Customer Information Letter 3/27/08

PA46 Operational & Maintenance Information, Nose Gear Steering

Some Piper customers have expressed concerns about the nose gear steering on the PA46 "Malibu" series of aircraft models. This document explains Piper's response to those concerns and provides specific actions that owners can take to ensure that their aircraft continues to operate properly and conform to factory specifications.

The geometry of the Malibu nose gear is a conventional zero rake, zero trail configuration, successfully used by several manufacturers on many different models.

When the Meridian was first introduced in 2000, some of these early customers reported an occasional pull to the right at the instant of touchdown. Piper immediately began an extensive testing program in an effort to understand this phenomenon. Although Piper was unable to duplicate the reported condition (either then or since, under varied and extreme conditions), analysis of the test data, combined with research into the dynamic behavior of the steering geometry, has resulted in a two-fold design improvement to the Meridian in 2002 which allows the pilot to better control the steering forces involved:

- A higher tire pressure was used to reduce the size of the rolling contact patch, thereby reducing the magnitude of the steering forces. An 8-ply tire inflated to 70 psi replaced a 6-ply tire inflated to 50 psi.

- A stiffer bungee was used to increase the pilot's authority in controlling the steering forces. The 83615-010 Bungee Assembly replaced the 83615-009 Bungee Assembly.

The analysis and testing that resulted in these design changes has been validated by the historical data:

- Prior to these nose gear steering improvements (that is, for the year 2001), the rate of occurrence (i.e., number of runway excursions reported for a given year, divided by the number of aircraft in the fleet) was 7.6%. By contrast, the rate of occurrence from 2002 to 2007 has dropped an order of magnitude to an average of 0.8%, remaining very consistent from year to year. The small percentage remaining represents excursions due to other causes.

- Additionally, the nature of the reported behavior has changed. In 2001, 89% of reported turns were in the right direction. From 2002 to 2007 (that is, for aircraft with the nose gear steering improvements), 54% of reported turns were in the right direction. The bias to turn to the right has been eliminated.

This design change was the subject of Piper Service Bulletin 1106, dated January 28, 2002 which was applicable to Meridian Serial numbers 4697001 through 4697125. Aircraft with serial numbers 4697126 & up have these design improvements incorporated at the factory.

In addition to the design changes made to the Meridian as described above, several *operational* factors have been identified as critical for optimum steering function on *all* Malibu models:

RIGGING & MAINTENANCE

Note: All Piper aircraft come properly rigged and serviced from the factory. They will perform satisfactorily over their life when properly operated, maintained and serviced in accordance with the appropriate aircraft operating instructions, maintenance manuals, and other Piper publications.

Tire Pressure

As mentioned earlier, low tire pressure can increase the forces associated with steering the aircraft on the ground.

According to both Michelin and Goodyear, aviation tires in service should have their “cold” inflation pressure checked daily to properly maintain operating pressures. For aircraft operating on a less frequent basis, inflation pressure should be checked before each flight.

Both tire manufacturers also state that aviation tires can lose as much as five percent (5%) of the inflation pressure in a 24-hour period and still be considered normal. For purposes of illustration, consider the Meridian, which uses a nose gear tire inflated to 70 pounds per square inch (psi). With a daily pressure loss of 5%, a tire inflated to 70 psi could drop to 49 psi in just a week and further drop to as low as 15 psi in 30 days. A tire may visually look to be properly inflated but may in fact be significantly under-inflated. The only way to be sure is to use a good quality tire gauge.

Tire pressure should be checked by the pilot as part of the preflight inspection.

Nose Gear Rake Angle

The proper nose gear rake angle for all Malibu models is zero to one-half degree forward from vertical, measured using the airframe lower skin just aft of the nose gear doors as a horizontal datum with the aircraft on jacks. In other words, the relative angle between the lower (belly) skin and the nose gear strut should range from 90.0 degrees to 90.5 degrees. See figure 1.

A rake angle outside of this range may result in dynamic instability, creating steering forces that exceed the pilot’s ability to control. This angle is set by adjusting thread engagement in the nose gear actuator‘s rod end bearing as described in the maintenance manual.

The nose gear rake angle is properly adjusted and verified at the factory and should be inspected and/or adjusted by an FAA-licensed mechanic according to the schedule and instructions in the maintenance manual, any time the pilot experiences poor steering, or there is replacement or service to the nose gear trunnion, the nose gear actuator, or the engine mount.

Steering Arm / Roller Gap

Mounted on top of the nose gear trunnion are two nylon rollers which are used to translate the rotation of the steering arm (from rudder pedal movements) into rotation of the nose wheel. When the gear is in the down and locked position, the two nylon rollers are directly forward of the steering arm as shown in figure 1. Excessive clearance between these two rollers and the steering arm will result in loose steering and allow the nose wheel to point in a different direction than is commanded by rudder pedal inputs.

The correct clearance between the Steering Arm and the Rollers is adjusted and verified at the factory to be 0.010 to 0.030 inches with aircraft weight on wheels. This clearance should be inspected and/or adjusted by an FAA-licensed mechanic according to the schedule and instructions in the maintenance manual or any time the pilot experiences poor steering, or there is replacement or service to the nose gear trunnion, the nose gear actuator or the engine mount.

