



WEARIBRIC





















VHEELS, TRACKS & SURFACES



















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WHEELS, TRAKS & SURFACES

In this issue of The Weathering Magazine, we present riveting articles to improve your techniques used to replicate the effects seen on the wheels, tracks, and wings of your favorite vehicles caused by their interface with the environment. This critical weathering subject, overlooked by many modelers, plays a key role in your subject's over-all realistic impression, especially if the model will be placed on a diorama or vignette. When accurately finishing a model of a specific vehicle, the historical location is identified by selecting the markings or camouflage scheme that are interesting to us, often without considering the consequences of our decision. The specific requirements of any given subject can be intimidating, and excuses are easy to find. Perhaps "it was not snowing on that day" or "the vehicle being presented was washed by the crew for Gen. Patton's visit" - why all the excuses? Is it not better to raise the bar and stand up to the challenge?

With a little patience and guidance from some of the world's best modelers presenting a full range of innovative techniques and subject specific methods, you will learn how to define your vehicle's setting and seamlessly place any subject on any groundwork by addressing the vehicle's contact with each unique surface. Within this critical aspect of weathering you will learn an entirely new range of techniques, and many of you will discover a new passion for the art of accurately connecting your favorite subjects to their environment by applying the unique wear caused by each variable including abrasive sand, bleaching sun, frozen earth and snow, and tropical humidity. These effects can easily be applied to finished models that most have around the workbench, you do not even need to finish a new kit to begin practicing.

This invaluable issue of The Weathering Magazine also holds the key to tying any subject, in any scale, to your dioramas and vignettes. With brushes, references, and The Weathering Magazine in hand, you and your next model will hit the ground running!

Sergiusz Pęczek



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PAINTING WHEELS WITH TIRES



Sergiusz Pęczek

Wheels with rubber tires are a very interesting element of wheeled vehicle models, both military and civilian. This critical element must not be neglected or overlooked as it is a defining feature that provides a great deal of information about the vehicle and its setting. The choice of the painting techniques used must produce effects that depict a close relationship with the environment in which the vehicle operated, or with the diorama terrain on which it will be placed. Reference photos used to guide an accurate reproduction of the effects of contact with a specific surface are invaluable. Different tread patterns, tire profile, size, and placement have a huge impact on the weathering of the wheels and the surrounding areas. The effects are often determined by a variety of factors - and cataloguing a range of reference photos of all types can be very helpful while working on the next model. I will show some of the most common types of surfaces on which vehicles move and the impact each environment has on rotating tires.

PREPARATION:







- 1 The entire surface of the wheel has been primed with Black OneShot Primer A.MIG-2023.
- 2 The rim was carefully airbrushed with a rusty shade of brown Shadow Rust A.MIG-043.
- 3 Once this colour was is dry, I applied two thin layers of Scratches Effects A.MIG-2010 and let it dry for 15 minutes.
- 4 The base colour was applied next, any overspray will be addressed in the following steps.



The next step was to mask the previously painted rims. I used ready-made masks from Eureka XXL Sagged Wheel Set for KTO Rosomak, but you can easily make your own masks using the Olfa circle cutter and a Frisket film.



Next, I repainted the tires with black acrylic paint to get rid of overspray created while painting the rims base colour. You can use different colours to paint the tire, each depending on the level of wear being depicted. For this model I used Rubber & Tires A.MIG-033 mixed with Satin Black A.MIG-032.



After removing the masks, a perfectly painted rim is revealed.



Old worn stiff brushes with different bristle shapes and Brass Toothpicks A.MIG-8026 were used to make chipping and scratches on the rims.



- 9 By gently moisten the surface with the water and then rubbing with a brush, I made small realistic chipping which reveals a rusty colour underneath.
- 10 The smallest chips and scratches were carefully made with the Brass Toothpick.
- For the next step, I added a more intense and vibrant colour of fresh rust using a precision felt pen.

