Updates to factual

WPR16IA025

On November 7, 2015, at 1234 Pacific standard time, a Cirrus SR22T, N999VX, sustained minor damage during the landing roll at Paso Robles Airport, Paso Robles, California. The airplane was registered to PHD Ventures Inc., and operated under the provisions of 14 *Code of Federal Regulations* Part 91. The flight instructor, student pilot, and three passengers were not injured. Visual meteorological conditions prevailed and no flight plan was filed.

According to the flight instructor, the student pilot was flying the airplane and the airplane touched down normally on the main gear. The student pilot then lowered the nose of the airplane and the nose landing gear collapsed.

Post incident examination revealed that the nose landing gear had separated. The nose landing gear consists of a main strut tube and two gusset tubes near the top portion of the main strut tube. The separation involved a crack beginning at the edge of the side gusset tubes weld to the main strut tube. Prior to the incident, a similar event had occurred, NTSB Incident WPR15IA252, and following this event, additional incidents occurred, including one in Japan.

The NTSB Materials Laboratory examined the nose landing gear strut and determined that the failure of the landing gear was the result of high stress fatigue cracking due to sideways bending from one side. No mechanical or metallurgical anomalies were noted with the landing gear.

On March 7, 2016, Cirrus Design Corporation issued Service Advisory Letter SA 16-03, which denoted the following:

- Cracks have been discovered on the nose landing gear strut assembly at the welds between the strut tube and the LH and RH gusset tubes.
- A visual inspection of the welds between the strut tube and the LH and RH gusset tubes for cracks must be performed every time the engine cowling is removed.
- If cracks are found, the aircraft is prohibited from flight until the nose landing gear strut assembly is replaced. (Refer to AMM-32-20).

Additionally, Cirrus Design Corporation performed structural testing of the nose landing gear.

Based on the data provided by the NTSB metallurgy lab, and a video of the Japan incident airplane experiencing nose landing gear shimmy 6 months before the nose gear collapsed, Cirrus explored two different methods of producing side loads in the nose landing gear. The first was through taxi and towing, the second through shimmy. Flight testing showed that significant side loads on the nose landing gear would develop during a shimmy event.

As a result of the testing, Cirrus did the following:

On April 12, 2016, Service Bulletin SB2X-32-22, "NOSE GEAR – Nose Landing Gear Strut Assembly Inspection," was released to inspect all the nose landing gear in the field for cracks in

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the welds between the strut tube and the LH and RH gusset tubes. In addition to the one-time inspection required by Service Bulletin SB2X-32-22, Cirrus added a post-shimmy inspection to Chapter 5-50 Unscheduled Maintenance Checks of the Aircraft Maintenance Manual (AMM). Similar to the hard/overweight landing inspection, this post-shimmy inspection would look specifically for cracks at the gusset welds exactly as noted in the Service Bulletin.

On April 12, 2016, based on the potential for damage to the nose landing gear due to loading from non-standard and abusive tug operation, Service Advisory SA16-05, "Aircraft Towing Guidance," was released offering aircraft towing guidance. This guidance includes the following;

- When towing aircraft, do not stop/start abruptly, especially when the tow bar is at an angle greater than 45° either side of center.
- When positioning the aircraft with a towing vehicle, the angle of the tow bar must be less than 45° either side of center for both pulling and pushing. Hand towing must be used if angles greater than 45° either side of center are needed for positioning.
- Do not tow aircraft at speeds higher than 15 mph.

On July 14, 2017, Cirrus Design Corporation Service Bulletin SB2X-32-22R1 was issued. The bulletin, which is considered mandatory, was revised to update Compliance, Effectivity, Purpose, Manpower Requirements, and Accomplishment instructions. The bulletin specifically states, "Operators who have successfully complied with the original release of this service bulletin, dated April 12, 2016, must complete Revision 1 of this Service Bulletin in its entirety, and must continue to perform this Service Bulletin every 50 hours thereafter until termination action occurs.

On January 5, 2018, Cirrus Design Corporation Service Bulletin SB2X-32-22R2 was issued. The bulletin, which is considered mandatory, was revised to update Compliance and Effectivity. The bulletin specifically states, "Operators who have successfully complied with the original release of this service bulletin, dated April 12, 2016, must complete Revision 2 of this Service Bulletin in its entirety, and must continue to perform this Service Bulletin every 50 hours thereafter until termination action occurs.

On July 14, 2017, Cirrus Design Corporation Service Bulletin SB2X-32-23, which Cirrus considered to be mandatory, entitled "NOSE GEAR – Nose Wheel Shimmy Reduction," was issued. The bulletin noted that on affected airplanes, nose wheel shimmy may exist on aircraft equipped with Beringer wheels. The bulletin states that a nose tire vibration due to imbalance or tire damage can be mistaken for NLG shimmy. However, it is advisable that both conditions be examined closely and considered tandem during aircraft inspection. The bulletin contains instructions for the adjustment of the nose tire pressure and force required to rotate the nose wheel fork.

On January 5, 2018, Cirrus Design Corporation issued revised Service Bulletin SB2X-32-23R1. The bulletin, which is considered mandatory, was revised to update Effectivity, Purpose, and Accomplishment Instructions. The bulletin states that operators who have successfully complied with the original release of this Service Bulletin, dated July 14, 2017, must complete Revision 1 of this Service Bulletin in its entirety. The Service Bulletin contains instructions for the

adjustment of the nose tire pressure and the verification of the force required to rotate the nose wheel fork.

On July 14, 2017, Cirrus Design Corporation issued Cirrus Service Advisory (SA) SA17-08, entitled "Possible Cracking at Nose Land Gear Fillet Welds." The SA revealed that cracks had been discovered on some nose landing gear (NLG) strut assemblies at the fillet welds between the strut tube and the LH and RH gusset tubes. These cracks had led to the collapse of the NLG assemblies. The SA further revealed that each of the aircraft involved had a history of excessive nose wheel shimmy following touchdown of the nose landing gear. The SA defined "nose wheel shimmy" as "a lateral oscillation or wobble of the NLG resulting in a shaking feeling throughout the cabin of the aircraft that can vary in intensity." This is normally encountered during the landing roll-out and will subside as speed is reduced. Cirrus noted in the "Actions" section of the SA that nose wheel shimmy can be reduced or eliminated by lowering the tire pressure. Prior to the next flight, adjust the tire pressure on the nose landing gear to 40 – 50 psi (276 – 344 kPa).

On January 5, 2018, Cirrus Design Corporation issued revised Service Advisory SA17-08R1 (revision 1). The Advisory was issued to update Effectivity and the NLG tire pressure as outlined in SA17-08, dated July 14, 2017. Cirrus noted in the "Actions" section of the SA that nose wheel shimmy can be reduced or eliminated by lowering the tire pressure. Prior to the next flight, adjust the tire pressure on the nose landing gear to 30 – 35 psi (207 – 241 kPa).

Cirrus Aircraft also incorporated specific emphasis and recommendations on how to further discourage shimmying on landing and actions to be taken if the situation occurs on landing in their pilot training program. These incorporations are included in the Landing Standardization Course. Maintenance guidance is also available to mechanics following a shimmy event.

To increase the strength of the weld in the critical area on the nose landing gear, the thickness of the main strut tube was analyzed with an increased wall thickness from 0.125-inch to the full thickness of 0.156-inch. The result of the analysis was an increase (3-5%) in the local stress levels in the static analysis. This design change has been made for all new and replacement gear.