Rudder Cable Tension

Low rudder cable tension can create variations between rudder angle and nose wheel steering angle. Operating with excessively low rudder cable tension could result in the nose wheel pointing in a direction that differs from the aircraft line of travel at the instant of touchdown, even though proper pilot technique (as described below) is followed.

The Rudder Cable tension is properly adjusted and verified at the factory, and should be inspected and/or adjusted by an FAA-licensed mechanic according to the schedule and instructions in the maintenance manual.

PILOT TECHNIQUE

The FAA has published document FAA-H-8083-3 "Airplane Flying Handbook", which is designed as a technical manual to introduce basic pilot skills and knowledge that are essential for piloting airplanes. The document may be downloaded for free at the following web site:

http://www.faa.gov/library/manuals/aircraft/airplane_handbook/

Like all steerable nosewheel aircraft with interconnected rudder, special technique is required during a cross wind landing as explained in Chapter 8. Specifically, page 8-15 includes the following text:

> In those airplanes having nosewheel steering interconnected with the rudder, the nosewheel may not be aligned with the runway as the wheels touch down because opposite rudder is being held in the crosswind correction. To prevent swerving in the direction the nosewheel is offset, the corrective rudder pressure must be promptly relaxed just as the nosewheel touches down.

Piper designs and builds products to the highest standards for safety and reliability. Following these guidelines will help ensure that your aircraft continues to meet these standards throughout the service life of the aircraft.

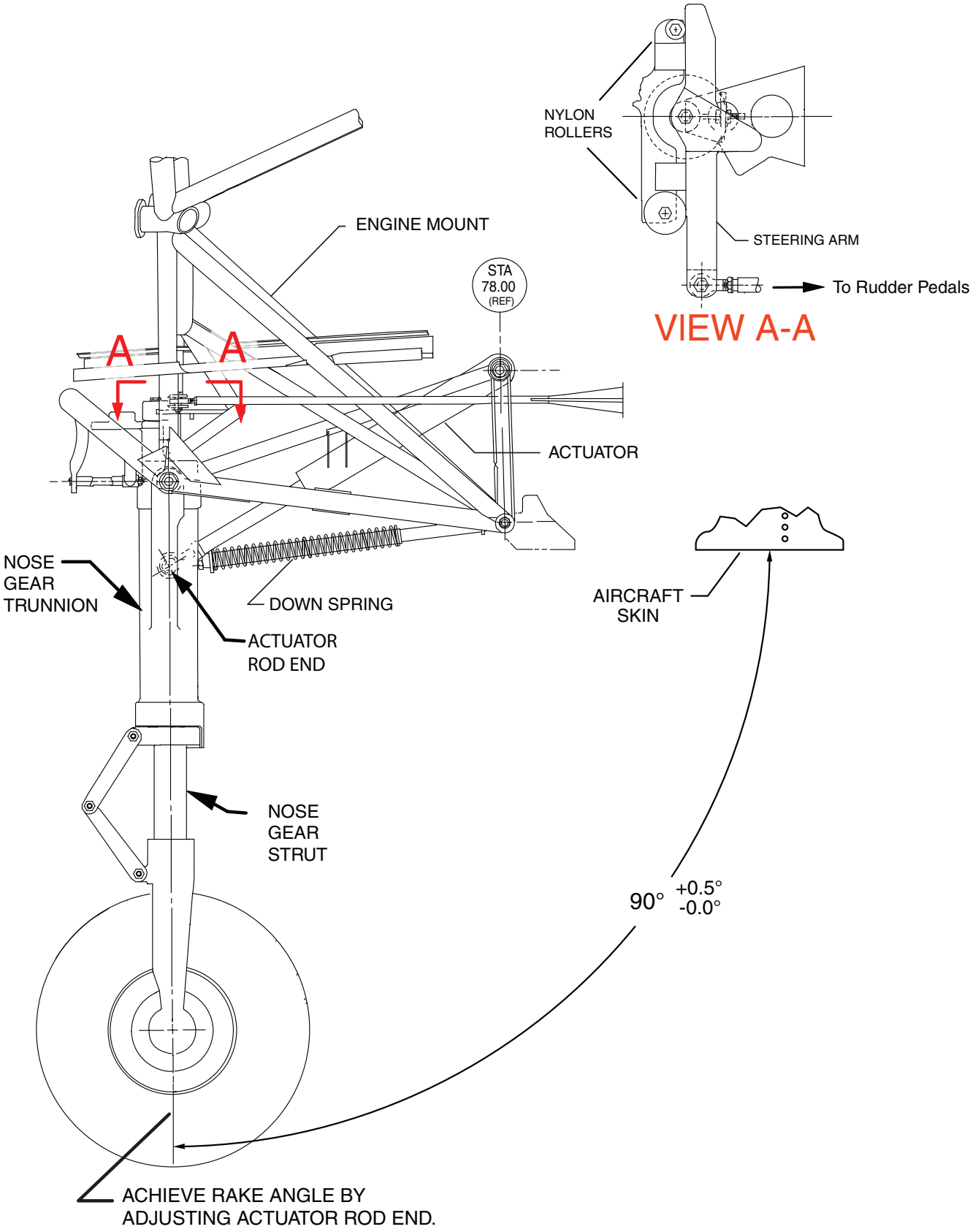

Figure 1

Left side view of Malibu Nose Gear