12 To emphasize the details, a classic wash was applied over the rims.

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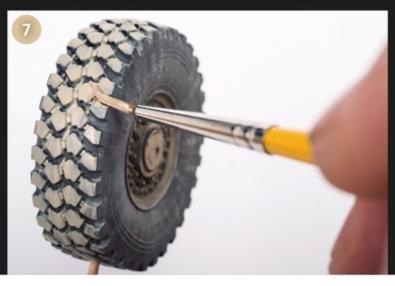
TIRES IN DRY TERRAIN ON DIRT ROADS:













- 1 I will now show how to paint a tire that is relatively clean on the sides but has a very dusty tread.
- **2** The process begins with a thin layer of Dust A.MIG-072 around the rim, the acrylic colour was applied with an airbrush.
- 3 I then drew the radial lines using the built-in brush applicator of Buff Oilbrusher A.MIG-3517. Please note that the lines run from the cavities in the tread.
- 4 Before the paint dries, I began to blend the lines with an AMMO #4 Filbert brush moistened with enamel thinner.
- **5** I corrected and adjusted the effect of radial lines using my favourite tool for removing excess wash Mr. Clean Stick II.
- **6** Dusty Earth Oilbrusher A.MIG-3523 was then directly applied to the tire tread.
- **7** Using a fine round brush and a little thinner, it is critical to ensure that the paint reaches the all recesses of the tread.









- I removed some excess paint by gently tapping over a tread face with a paper towel.
- 9 To add a texture and a matte look, I applied Europe Earth A.MIG-3004 pigment to the Dusty Earth Oilbrusher colour while it is still wet.
- The surface was dried with a hair dryer and the excess removed with a dry flat brush.
- 11 I highlighted the raised details on the tire face using the dry brush technique with the colour Matt Black A.MIG-046.



Here we can see the final appearance of the dusty wheel.

Remember that when painting wheels for a vehicle that has as many as 8, it is worth your time to pay attention to each wheel and differentiate from the others for a nuanced and much more interesting and realistic result.



TIRES IN DRY TERRAIN WITH CAKED MUD:





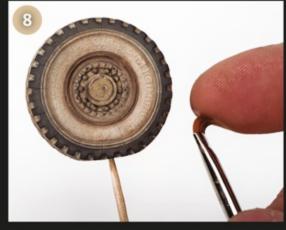














- 1 In this example we will start from the stage where we left off on the previous wheel. First, I apply the pigment Europe Earth A.MIG-3004 diluted with water around the rim.
- 2 The pigment mixture was dried quickly with air from the airbrush.
- **3** Any excess was removed with a soft flat brush while blending the line of caked mud on the side wall of the tire.
- **4** Then to both fix the pigment and diversify its colour, I applied an acrylic Dust A.MIG-072 paint layer with an airbrush.
- 5 Then using a mixture of Black A.MIG-3500 and Starship Filth A.MIG-3513 Oilbrushers and a dry brushing technique, I established the rubber colour on the outer edge where the caked dry mud has fallen and exposed the tire.

- 6 I emphasized the inner edge of the muddy area and edges the rim using Earth A.MIG-1403 enamel.
- **7** The effect is easily blended with a clean brush moistened with enamel thinner.
- **8** Using the same Earth enamel colour and a speckling technique, I flicked small dots of paint from the brush.
- 9 To finish the tire, I gently evened out the effects by applying dry Light Dust A.MIG-3002 pigment.
- 10 The finished tire once accurately weathered with an opaque layer of mud caked to the tire sidewalls.



TIRES IN DESERT ENVIRONMENT ON SAND:











