ALUMINUM FOIL FINISHING DEMO NOTES **Bob Bradford 03/26/14**

Intro - *Why do this?*

- Realistic natural metal finishing opens up a range of aircraft subjects that can be realistically modeled:
  - Near-polished finish on many bombers; i.e. B29, B36, early SAC
  - Early Cold War era jet fighter aircraft, many types / countries
  - Interwar fighter cowls and engine panels, i.e. Bristol Bulldog, all French aircraft of this time, Seversky P-35, and many others
  - Commercial airliners / Reno racers
  - Prototype aircraft
- Also applicable to:
  - Automotive – racing fuel cells, cockpit tubs, similates mirrors
  - Figures – mech warrior and knight armor

Foil vs. Metalizer paint

- Modern metalizer paints (AlClad, ModelMaster) are pretty good at getting the panel variation & color right on moderately or heavily weathered natural aluminum subjects. Includes MiGs, combat weathered USAF WWII aircraft
- Foil provides truest reflectance variation and 'grained' effect that I have not seen matched by paint
- Downside to foil – **10 times the effort** required!

Modeling mindset - *Mostly similar to painted modeling subjects*

- Surface preparation is critical, foil is not any more forgiving than paint
  - This is because aluminum foil and paint are about the same thickness, approx. .001" thick
- Except:
  - Assembly planning requires rethinking – finishing requires working on subassemblies and components (i.e. wings, tailplanes, fuselage) rather than on assembled airframe
  - Foil application process is different (of course)
  - Finishing process (i.e. sanding, polishing) is conceptually similar to paint but is very different in materials and technique

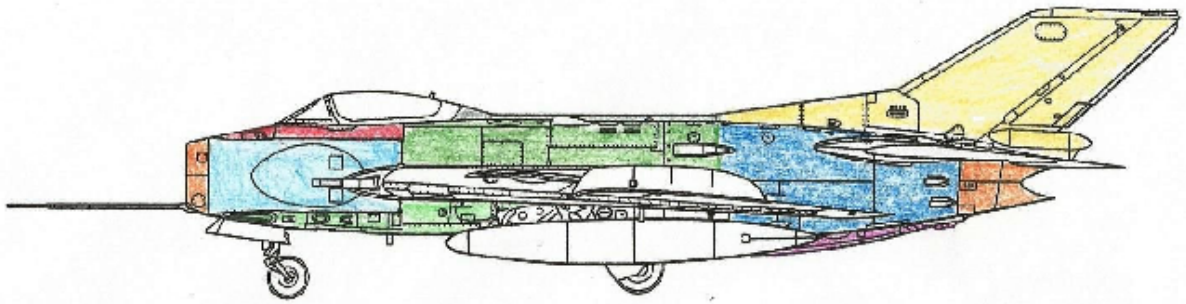
Demo is in (3) parts:

1. Foil Application
2. 'Graining' foil surface
3. Coloring

1. FOIL APPLICATION:

Materials		***Source***
Foil – Regular kitchen foil ~.001" thick, best for most applications Premium foil (*Reynolds Heavy*) ~.002" thick, for large scale, heavy polishing *BareMetal*' foil < .0005" thk, do not use		supermarket
Knife with curved blade (*Xacto* #10) – for trimming *Micro Scale* Metal Foil Adhesive		hobby shop
Large brush w/ soapy water / Hair dryer / Masking tape / Qtips		household
Alcohol – for prep and cleanup (not for post foil covering therapy)		drugstore

FOIL SECTIONS

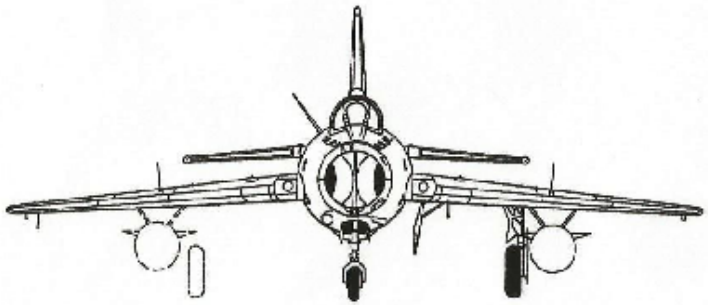


Specification

Shenyang F-6 Farmer C

Wingspan.....30 feet2 inches (9.1 m)
Length.....46 feet 11 inches (14.32 m)
Height.....12 feet (2.97 m)
Empty Weight.....12,699 pounds (5,760 kg)
Maximum Weight.....22,046 pounds (10,000 kg)

