



# Skin Tight Rattle Fit - Annular Piston Towrope

(STRF – APT)

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# Background

- In November 2011, unexpectedly slow and inconsistent launch performance halted Mark 4 launcher production. Exhaustive testing by Hood Tech provided irrefutable evidence that the speed variability was caused by inconsistent friction between the original (teflon) piston sleeve and the cylinder bore. This triggered a flurry of redesign effort. Hood Tech developed the Skin Tight Rattle Fit Piston design, which eliminated the speed variability.
- In August of 2012, Hood Tech staff and (separately) staff engineers employed by Hood Tech's customers began expanding the flight envelope of the Mark 4 launcher in anticipation of aircraft variants that exceed the 135lb GTOW and 32m/s limits. Both groups experienced failures as the towrope length allowed the piston to reach the end of the cylinder and impact rain/dust caps. A (interim?) solution, demanded by Hood Tech's customer was to shorten these 30-ft towropes a fraction of 1-inch, and to tighten the finished length tolerance to a 4<sup>th</sup> significant digit. Subsequent testing revealed that the "new baseline" Mark 4 piston design lacks strength margin even to support the baseline 135lb and 32m/s requirement, and the super-precise baseline towrope length still allows destructive impact with the rain/dust cap when used as intended.
- In 2012, Hood Tech developed the annular piston termination, which shortens the overall rope length by 3 inches without sacrificing termination strength or carriage stroke. This design survived rigorous testing as summarized in this presentation.
- Also in 2012, Hood Tech developed a dramatically more convenient rubberized, tension-molded eye splice for the carriage end. This feature eliminates the tedious pin fiddling historically associated with Mark 4 carriage installation.

# Torture Test Results

1. APT towrope assembly survived proof load test to 14,000 lbs (Factor of Safety > 4 demonstrated)
2. APT towrope survived 30,000 load cycles; 0-6,000 lbs tension. Post-test inspection revealed only compacted fibers, no abrasion, <1% broken fibers
3. Length margin indicator confirms >3 inch rain/dust cap clearance during 1600psi (max GTOW) shot, even after 200 launch cycles.

# Annular Termination Piston



# Silicone Rubber Tension-molded Eye Splice

