Crafting Scale Standard Nike Fins

By John Brohm, NAR #78048 **April 28, 2026**

Introduction

Most scale modelers have likely encountered a Nike-based prototype at some point during their modeling career. One could say that the Nike M5 motor enjoyed ubiquitous use amongst the many different sounding rockets that NASA deployed, being used as the prime mover in the single stage Nike Smoke, and showing up in many multi-stage vehicles like the Nike Apache, the Nike Orion, the Black Brant VIII, the Argo D-4 Javelin, and so many others.

Initiated by the US Army's Ordnance Corps in the mid-1940's, Project Nike envisioned the development and deployment of the Nike M5 rocket motor[1] as part of the Nike Ajax surface-to-Air missile defense system. Hercules Aerospace was contracted to develop the motor, and initial test firings were conducted by the fall of 1946. By the early 1950's, Nike motor production began to outpace the Army's needs, and so surplus units were made available to various arising sounding rocket programs. The first mating of a Nike motor to a sounding rocket occurred in 1953, with the creation of the Nike Deacon.

Given the Nike's diverse application potential, Atlantic Research Corporation developed a series of fin types, fin can assemblies, and mating adapters for the Nike motor to leverage its use with ARC's various upper stage vehicles. Which brings us to the topic of this article, ARC's Standard Nike Fins.

The Nike Standard fin was a lightweight, foam-filled, trapezoidal structure paneled with sheet aluminum and featured a simple diamond airfoil profile. Providing a compact aerodynamic surface of only 2.5 square feet, the fin type could be adapted to a variety of mounting configurations[2]. The Standard Fin found broad use, showing up in the Nike Cajun, Nike Apache, the Black Brant VIII, and various other prototypes. One of the scale models I'm working on is a 1/5.489 size Nike Apache, and in this article, I'd like to share with you my approach to modeling scale Standard Nike Fins.

[1] Further background on the Nike motor can be found at https://meatballrocketry.com/scale-data/. An excellent monograph covering the Nike Cajun/Apache sounding rockets can be found in the 2018 Jan/Feb issue of the JMRC Newsletter, **Total Impulse** https://cv41.org/newsletters/V18I1.pdf

[2] "Standard Fins – Nike Rocket Motor", Atlantic Research Corporation

The Nike Standard Fin

As mentioned, the Nike Apache deployed a Nike M5 motor as its booster. The motor was fitted with four Atlantic Research #16151 Standard Nike Fins, as shown in Figure 1.

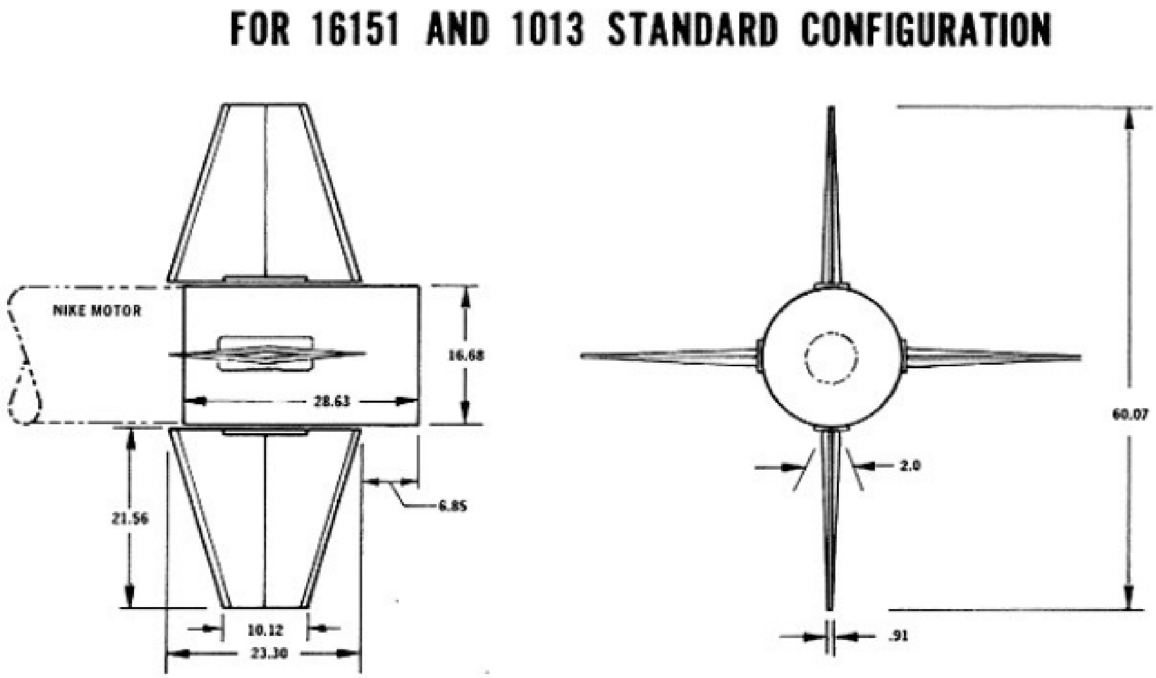

Figure 1: Nike Standard Fins #16151

https://meatballrocketry.com/wp-content/gallery/scale_data/nike_data/nikefins.pdf

As Figure 1 shows, the Nike Standard Fin was fabricated with a simple diamond airfoil, tapered from root to tip. For our model, we'll base the booster's fins on 1/16" aircraft plywood cores and we'll face the cores with shaped balsa segments to realize the diamond airfoil. Consideration was given for traditional built-up fin construction, but because the fins are relatively thin at this scale factor, a solid core seemed the better approach.

Figure 1 also shows how the leading and trailing edges converge to a knife-like edge. Actualizing that sharp edge requires a bit of math. Our 1/16" fin cores are much too thick to represent that knife edge; the prototype had a leading/trailing edge width of about 0.20"[3], not counting the protective cuff. At our scale factor, that reduces to 0.036". And, since we want a nice smooth convergence of the skins at the edges, we'll need to size our fin cores to something less than the full fin plan. Ideally, the fin core edges would sit just tangent to the inside face of the fin skins. Figure 2 highlights the point.