Power plant.....Two 7,165 lbst Wopen 6 afterburning turbojet engines
Armament.....Three NR-30 30MM cannons.
Speed.....903 mph (1,453 kph)
Service Ceiling.....58,725 feet (17,900 m)
Range.....1,243 miles (2,000 km)
Crew.....One



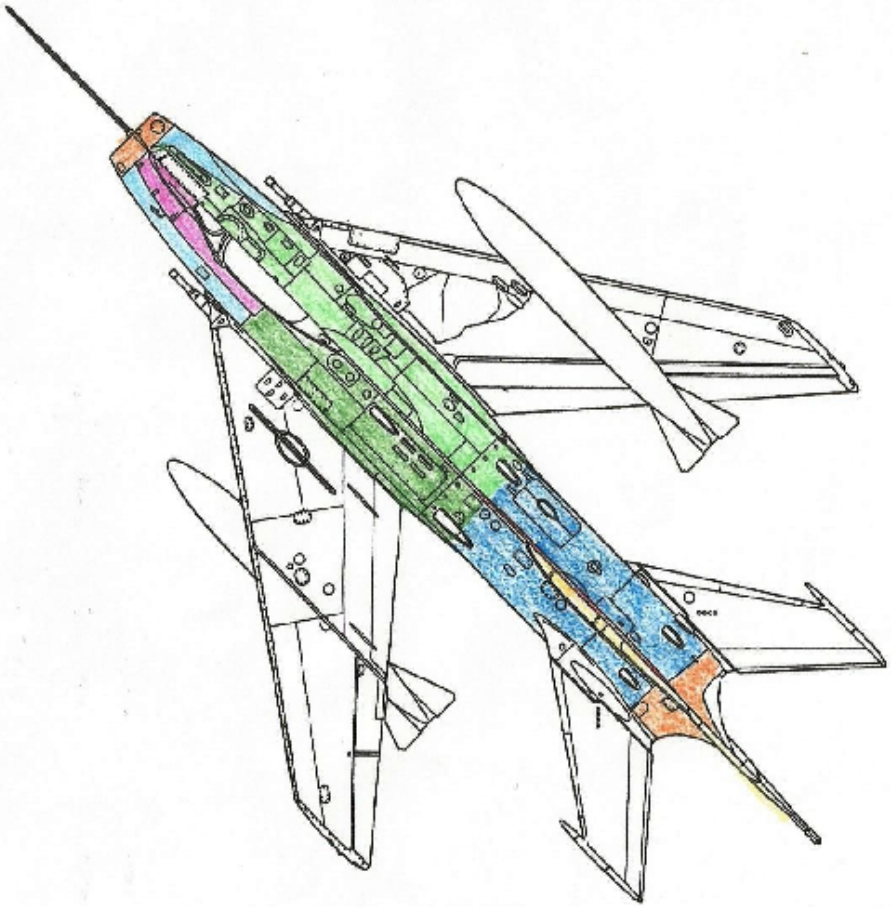


Figure 1 : Foil Map for Fuselage Assembly

- **Process Planning**
  - Model assembly sequence should favor finishing major components separately
  - Create '**foil map**' (Fig. 1) to define area covered and application sequence for individual foil sections. This is a balance of:
    - Minimizing the number of sections to reduce the number of seams
    - Maximizing the number of sections in order to avoid wrinkling of foil over compound curves
  - Strategies
    - Locate seams
      - On recessed panel lines
      - Under decals
      - At intersecting corners
      - At part junctions
    - Don't worry about grain or color variation, this comes later

- **Application** *(hands-on demo here)*
  - Block out panel outline using masking tape per foil map
  - Cut out foil piece larger than blocked area
  - Brush on adhesive to foil on etched side (maximizes adhesion)
  - Dry adhesive using hairdryer (milky to clear)
  - Burnish foil on plastic using Qtip working inside to outside
  - Trim off excess foil at masking tape line. **Shear** foil, **don't cut** foil

Next steps require clean handling, so it's best to foil cover the entire model before proceeding. If model is a mix of foiled and painted surfaces, then fully finish foiled surfaces **first** before overall painting.

