

Rudder Cables

Unless otherwise noted photos and article by Steve Mestler

Caution: These procedures are to be used at your own risk. Republic had no instructions on how to adjust or replace the rudder cables in the Republic Seabee, so use caution and if you have any doubt about your abilities, please get the advice of an FAA Approved Mechanic. He or she will have to check your work and make a logbook entry after the procedure is complete. Any photographs or illustrations listed below are for clarification purposes only. Your installation and procedures may vary. Read through this article completely first.

I may be the only one with this problem, as communicated by many of the Seabee Club members, but the forward rudder cables have been a source of much trouble for this Club member and others. Specifically the forward rudder cables have had an inordinate amount of wear and have been changed three times in 15 years. Perhaps I'm a little paranoid but any time I see cables that are frayed I get nervous. AC 43-13 says: "that any time the cables show wear and/or fraying through a fare-lead or around a pulley it must be replaced." The rear rudder cables, going around the rudder control horn, don't seem to have this problem. This problem seems to be limited to steerable tail wheel Seabees only but it might be worth a check anyway.

During an annual inspection about ten years ago the pulleys were being changed due to excessive wear. After the pulleys were removed the cable was inspected and seemed normal until I ran a rag over them. As is the case with frayed cables the rag caught one of the cable strands. So, just for the heck of it, the cables were bent slightly by hand just to see what was happening inside the cable. Much to my surprise at least a dozen (maybe more) strands stuck out like a porcupine! I couldn't believe it. Well, yes I could because they had been in the "Ol' Marty B" for at least 15 years prior to that.



Cables appeared good until they were bent!



These cables run forward and under the forward 2-inch pulleys (under the forward center floor panel) and then make a rather sharp turn up to the rudder control arms that are welded to the rudder pedal cross bars. The angle that the cable makes after the pulleys, in my estimation, is too large for a 2-inch pulley. There is no way to modify this without major work to increase the pulley size or decrease the cable angle going to the control arms. Occasionally, with a steerable tail wheel, there is quite a bit of force used on the rudder pedals, which makes matters worse.

The new cables are steel aircraft cables and a reputable cable manufacturer recommended and made them. I know some use stainless steel cables and they seem to not have the trouble mentioned above but the same manufacturer did not recommend stainless as it is actually more brittle than steel and, according to him, they don't last as long.

There are a few circumstances that must be taken into account when discussing rudder cable wear; stainless steel vs. steel cables, locking tail wheel vs. steerable tail wheel and of course pilot technique.

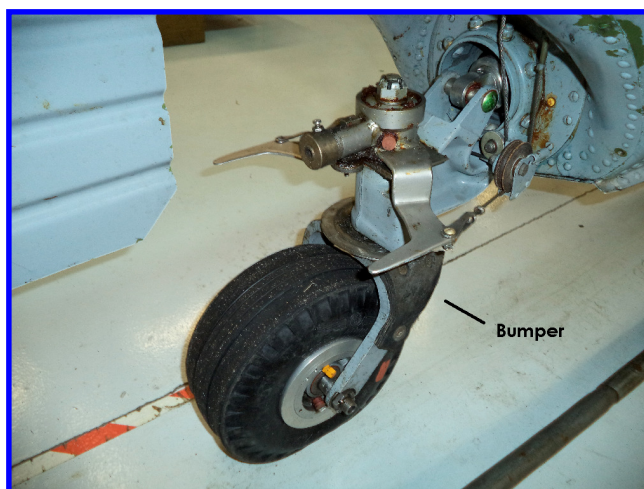
Stainless Steel vs. Galvanized Steel

The normal galvanized steel cable uses the galvanizing as a lubricant and anti-corrosive. As the cables are moved and forced around a pulley, the strands rub against each other and the galvanized covering allows for easier movement and less wear. Stainless steel does not have this however, most cables are lubricated either by the manufacturer or by us, the Seabee Owners. If you operate near salt-water stainless steel is probably the way to go even though they may wear sooner than the galvanized version.

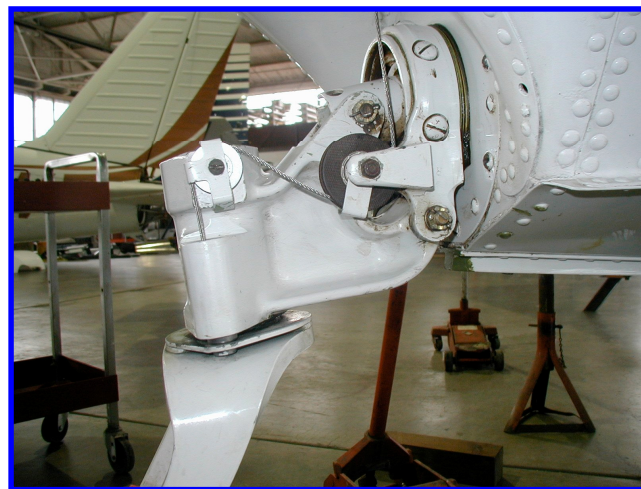
The manufacturer mentioned above told me from his experience that "Once you see any corrosion on steel cables you still have fifteen years of useful life left". Corrosion was not the problem however; wear was. I must admit I have never tried stainless steel cables and can only go by what the professionals tell me.

Locking tail wheel vs. Steerable tail wheel

Early on in the production of the Seabee, Republic found it necessary to include a steerable tail wheel. I know this is a bone of contention between Seabee owners and I know for a fact that the late Seabee owner Jim Poel preferred the locking tail wheel. I can see his point; less weight in the tail, less cable stress and the tail wheel stays in the 90-degree position after retraction like it should. Steerable tail wheels do not, for the most part, stay in the 90-degree position after retraction and they do weigh more. They always sag causing undue banging and clanging upon landing on the water. That's why there is usually a bumper either on the tail wheel fork or on the fuselage to act as a shock absorber.