[3] "Nike Apache Sounding Rocket", Sht2, drawing by Mike Dorffler, 1996

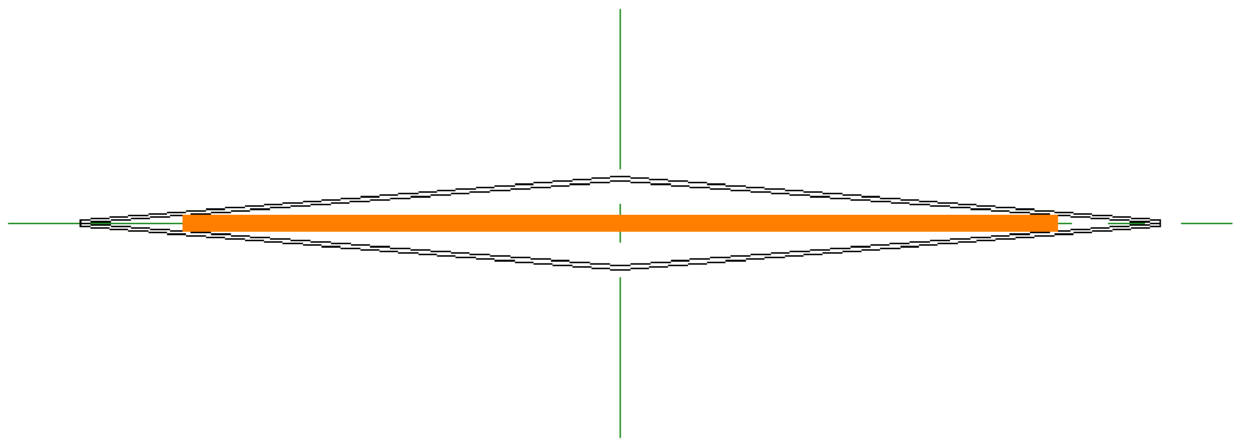

Figure 2: Nike Fin Root Section

Figure 2 illustrates the fin section right at the root. The fin skins are represented at scale thickness, and the tangent fin core is represented by the orange bar. As one can see, to get a knife edge based on the skins alone (just like the prototype), our fin core edges must be placed further back to the tangent point, based on the core's 1/16" thickness.

Finally, the fin skins. The skins on our model's fins will be fashioned from 0.015" thick Styrene sheet. As we'll see in the following construction section, we'll take some steps to strengthen those plastic leading and trailing edges.

Our build strategy set, let's start with those 1/16" plywood cores.

Fin Construction

A fin core template was drawn in TurboCAD and was used to cut the cores. Our usual practice is to make our own ply core blanks to mitigate warpage, but in this case, a serious shop search turned up an old sheet of 1/16" ply suitably flat for our purposes.

1/16" plywood is usually made up from three thinner plys, which means the finished material has a dominant grain. When cutting the cores, the fin template was placed such that the leading edge was parallel to the dominant grain.

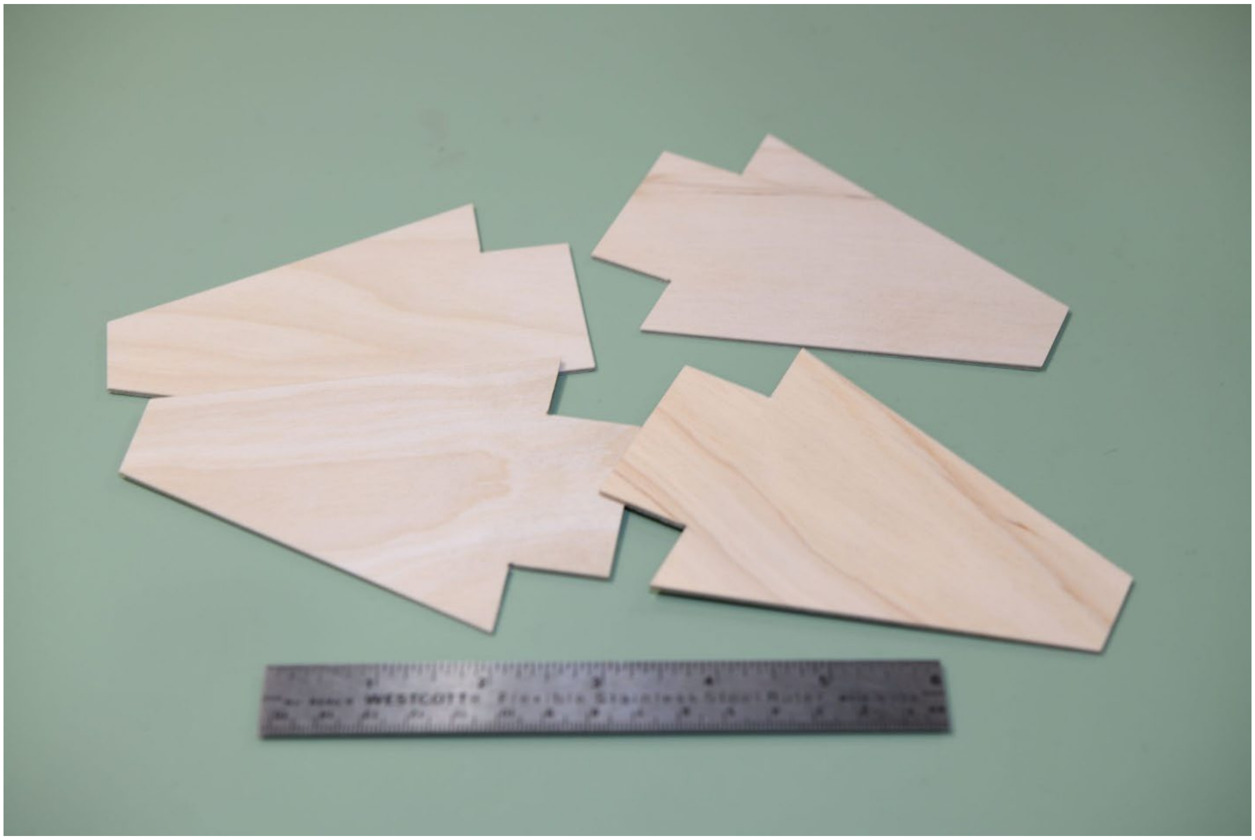

Photo 1: 1/16" Plywood Cores

Now for the tapered diamond airfoil. Since I'm not proficient at free hand-sanding a consistent airfoil, I decided to fashion the airfoil faces from individual balsa segments, each segment to be precisely shaped on a segment shaping and sanding fixture. The fixture is based on a piece of 3/16" aircraft plywood, its width cut to the precise length of the fin span. The fixture uses 1/16" plywood fences, cut to match the airfoil tapers, which are used as the sanding block guides. The fences are glued in place, mirroring the exact shape of the tapered segments that make up a diamond airfoiled fin face.