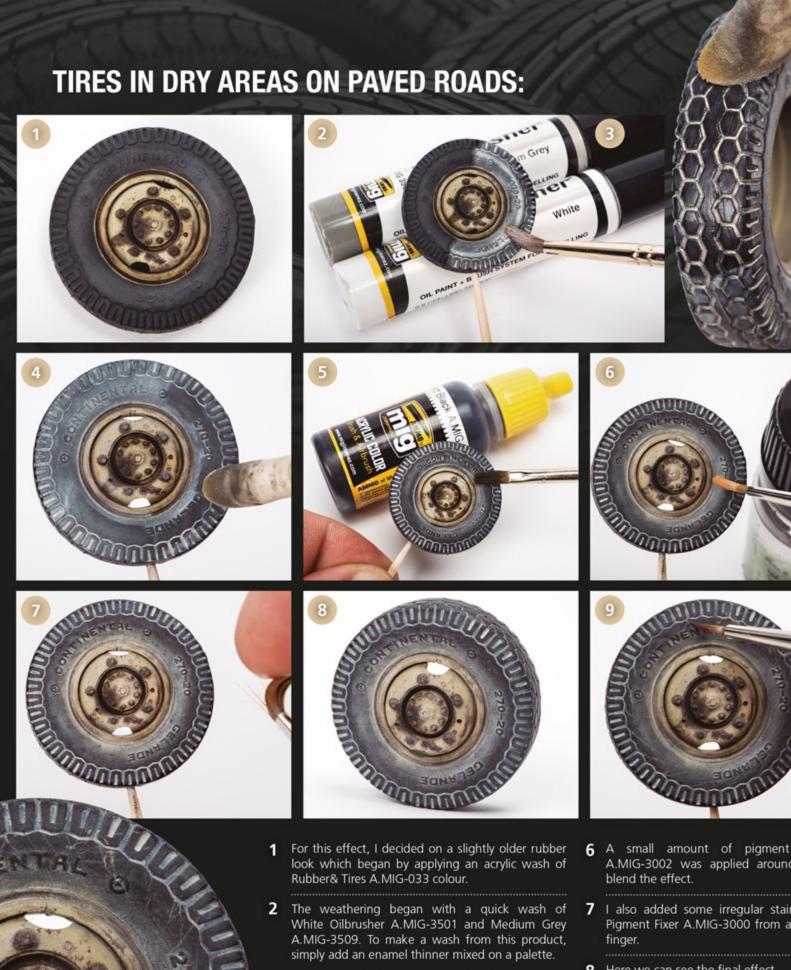


- In this example, we will explore how to realistically weather tires in a dry desert climate. The base is a black rubber colour.
- I started by applying the wet pigment Sand A.MIG-3012 mixed with water and applied on the entire surface of the tire and rim.
- 3 To dilute the pigment, you can also use enamel thinner which gives a slightly different softer effect and better adhesion.
- 4 The pigment mixture was quickly dried using air from an airbrush. Here we can see how the pigment returns to its original colour once dry.
- 5 I removed the excess with a dry brush, exposing the rubber from underneath while leaving the colour of the sand only in the recesses.

- The effect was refined with a Mr. Clean Stick moistened with an enamel thinner.
- 7 Then I permanently fixed the pigment in place by spraying the Pigment Fixer A.MIG-3000 with an airbrush at low pressure.
- The last step is to highlight the detail of the tire with a dry brush and black matt paint.
- With the final effects in place, the cumulative result of these layered effects is quite convincing.







- When the surface of a tire is in contact with asphalt, mud and dust are quickly worn away, revealing bare rubber. For this purpose, I removed the excess with help of Mr. Cleans Stick moistened with thinner.
- I also removed the dust from the sidewall of the tire.
- Again, using the tried and tested dry brush technique, the inscriptions and texture of the tread are re-established with Matt Black acrylic imitating where the dust has been removed to expose the rubber.

A small amount of pigment Light Dust A.MIG-3002 was applied around the rim to

Light Dust

Light D

- I also added some irregular stains by flicking Pigment Fixer A.MIG-3000 from a brush with a
- Here we can see the final effect.
- Very often, there is an interesting effect radial streaks on tires caused by water washing the mud from the groove of the tread when the wheel is spinning. To imitate this common detail, you just need a good Kolinsky brush and acrylic paint in a dust colour.
- 10 This effect can occur under most driving condition and climates. All you need is a reference photo to confirm the effect.

TIRES IN WET ENVIRONMENT ON MUDDY ROADS:



I again used a wheel from KTO Rosomak, this time with a green coloured rim.



The first layer of effects applied were radial lines common for large treaded tires applied with Buff A.MIG-3517 Oilbrusher.



The colour was blended to follow the radial nature of the pattern using a brush moistened with Odourless Enamel Thinner.



I removed the excess paint from the rim and details which emphasizes the lug nuts.



Then I applied Dry Steppe A.MIG-1751 medium density enamel with an old brush around the outer edge of the tire.



Using a stiff old brush, I gave more texture to the mud by working the surface.



If you want to change the colour of the mud product, you can add an Oilbrusher colour to Heavy Mud to create your own unique colour. I mixed Turned Earth A.MIG-1702 with Ochre A.MIG-3515.