Steerable Tail Wheel
(Unknown Seabee)



Locking Tail Wheel
(Photo by Bruce Hinds)

Pilot technique

When steering on the ground with a steerable tail wheel, there can be much strain on the cables and pulleys upon initial taxi. Always try to go straight for a few feet before turning. This will mitigate any cable strain and eliminate the pressure required to turn from a dead stop. Locking tail wheels do not have this problem as the tail wheel swivels when the turns are initiated.

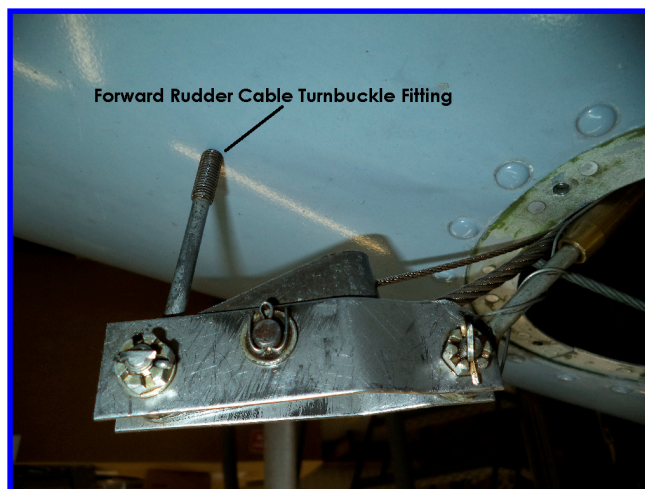
As mentioned above, starting a turn before the Seabee is moving forward puts undue strain on the rudder cables and pulleys. Space permitting, get the Seabee moving forward first then start the turn.

Other than the sharp angle the cable makes up front, little rudder cable strain is evident on the water. Steerable tail wheels are retracted and the tail wheel steering cables are limp. Even so, taxiing on the water with the gear down is not as strenuous as on land. Locking tail wheels, however, don't care if they are up or down on the water; no strain at all.

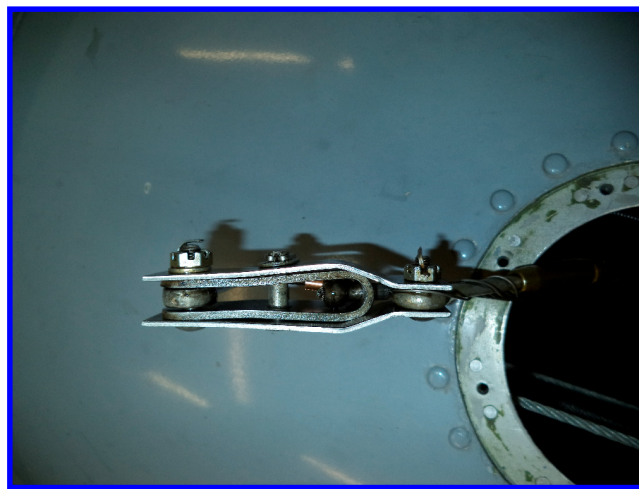
Rudder cable replacement

If you find that the rudder cables do need replacing it's not that difficult. Remove the center floor panels, disconnect the clevis bolts on the rudder control arms and remove the forward pulleys. There are three fare-leads that need to be removed; one on the bulkhead under the propeller and two along the forward side of the baggage compartment floor that are side-by-side. Two turnbuckles in the aft compartment need to be un-safetied and removed. Remove the old cables pulling them forward. Then it is just a matter of threading the new cables through from front to back to the aft turnbuckles.

Tip: Cable tension should be 20# \pm 5# according to the Republic Seabee Maintenance Manual. Use a cable tension meter to measure this. The rudder cables should be 5/32" cable and are two different lengths! In order to get the correct cables make sure you send the old ones into the manufacturer for the correct measurement. They should be approximately 182" for the left cable and 183.25" for the right. The reason for the difference is that the control arms are staggered by 1.25". Tighten the cable turnbuckles and make sure the water rudder, steerable tail wheel, air rudder and the rudder pedals are all in alignment. When the tension and alignment is correct, disconnect the cables from the forward rudder control arms and allow the cables to go slack. Don't touch the turnbuckles again! This will allow you to safety the turnbuckles OUTSIDE the fuselage through the left and right hand-holes by the aft compartment (see photo below). This is a real time saver and makes the job much easier. Once the turnbuckles are safetied, reconnect the cables to the control arms and reinstall the forward rudder pulleys. The tension and alignment should be correct. If not, repeat the above procedure. The fare-leads can then be reinstalled and the clevis bolts (4 ea.) up front safetied (cotter pins). Have your mechanic check your work and sign the logbook.



One of Two Rudder Cable Junctions



Rudder Cable Junction (top view)

I believe that the combination of Steerable Tail Wheel and small forward pulleys with a sharp turn up to the control arms are the reason for the premature fraying of the rudder cables. When you do your next annual inspection, whether you have stainless or galvanized cables, take the forward pulleys off and disconnect the cables from the rudder control arms and bend the cables slightly to see if there is any fraying. You may be surprised. Don't forget to re-safety the four castle nuts! (two on the control arms and two for the forward pulleys).

Since there's never been an official Service Bulletin published on the topic, please let us know of your findings so we can keep our Seabee community safe.



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