2. 'GRAINING' THE FOIL SURFACE

Materials		***Source***
3M 600 grit wet or dry paper 0000 steel wool Masking tape		DIY store
Toothpicks Thin cotton gloves / tissue paper		household goods store (i.e., Walmart)

- **Planning**

  Use photo research material to create a '**grain map**' (Fig. 2). The idea here is to capture the grain appearance of aluminum sheet that results from the rolling of aluminum sheet during its manufacture and during panel fabrication. As applied on the aircraft, grain direction is not random, but follows an engineered pattern on stressed skin aircraft. Typically grain direction runs circumferentially around the aircraft fuselage and on wings is parallel to the spars. Access panels often vary in direction, typically grain is parallel to the long edges of a rectangular panel.

  I use only photographs as artist's renderings may not be accurate in this area. Most of the time my map is a composite resulting from photos of different areas of different individual aircraft. I think that this is ok because the panel grain patterns should be consistent between individual aircraft of a specific type.

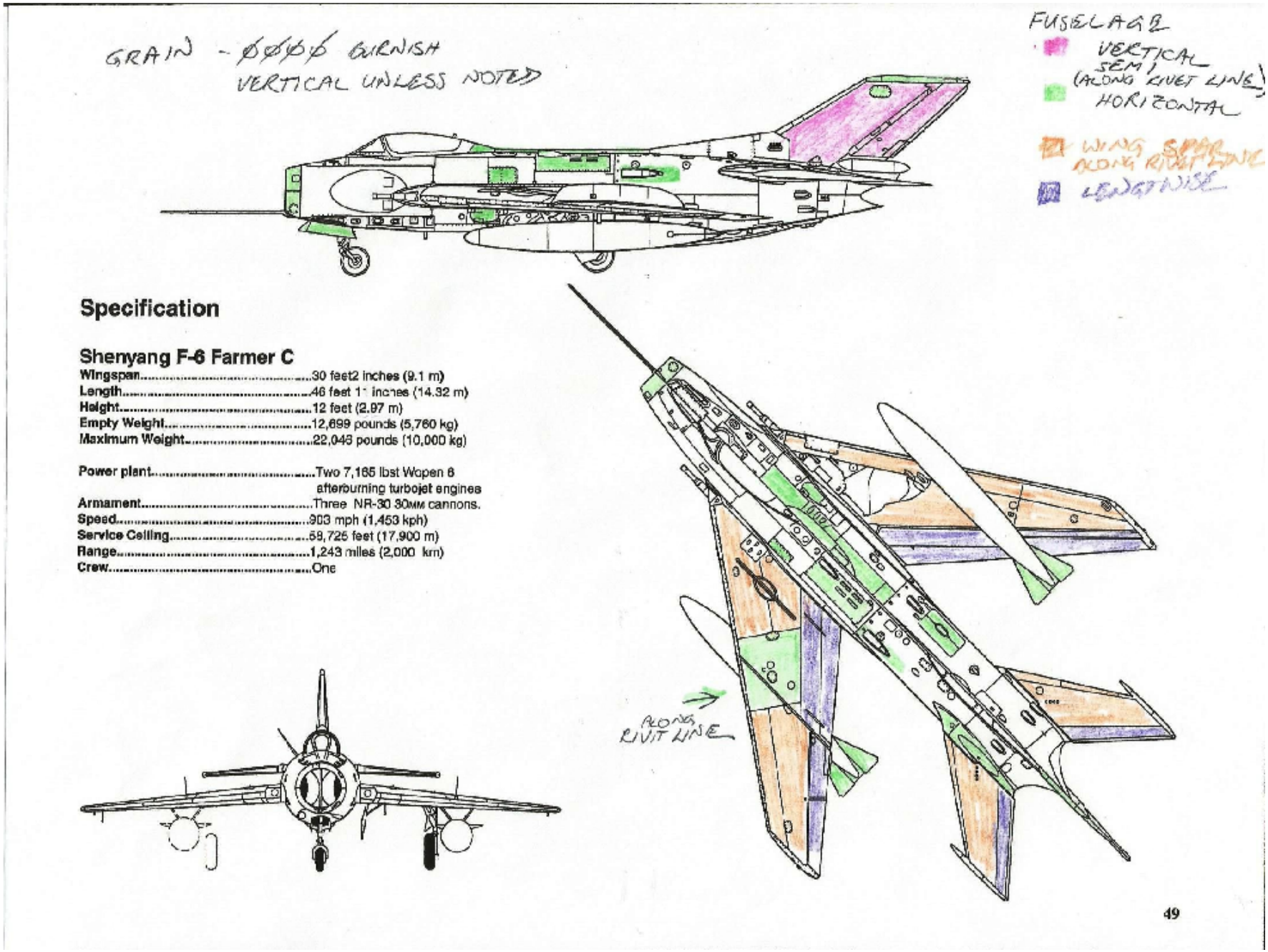


Figure 2 : Grain Map

- **Graining Process** *(hands-on demo here)*
  - Level foil surface and seams using 600 grit paper in primary direction defined by grain map
  - Burnish surface using 0000 steel wool in **primary** direction to create a uniform surface finish over the **entire model**.
  - Finish panel lines and rivets using toothpick, re-burnish as required
  - Block out separate panels using masking tape
  - Lightly burnish **separate** panels per grain map
  - Wash model to remove residues and oil from steel wool

3. COLORING

Materials		***Source***
