

INFORMATION SHEET: The New Improved Gooseneck for the Supernova

The existing Gooseneck and its limitations

The problems with the existing gooseneck are several and well known:

1. The wear surfaces of the pin, toggle and mast bracket oxidise easily and the deposits mark the boat deck surfaces especially around the mast step and control lines. As the gooseneck wears, more fresh metal is exposed to oxidation which results in more 'black sludge'. This makes the boat look dirty and stained with dark smudges.



2. Although the aluminium alloy has high tensile strength, it is susceptible to permanent deformation under extreme stress conditions, such as a broach capsize downwind to leeward when the rig hits the water and the momentum of hull and rig subjects the gooseneck to sudden high forces. This has resulted in the gooseneck shearing or breaking away from the boom. In normal use, over time, the pin flanges can permanently distort and the toggle-pin rivet can start to pull away.

The photo shows a gooseneck after 2 years of use.

3. Depending on sailing conditions, the assembly can wear badly, especially on the pin to boom connection and mating surfaces (as shown by the brighter areas on the pin). Wear on the mating surface of the lower flange on the mast bracket is also accelerated if a stainless washer is not used as a shim. Consequently, the gooseneck assembly can have a relatively short life, maybe 2 years or less. Although it is not an expensive part to replace, the mast bracket itself is not easy to replace on a DIY basis. The cost of a replacement assembly is £30.

Development

The new gooseneck has been developed initially using 3D printing technologies to investigate material properties and 'fitness for purpose'. The development blog is on the Website Forum (The Gooseneck Diary - <http://www.supernovadinghy.org/forum>). The current version is SG5 (Supernova Gooseneck version 5).

- SG1: Designed with TinkerCAD - a 3D printed FDM (Fused Deposition Modelling) Nylon pin and toggle using MarkForged Nylon/Kevlar mix. Exhibited very poor intrinsic strength on the pin due to print layering, so was unsuitable.
- SG2: Designed with FreeCAD (Open Source Software) – Modified design for 3D printed Nylon-12 with graphite infill for added strength. Printed with a Selective Laser Sintering process. The pin broke during a capsize but there was no damage to the toggle.
- SG3: As SG2 but slightly modified to suit CNC manufacture. Prototype was 3D printed in nylon-12 with graphite and carbon fibre infill for 30% extra strength. This was the complete assembly (pin and toggle). The pin sheared during a 45mph gust on capsize.



- SG4: Used a stainless steel pin to remove the weak point. The prototype composite (metal pin with nylon + carbon fibre toggle) has stood up well so far without failure. However, long term concerns over Nylon (UV and moisture absorption) does not make this a commercial solution.
- SG5: Replaces the Nylon toggle with an Acetal component. Slightly larger toggle to allow compatibility with both standard mast bracket and extended mast bracket using shims. CNC manufactured, not 3D printed (photo to follow).

New design

SG5 has two principal parts:

1. The pin is a proprietary A4 stainless steel (marine grade) part from Allen Fittings Ltd and is used on a wide range of Allen gooseneck parts. It is formed (not milled or turned) from stainless sheet and pressed to shape and comprises a 12mm diameter pin. This makes for a good fit to the Superspars B7 boom inboard end. As the pin is used across a wide variety of parts, economies of scale make this a relatively cheap component.
2. The mast bracket to pin universal joint ('toggle') is made of an engineered plastic known as Polyoxymethylene (POM-H), also known as Homo-Polymer acetal (Delrin®). This is the "Homo-Polymer" grade of Acetal and Delrin® is DuPont's trade name for it. You may have seen this material on older Supernovas as it was commonly used to create a mast ramp before Hartleys built the ramp into the deck. Delrin® has excellent load-bearing qualities in both tension and compression. It will absorb a minimal amount of moisture and is resistant to a wide range of solvents. The service temperature range is -29° to 85° C. It has high yield strength even at elevated temperatures. Properties include low friction (very slippery), high wear resistance and ease of fabrication.

The toggle uses black Delrin to reduce the effects of continuous exposure to UV over a period much longer than 2 years.

The toggle is a proprietary part, and CNC-milled to 0.1mm tolerances, specifically for this application. All metal parts are to marine grade A4 Stainless Steel.

Advantages (important ones first):

- Good mechanical strength and durability (high resistance to fatigue failure from 40 to 82°C)
- Good abrasion resistance (often used in marine rope sheaves)
- Low coefficient of friction, self lubricating (no creaking or grinding of the assembly)
- Low water absorption (will withstand marine environments)
- Better fit to boom than existing part (boom won't fall off so easily)
- Pretty good heat resistance and good electrical properties (not very important for us)

Disadvantages

- Susceptible to being attacked by both strong acids and oxidizing agents (eg. chlorines)
- Not readily available in a flame-retardant grade (not important)
- Very difficult to bond (not important)

Assembly

The gooseneck is supplied ready assembled. The two parts are joined by a 3/16" (4.8mm) clevis pin and secured by a cotter pin with tensioning shims for improved security. The pin and toggle assembly are joined to the mast bracket by a M6 (6mm) bolt with nyloc locking nut. Two shims are provided (1.6mm and 0.8mm thickness) to allow the gooseneck to fit both the standard mast bracket and the newer extended mast bracket (this is currently supplied by Hartley Boats complete with the standard aluminium gooseneck, which will need to be removed).

Fitting

The replacement gooseneck is an easy retrofit and should take no more than a few minutes. No tools are required apart from a tool to tighten the mast bracket bolt (10mm socket). The standard mast bracket version is supplied with a 40mm mast bracket bolt which replaces the existing clevis pin and split ring. The extended mast bracket version is supplied with shims only – you will need to use the existing bolt and nut (this is done to keep the costs down).

The shims are vital. Not only do they act as spacers to keep the gooseneck reasonably 'tight', they also act as bearings to prevent undue abrasion of the toggle by the relatively rough surface of the mast bracket, thereby providing a longer life. If the lower shim is omitted, the relatively soft material of the aluminium mast bracket would eventually be picked up by the surface of the Delrin. Most other engineering resins do not perform well running against soft metals due to the tendency to pick up metal particles in the plastic surface. Because Delrin acetal resin is harder, this tendency is reduced. However, with the hard steel shim, this tendency is virtually eliminated.

The toggle will be available as a replacement service part (if needed) for around £10.

Pricing

Pricing per unit: £24.95

*** Class Members can purchase at a **discounted price of £19.95**, which is only a 10% price premium over the standard Superspars pin and toggle.

Post and Packing (UK address, Royal Mail First Class) £3.50

Availability around mid April 2019

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