First the mixture was applied to the tire tread.









- Then applied to the side wall while leaving the lighter colour applied in the previous step slightly visible.
- You can leave the mud on the tread or remove it if you are depicting a vehicle traveling on asphalt or on wet grass after travelling over muddy terrain.
- To create a truly realistic texture, you must work in stages and change the brushes used to create a range of layered effects.
- 12 To finish the wheel, I added a bit of Glossy Lucky Varnish to increase the impression of moisture on the rubber.
- 18 Final effect showing dry mud in a distinct colour layered with damp mud and wet rubber on the tread face.



TIRES COVERED WITH DRY OR WET MUDDY CLAY:



loured muddy clay.





In this example, we will depict a wheel I started by applying a quick acrylic As previously demonstrated, numercovered with a thick layer of light co- wash of Dust A.MIG-072 diluted with ous radial traces of streaking mud domly change the direction in which were painted originating from the tread depth.



To depict this effect realistically, ranthe streaks are arranged. Subtle traces were also added to the rim.















- 5 Now it's time to apply a thick layer imitating wet clay. The colour was made by mixing two light colours from the Heavy Mud range of realistically textured earth effects - Thick Soil A.MIG-1701 and Dry Light Soil A.MIG-1700 and applied it in a thick layer onto the sidewall and the tread of the tire.
- 6 A hairdryer can be used to speed up the dry time of a thick enamel product, allowing you to proceed to the next layer more quickly.
- I then used Buff A.MIG-3517 Oilbrusher to blend the clay with painted streaks.
- 8 Using an old toothbrush, some texture was added while the mud was still wet.
- 9 Once the thinner has evaporated and the effect is completely dry, Heavy Mud enamel leaves a highly realistic textured effect. If you stop at this stage, you will have the effect of dry clay.
- 10 If you want to achieve the effect of wet clay, simply apply both Satin and Glossy Lucky Varnish and blend the effect with water. Do not use enamel varnish because it may dissolve the mud and ruin the effect.
- 11 The final effect of the wheel covered with wet clay.

TIRES IN WINTER ENVIRONMENT WITH SNOW:



The last example is a wheel covered with a thin layer of dry splashed earth and dust combined with fresh snow.



I first mixed the Europe Earth A.MIG-3004 and Dark Earth A.MIG-3007 pigment blended with Odorless Enamel Thinner and applied it to the tire using the Aircobra airbrush. I really like the diversity of applying the pigments this way - it can provide a smooth even layer or select and random effects.



The base obtained is a great foundation for the effects that will follow. Be careful when handling the wheel as this layer is not completely resistant to smudging and fingerprints.



diluted with enamel thinner, I mimic the wet surface around the outer edge of the tire where the contact surface meets the snow.



Next using enamel Wet Effects A.MIG-2015 I dried the surfaces with a hairdryer and carefully applied clean Wet Effects only at the edges where the tire should appear most wet.



When the effect is dry you can see the different levels of wetness absorbed in dry pigment in a very realistic and random way. To secure the pigment, I misted it with Pigment Fixer A.MIG-3000 using an airbrush and low pressure.



7 Now it's time to apply snow. I use Citadel acrylic product named Valhallan Blizzard which was applied straight from the jar.

The effect was blended using Glossy Lucky Varnish.

The final result is very realistic showing shiny wet rubber and a flat layer of dry earth on the sides.



These BOOTS are made for walking



In this short tutorial I will show you two of the most common types of effects to occur when boots are in contact with the ground - mud and dust. I encourage you to use a more deliberate painting and shading technique using Oilbrusher paints combined with the gradual building of the effect of dust and mud using the textured enamels from the Mud & Splashes series.



















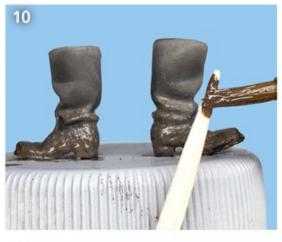


MUDDY BOOTS:

- The boots are first primed with a light gray primer Mr. Primer Surfacer
- Once dry the boot was painted using acrylics, a very dark shade of bronze was mixed using Matt Black A.MIG-046 and NATO Brown A.MIG-085 in a 1: 1 ratio.
- A range of Oilbrusher oil paints was prepared on a small palette, my mix of colors for shading German boots is Black A.MIG-3500, Dark Brown A.MIG-3512, and Light Flesh A.MIG-3519. The colors mixed together to create a palette of tones ranging from very dark brown to gray.
- 4 The darkest shade was applied to the shadows using a thin brush.
- Using a slightly thicker brush, the colors were blended so that the intensity of the color tappers of towards the upper surfaces. Always keep the brush clean and dry each time you use it.