Clear acrylic paint, (*ModelMaster* Acryl) SemiGloss and Flat		hobby shop
"*Nevr Dull*" polishing wadding		marine supply
Aluminum metalizer paint i.e. *Tamiya* flat aluminum *Vallejo* wash		Ed's Hobbies
Optional:		
Corrosive cleaner i.e. *Duro* Naval Jelly		Walmart
Simichrome/Flitz polishing paste		MicroMark

- **Planning -** Again using your photographic reference materials, create:
  - Finish process coupons *(hands-on demo here)*
  - The idea here is to create coupons of various graining, polishing, and clear coating sequences and pick from this 'menu' those coupons that best represent the aircraft you are modeling. Below I've listed the coupons and associated processes I used for the Chinese MiG, but of course many more combinations are possible. At the end of this outline I've summarized other techniques not used on the MiG but perhaps desirable on another subject.

- **Coloration Map** (Fig. 3)
  - This is yet another map defining the various polishing and/or clearcoats used in panel areas
    Process used for the MiG (referencing the coloring map):
    - **Yellow** – left at natural metal burnished finish (the 'base finish')
    - **White** – Base finish / SemiGloss clear
    - **Red** (blast panel) Base finish / Flat clear / SemiGloss clear
    - **Orange** Base finish / Polish using *Nevr Dull* / SemiGloss clear
    - **Green** (and red tips) Aluminizer paint (representing anodized, not natural, aluminum)

Be aware that the burnished aluminum 'base finish' is highly subject to **permanent fingerprinting** due to handling, especially if you've enjoyed pepperoni pizza the night before. Wear **cotton gloves**, wrap the handling areas of the model, or otherwise fixture the model as you perform this last finishing step.