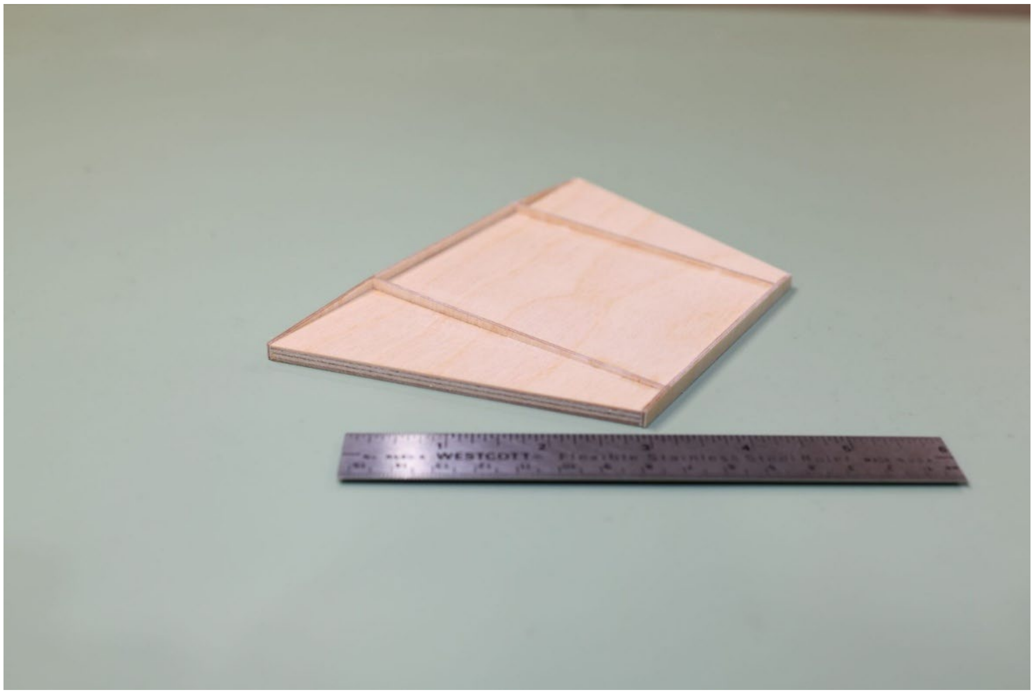

Photo 2: Sanding Fixture

Next, a set of airfoil segments was cut from a sheet of 3/16" thick balsa. Note that a top and bottom segment is required for each fin face.

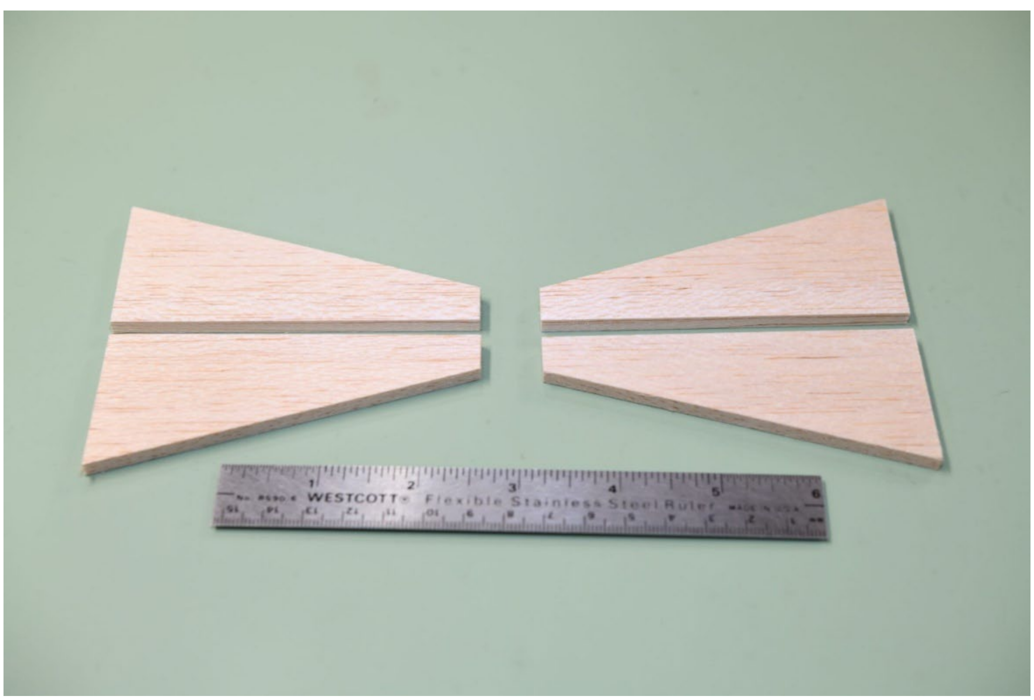

Photo 3: Balsa Segments

To shape a segment, a balsa blank is set into the fixture (held in place with a small piece of 3M double-sided tape) and is then carefully shaped with a miniature plane and sanded with a progression of grits until the blank is profiled flush to the tapered fences.

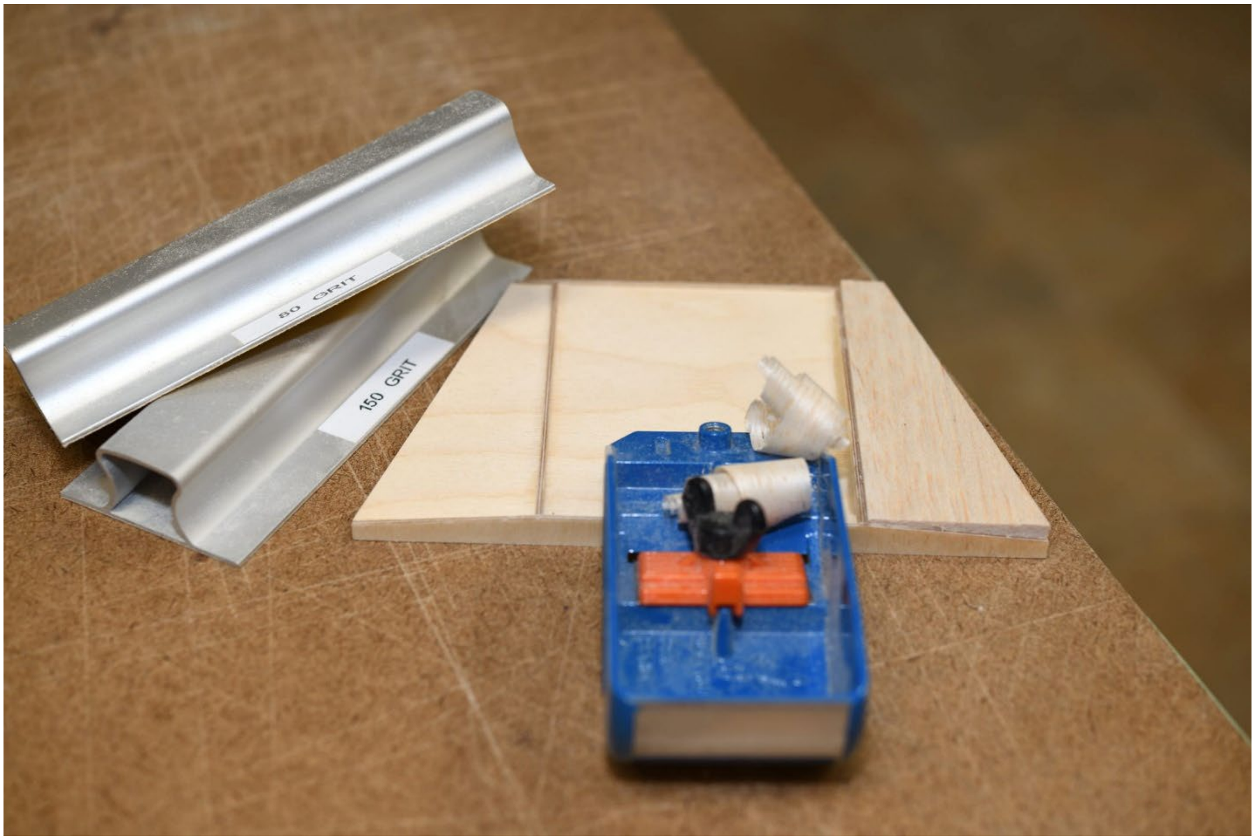

Photo 4: Segment Shaping

We'll repeat this process for the other three segments, and with a bit of elbow grease, we end up with a set of four precise, consistent fin segments, ready to be applied to the plywood fin cores.

