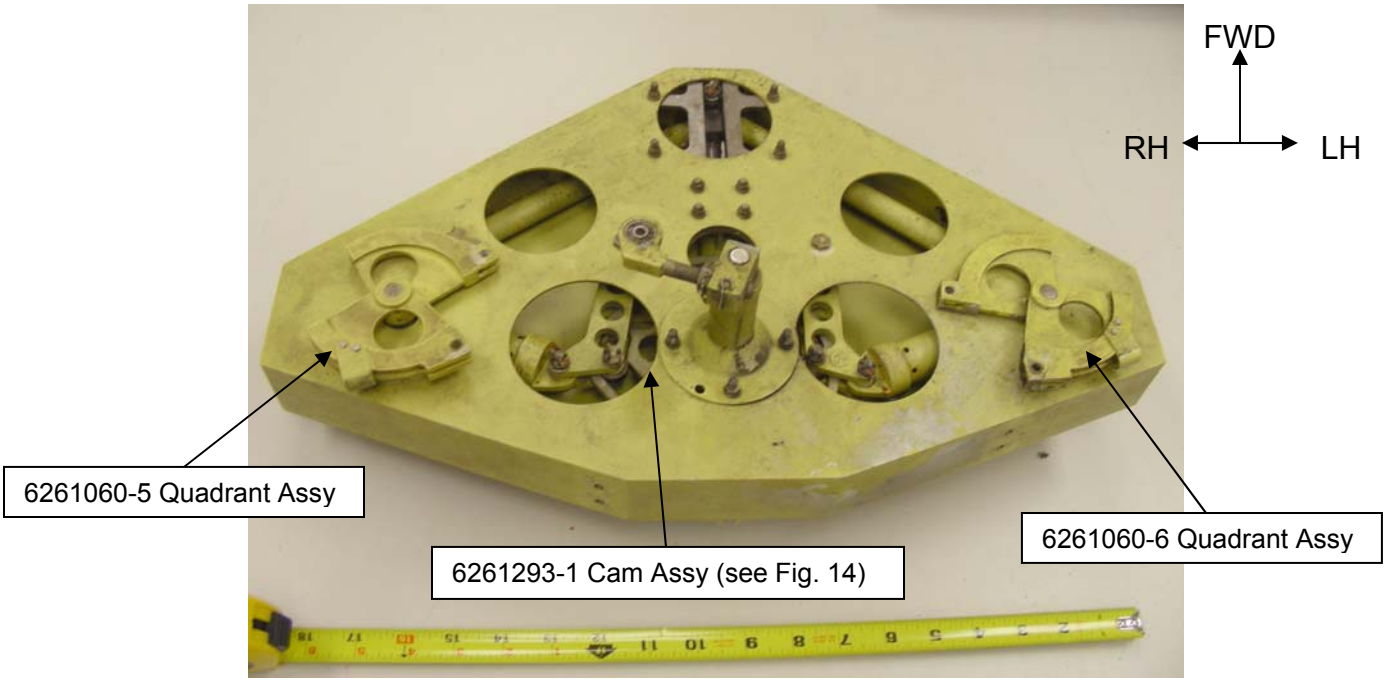


Figure 13. View of the lower surface of the 6261282-1 Box Assy-Spoiler Mixer, s/n 306 in the condition in which it was received.

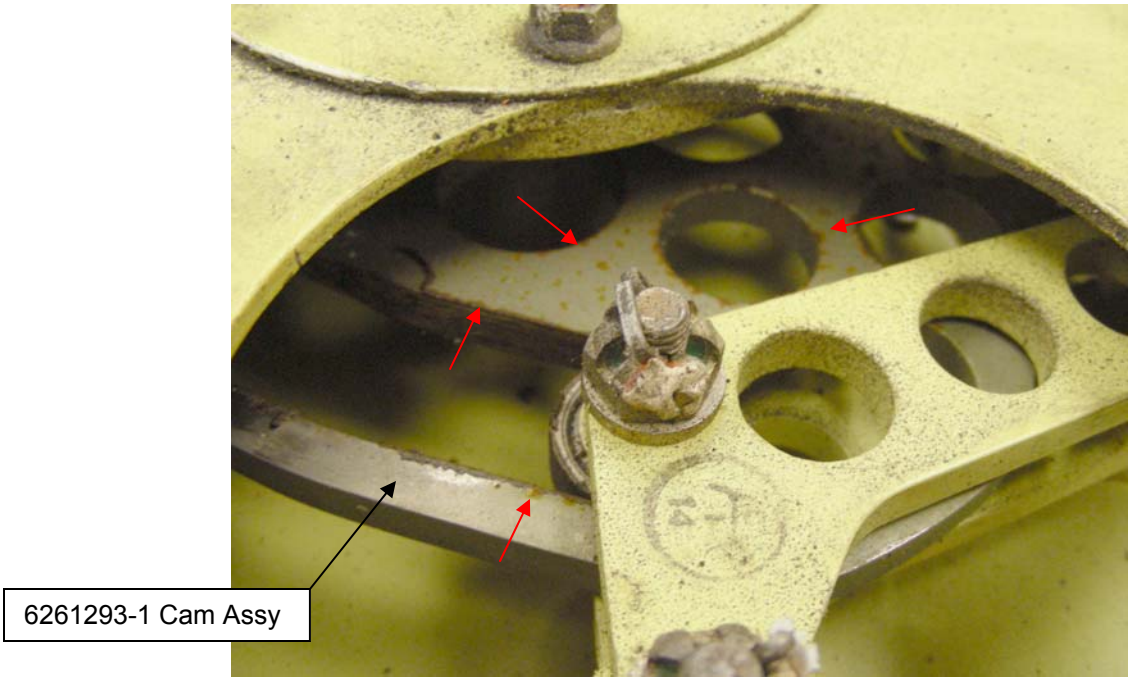


Figure 14. View of the 6261293-1 Cam Assy showing small local areas of corrosion (red arrows).

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Figure 15. View of the cable groove on the 6261060-6 quadrant assembly showing wear due to contact with the control cable. Wear of the cable groove of the 6261060-5 quadrant assembly was similar.