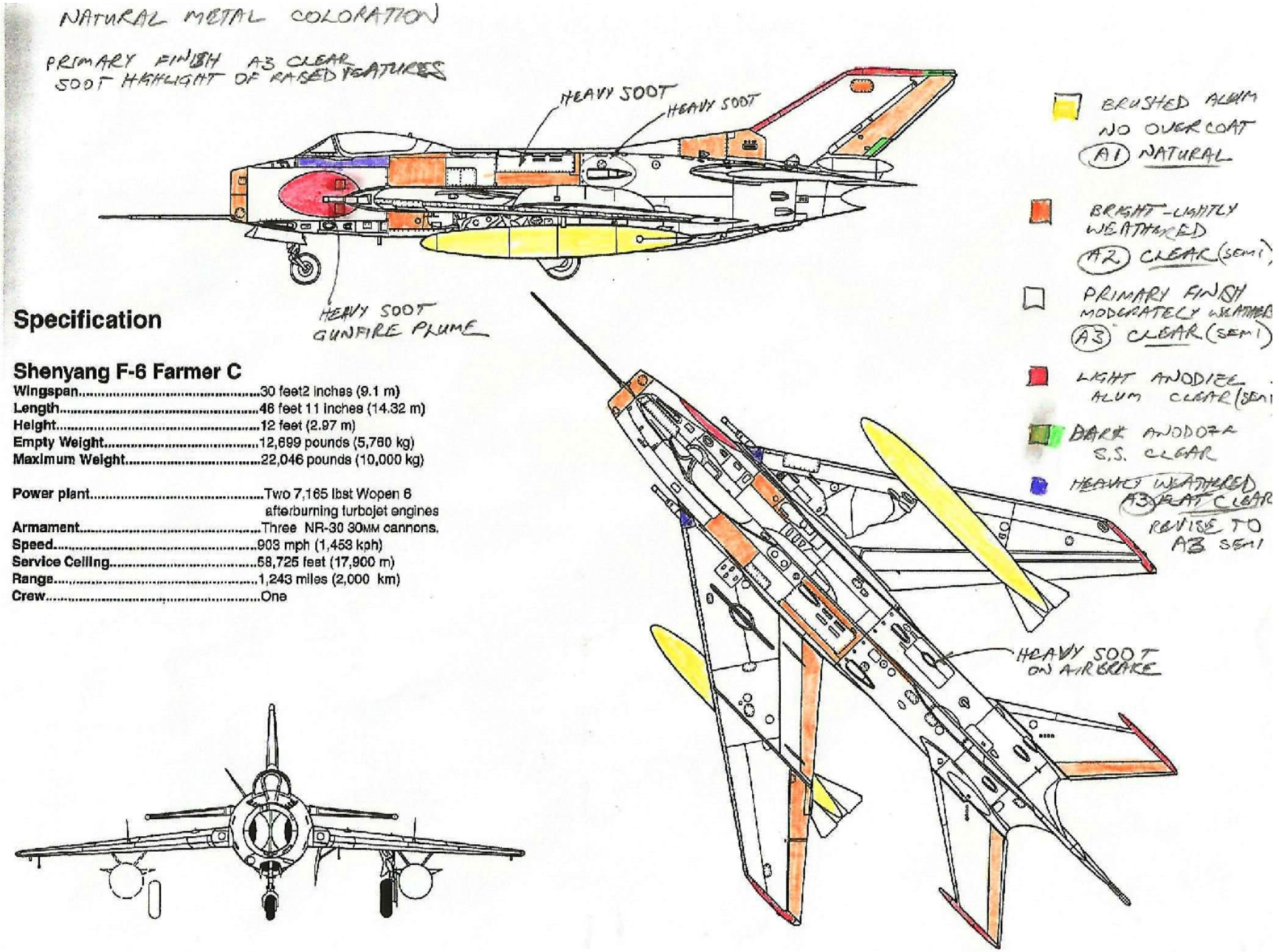


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Figure 3 : Coloration Map

Commentary on going through all of the trouble to finish in foil and then painting over with clear paint:

A major problem in finishing with foil is that a true natural aluminum finish is extremely reflective; just pull out a piece of kitchen foil to see what I mean. The highly reflective side is pure aluminum, marred only by rolling grain resulting from its manufacture. (the 'backside' of the foil is etched and has lower reflectance). Of course this is unrealistic for all but highly polished surfaces. Even a steel wool burnished surface is too bright and reflective for many models that represent subjects in active use.

I think what is going on is that the metal panels of in-service aircraft have a corrosion film that develops over time on the aluminum surface. Possibly the alloying elements in the aluminum used i.e. Duralumin have something to do with this. This is evident in my photos that show 'new' compared to 'in-service' Soviet aircraft; the metal appearance is clearly different in color, the older aircraft much grayer in 'color', and the reflectance is muted. Yet the grain and reflective nature of the metal remain (the corrosion film is very thin and not perfectly opaque). So at least on the MiG, a semigloss clear coat film simulates this thin corrosion film, darkening the aluminum color and reducing reflectance.

Other possibilities and tips

- Aluminum corrosion is difficult to achieve chemically in a modeling environment, but certain household cleaning agents (bleach) can create AlCl corrosion on aluminum that shows up as a milky white film. Look for cleaners that say 'not for use on aluminum'. If you've ever seen photos of Cold War Albanian MiGs, this is a perfect finish for them. Multiple flat clear paint coats will look the same and is safer to do though.
- Highly polished surfaces – The MiG's control surfaces were only lightly polished in order to slightly increase the reflectance of these areas. Polished aircraft like racing planes would require more rigorous polishing and omission of any clear coat.
- The KOPRO MiG's raised panel lines created much unwanted spot reflectance. I picked out these and other unwanted edge and corner highlights using flat clear in order to knock down these unrealistic highlights.
- The MiG's decals and washes were applied just prior to application of clear coat (after burnishing and/or polishing). No single 'right' answer here, but I think this works best.
- Color tinting – for engine heat discoloration (think a F-100 Supersabre's tail), I think that multiple blue/brown/black translucent tints (washes thinned with Future) over a foil covered tail MiGht be impressive. Just an idea; I have not yet tried this.
- Tinting the foil is possible by boiling with eggshells - will create brownish color tints that look like heated titanium. Varying the length of time changes the darkness of the tint.