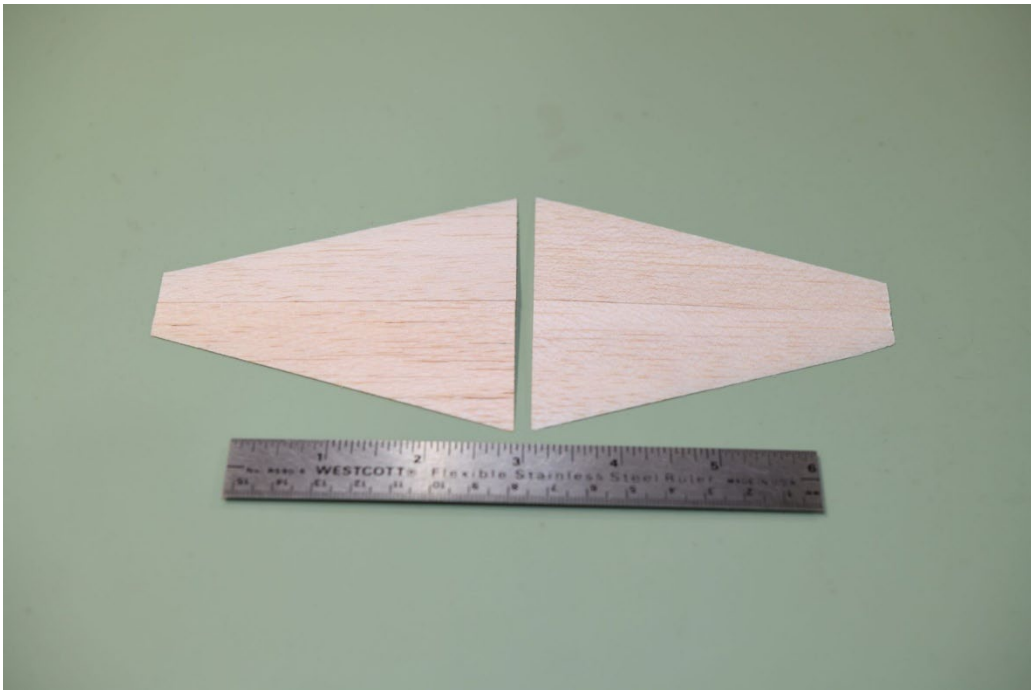

Photo 5: Ready for Application

Each segment is applied to the fin core with a very thin layer of epoxy, to provide working time to align and adjust the segment on the core.

Photo 6: Segment Glued in Place

One will notice that the balsa segment is slightly longer than the plywood core. The reason for that goes to the finishing step. If the core is also cut to the precise length of the fin span, then the hard plywood center presents a pivot point while sanding. This makes it more difficult to sand the completed fin's tip face flush and perpendicular, as the surrounding material is softer. Since we need that tip face flush, square and perpendicular, the fin core is slightly shortened to facilitates the finishing process.

Once the epoxy cures, we have a native fin, ready for skinning.

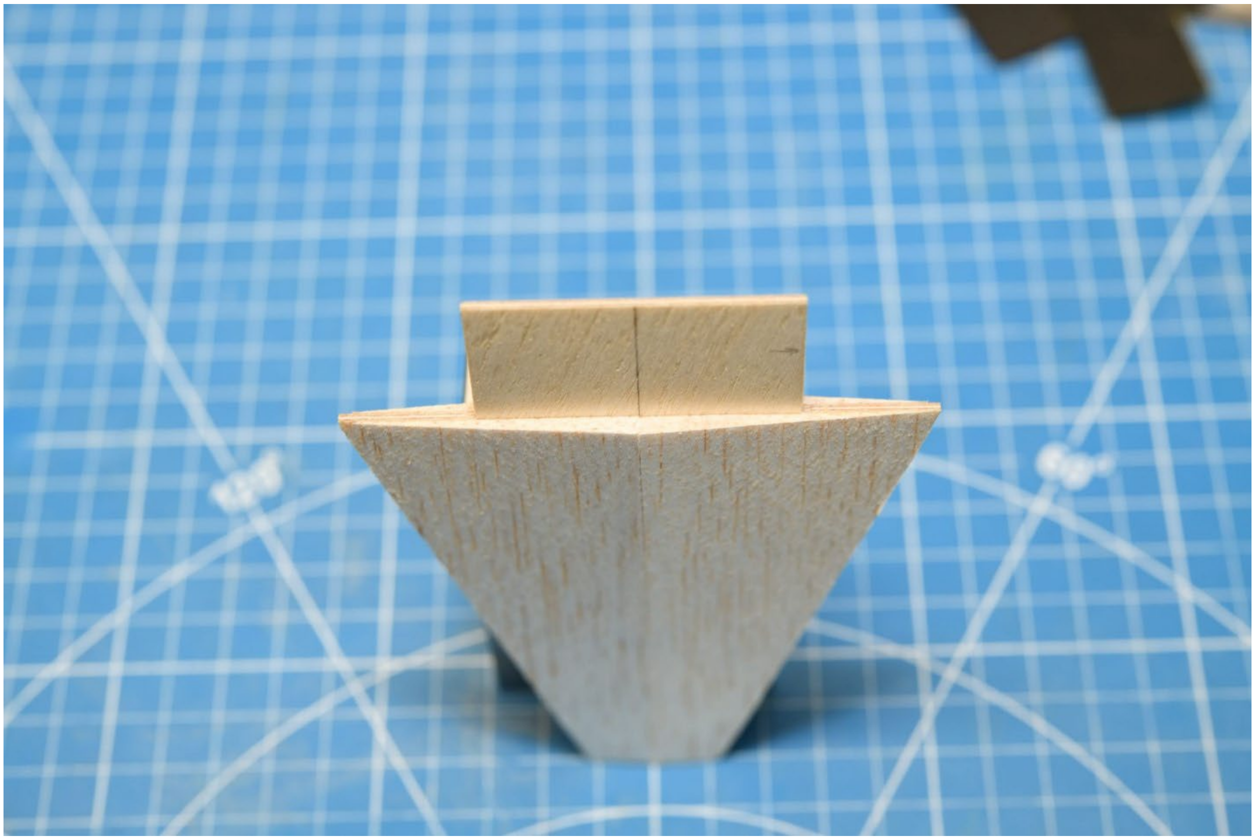

Photo 7: Native Fin, Ready for Skinning

The fin skins are cut from 0.015" thick sheet Styrene but before they're applied, they must first be detailed with the fin's rivet pattern. Some Nike Orion photos give us a good view of the Standard Fin rivet pattern.

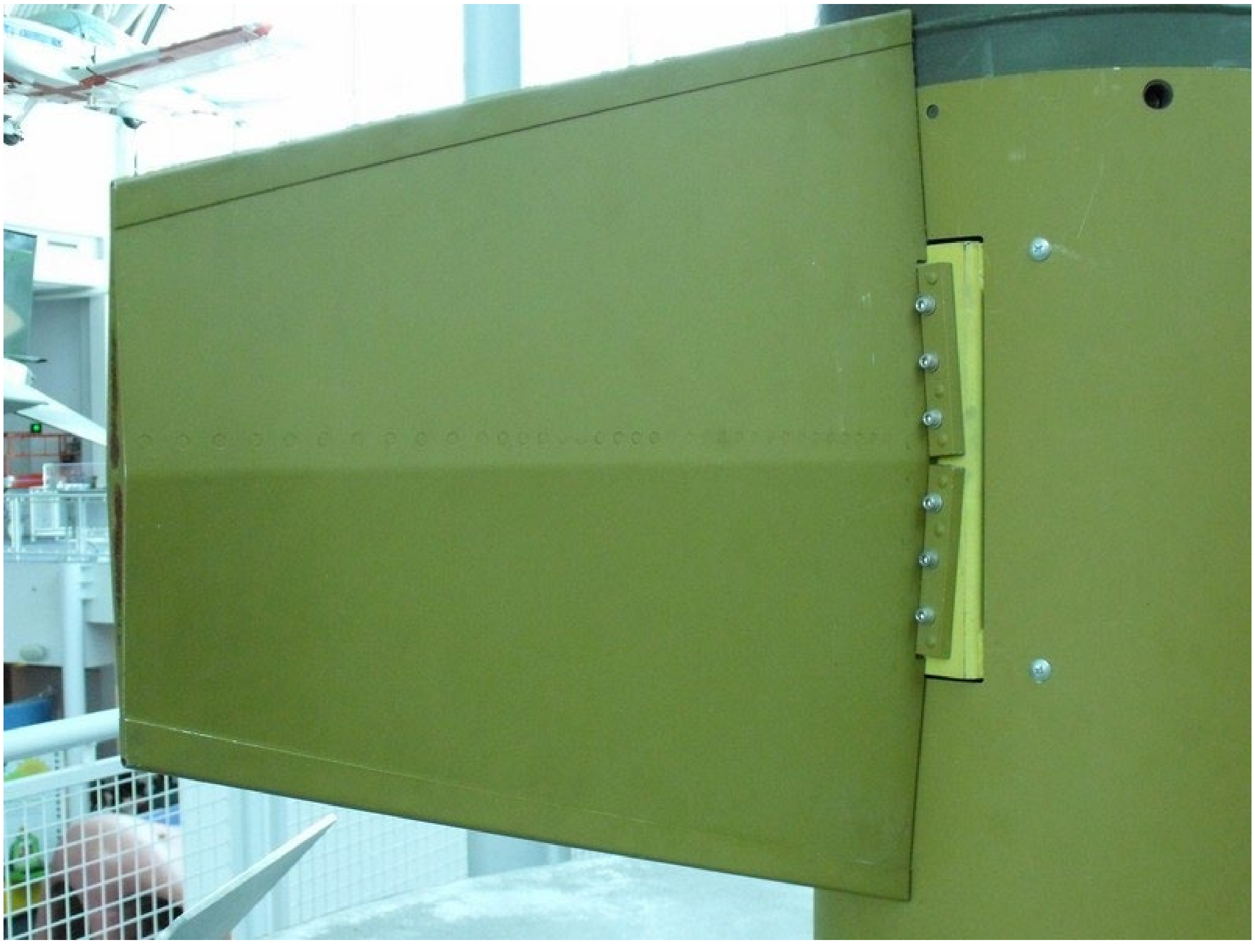

Photo 8: Standard Nike Fin Span Rivets

Photo provided by Josh Tschirhart

Photo 9: Nike Fin Root Rivet Detail

Photo provided by Josh Tschirhart

We'll replicate that rivet scheme on a piece of 0.020" thick Styrene sheet to create a rivet template.

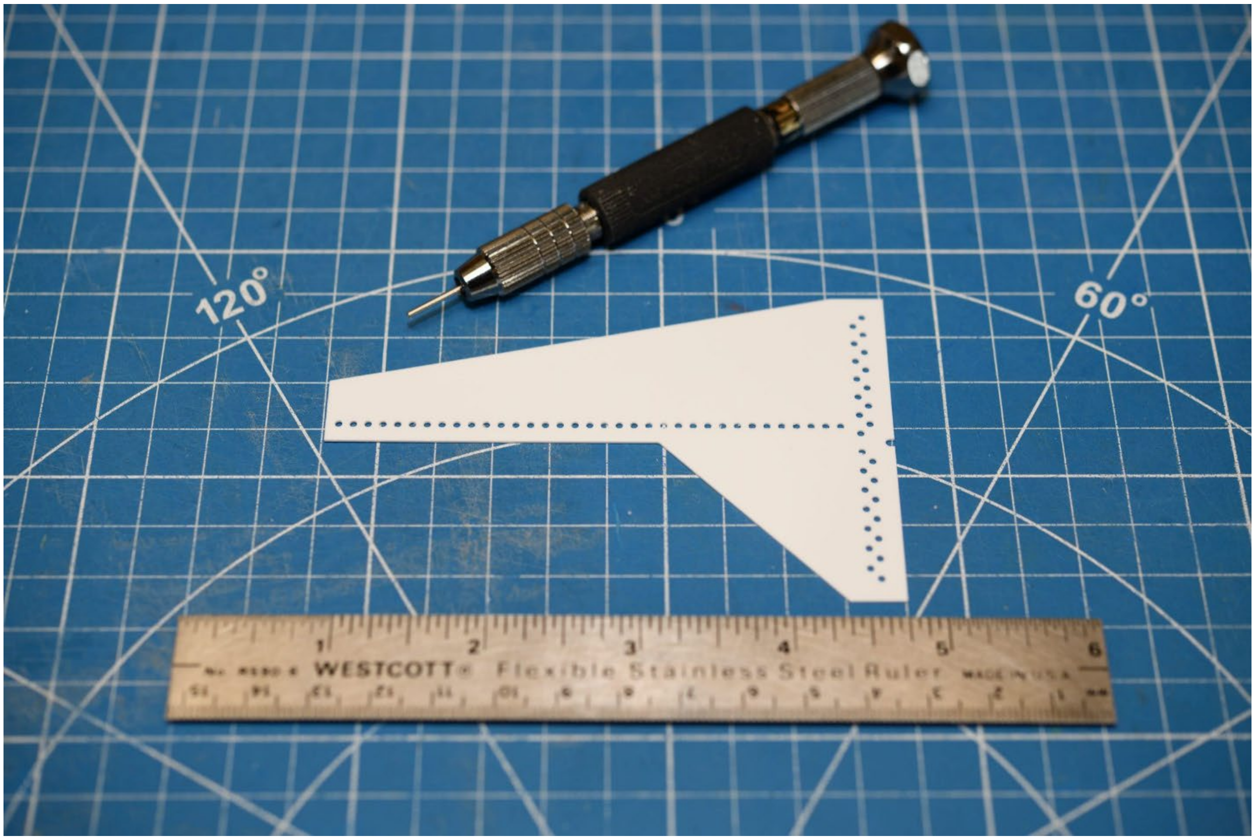

Photo 10: Fin Rivet Template

The rivets scale out to a 0.25" diameter on the prototype, which at our scale factor is 0.046". An 18-gauge glue syringe needle provides an OD of 0.05", and when pressed into the Styrene fin skin it produces a reasonable facsimile of the flush rivets we see on the prototype fin.

So, the needle is chucked into a pin vise, and with the rivet template taped in place, hole by hole, we arrive at a fully riveted fin skin. The skin is scored down the middle on the backside, is then bent along the score, and then tested with a dry fit. Satisfied with the fit, we can glue it in place with thin CA, taking care to check alignment along the way. The process is repeated for the other side, and once applied, we have a fully skinned fin, ready for leading and trailing edge finishing.

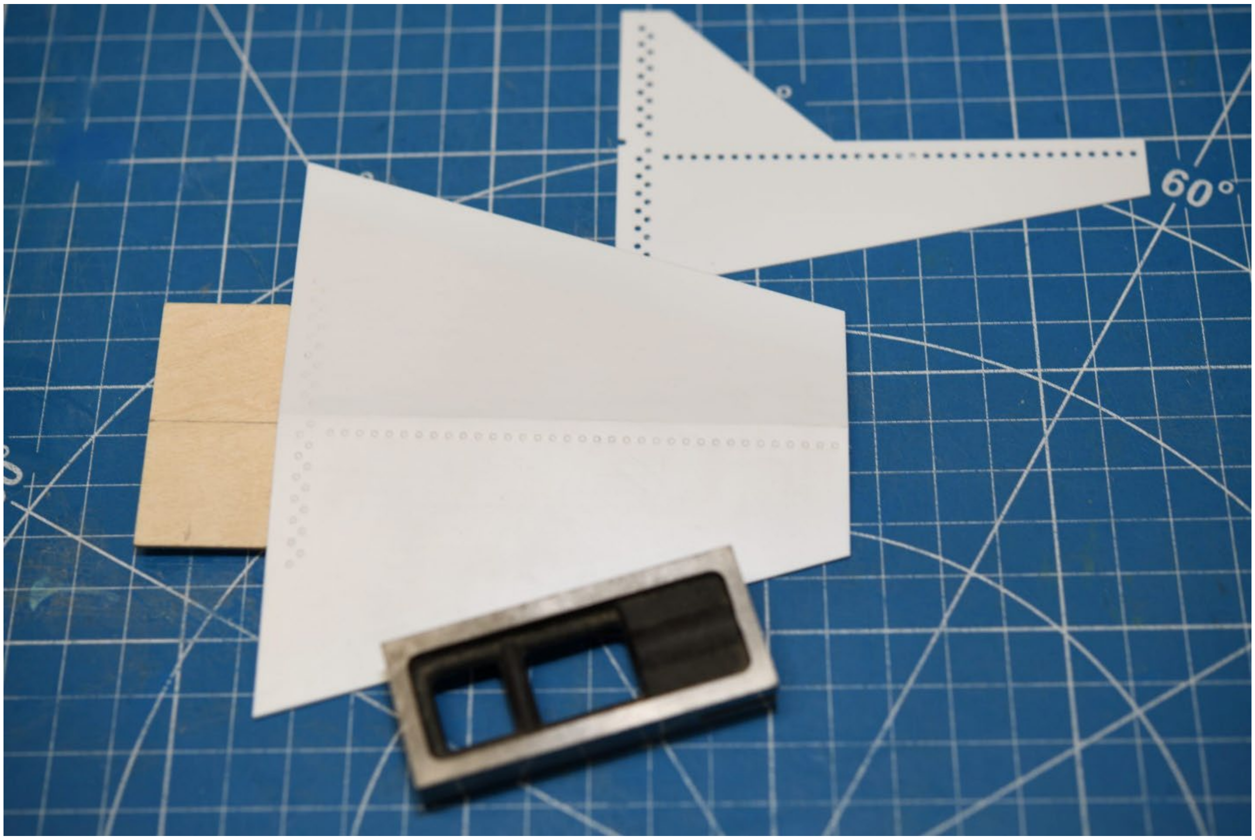

Photo 11: Skinned Fin

If our math and construction efforts converge as planned, then so too should the leading and trailing edges of the Styrene fin skins. With some thin Styrene cement, we can carefully close up those edges. A sharp, scale-like knife's edge greets us.

Photo 12: A Knife's Edge

Our earlier Figure 2 makes it apparent that there's an airgap between the internal fin core edges and the outer leading and trailing edges of the fin. Without reinforcement, landing loads could damage the fin tips and edges, so we'll add some reinforcement by borrowing a tip from our friend and noted scale modeler, Marc McReynolds.

The following photo shows the process underway. A length of 0.030" diameter carbon fiber rod is inserted into the airgap and is allowed to settle naturally between the two fin skins. CA is then dribbled down the CF rod, cementing it in place.

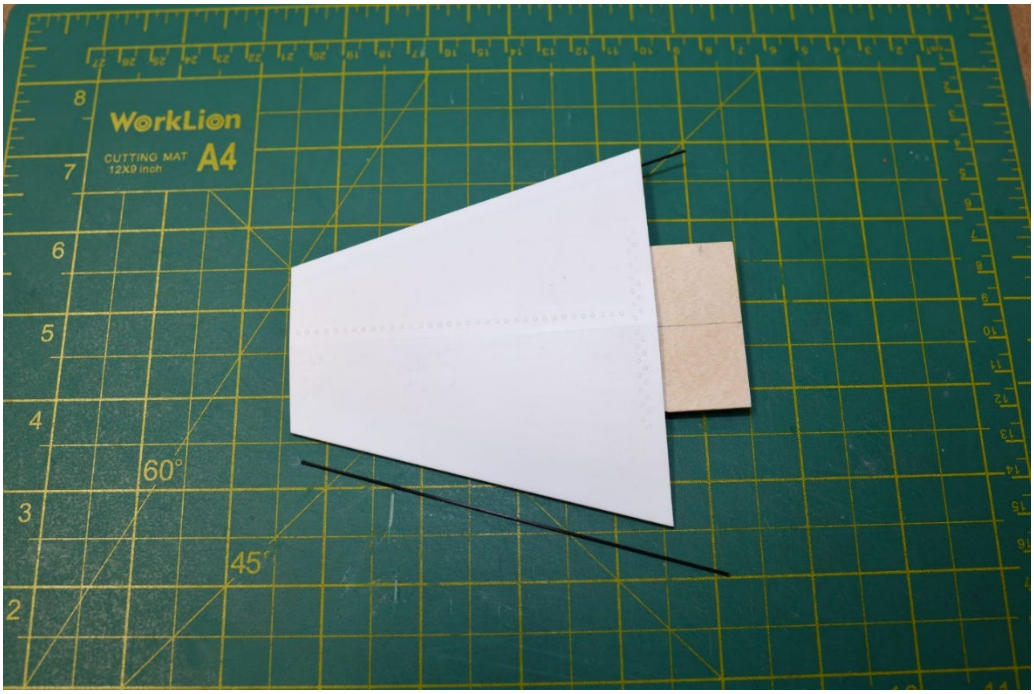

Photo 13: Carbon Fiber Reinforcing Rods

Once the CA has cured, the aft end of each rod is cut flush with the Styrene fin skin. Fin construction is completed by filling the tip face with a mix of epoxy and micro-balloons.

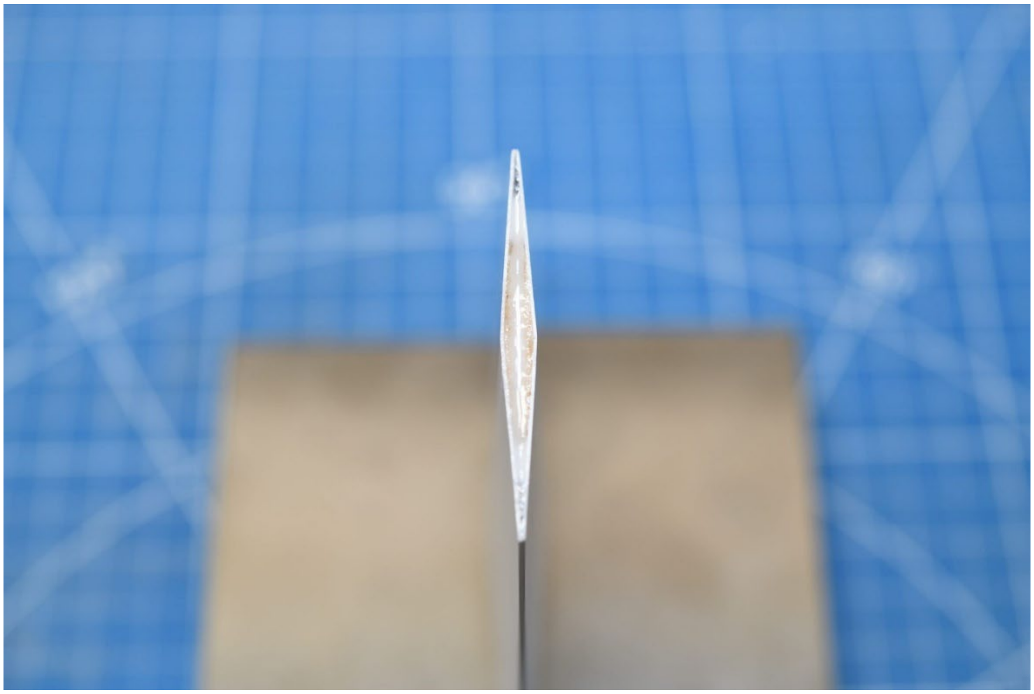

Photo 14: Fin Tip Filled

This process is repeated for the remaining fins, leaving us with just the leading and trailing edge protective cuffs to add. But before we do that, we must first detail and cut them.

The Leading and Trailing Edge Cuffs

The prototype fins had their leading and trailing edges covered with an Inconel cuff[4], riveted in place, intended to protect the edges from the aerodynamic heating effects that occur at high rates of speed. For our model, we'll add 0.010" thick strips of Styrene, cut to scale width, to represent the sides of these cuffs. We can get a clear view of this cuff rivet pattern from the following Nike photo.

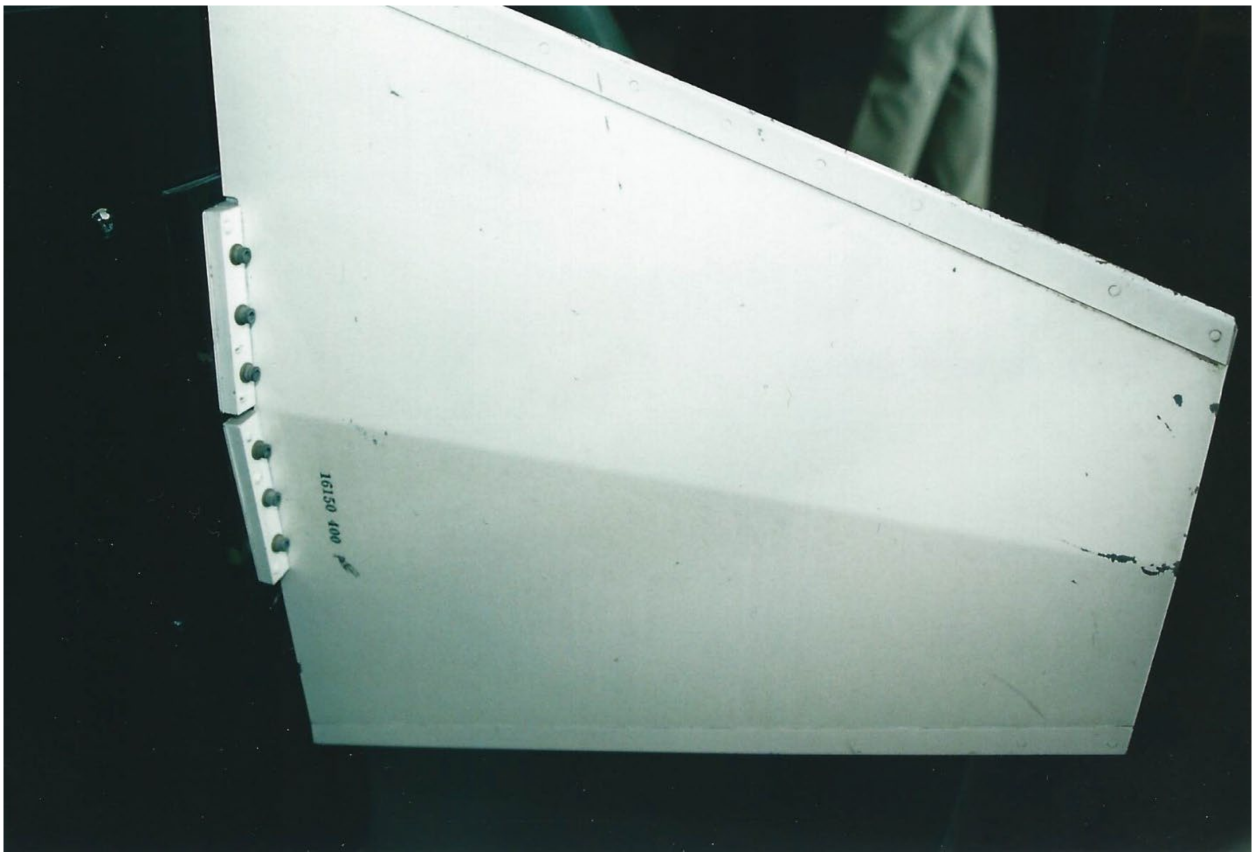

Photo 15: Nike Standard Fin Leading Edge Cuff

To realize the rivet pattern, we'll fashion another rivet template from a strip of 0.020" Styrene sheet. The rivet template is secured to a sheet of 0.010" Styrene and then as we did for the fin skins, the rivet tool is pressed hole by hole into the rivet template.

[4] "Standard Fins – Nike Rocket Motor", Pg 3, Atlantic Research Corporation

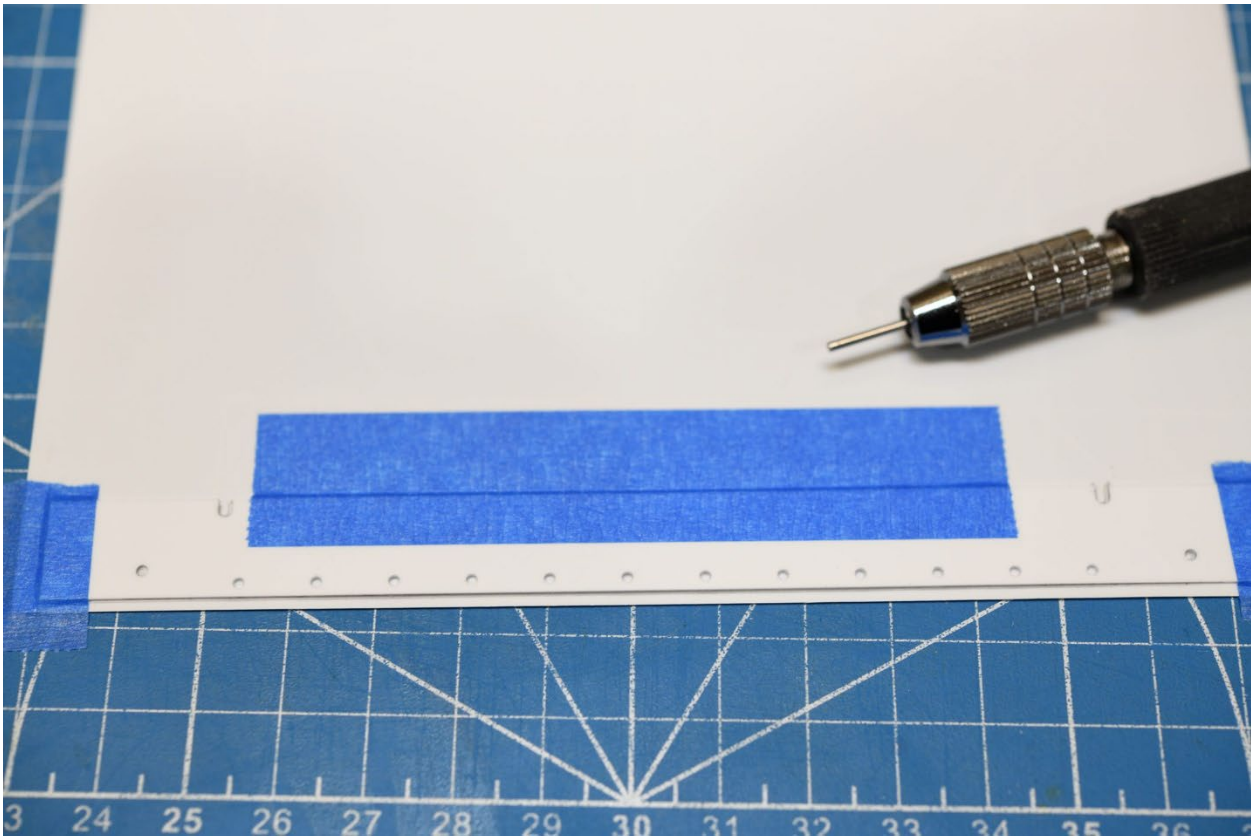

Photo 16: Cuff Rivet Template

The resulting cuff rivet strip is cut from the sheet and then applied to a fin edge with careful dashes of thin Styrene cement. Once all cuff edge sides have been placed and trimmed, we have a completed fin.

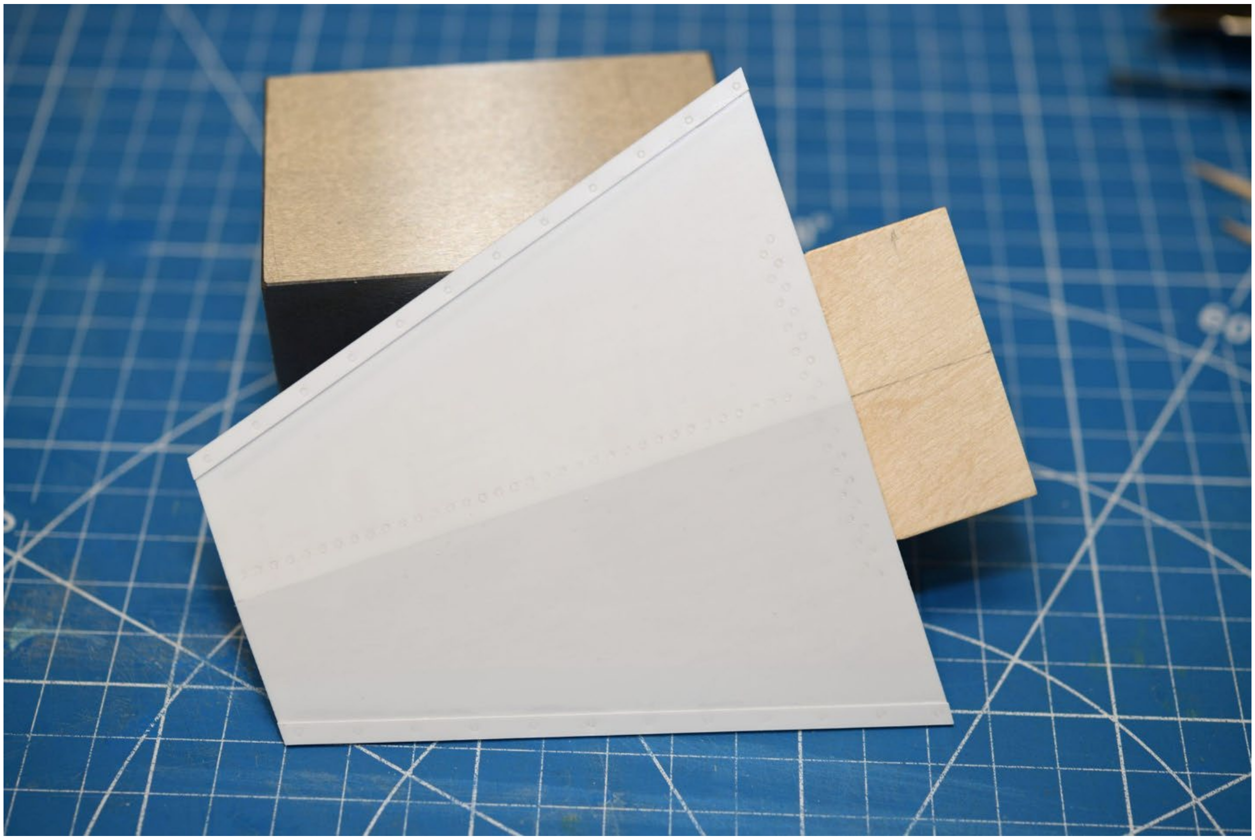

Photo 17: Finished Fin

All that remains is to run a high grit sanding block along the edges to round them. With this our scale Standard Nike Fin is ready for a visit to the Paint Shop. I hope you found this article of interest, and as always, best of luck with your scale projects!