- Next a lighter shade of grey was used to emphasize the highlights.
- Working in the opposite direction, the colors were blended with the previously painted shadow. The effects are blended while the oils are wet to create smooth transitions. An unquestionable advantage of Oilbrushers is that they offer a much faster drying time than ordinary oil paints. You can additionally speed up the drying time by applying a matt clearcoat. As you can see, I only painted the part of the boots above the ankle. We will deal with the lower area in the next stage.
- For muddy boots I use the product Heavy Mud Wet Mud A.MIG-1705 and Splashes Dry Steppe A.MIG-1751. Both products already contain a mixture of realistic textures, providing not only accurate colors but also a distinct texture of mud.
- Using a fine brush, I applied the Wet Mud to the bottom of the boots.

















16

- I added more irregular splashes by gently flicking enamel mud from the brush with a toothpick.
- Indirect effect after applying dark wet mud.
- The next step is to add a layer of a lighter colored dry mud splashed over top. The Splashes series of products are designed to imitate mud splashes.
- I use the same flicking technique again with a toothpick and brush to apply the splashes of a lighter color.
- The darkest shadows were reemphasized using the darkest shade of brown in my oil palette.
- 15 The darker shades were blended upwards.

- 16 It is impossible to fully control the splashes of mud; the effect should be random just as it is in reality. However, any errors can easily be corrected easily using a brush moistened in enamel thinner.
- 17 This cleaning step can be used to refine the effect and remove any effects that are out of place or out of scale.
- 18 The contours of the raised stitching were outlined with the lightest shade from my oil range.
- Once dry, the textured mud and earth effects will harden completely.















- I varnished the fabric surface with Acrylic Matt Lucky Varnish A.MIG-2051 using an airbrush to apply it in a thin layer.
- Notice that the shades and highlights painted with Oilbrushers are flat, while the wet and shiny satin mud is now satin and looks fresh in contrast due to the delicate layer of Matt Lucky Varnish.
- After a few minutes, the shoes are ready to be placed in their designated location on the model or diorama.

DUSTY BOOTS:



These officer boots were primed with light gray Mr. Hobby primer.



For the base color, I used the same mixture of Matt Black A.MIG-046 and NATO Brown A.MIG-085.



From my oil mixture for painting German boots, I use the darkest shade of brown and apply it into the shadows.

3



Then I blend the paint upwards with a clean and dry brush.



A grey mid-tone was used to emphasize the raised folds and creases.



This time, I blended the paint downwards by mixing it with the previously applied shadows to create smooth transitions.



I repeated the highlighting stage using a lighter tone of gray.



The shadows and highlights were blended by feathering the paint with a clean and dry brush.



Once the lighting effects are blended and dry, the boots are ready for dust. The Oilbrusher Dust A.MIG-3516 is the ideal color and medium for applying this effect. The dusty areas should also be shaded, so I use a thin brush to apply color to places that should be dusty, but only to the details where light falls from above which are the same details that I've highlighted before.



Again the colors were combined by gently blending with a dry brush.



I marked the recessed areas at the seams with the darkest tone of bronze. The 5/0 brush A.MIG-8600 from the Marta Kolinsky range series works well for this task.



I emphasize the raised stitching with Dust Oilbrusher.



13

The colors were blended and feathered creating soft transitions.



14

To intensify the effect, I placed small dots of Oilbrusher Dust onto areas prone to accumulation.



15

With a dry brush, gently dab and stipple the paint to create an irregularly blended surface.





CONTACT WITH THE CONTACT WITH



In this continuation of Kim's submarine article, we will show you how to realistically integrate the plastic model into artificial water. We will explain the technique of making realistically painted water. This method is a joy for painters and with a little patience it will provide realistic results and an excellent modelling experience.

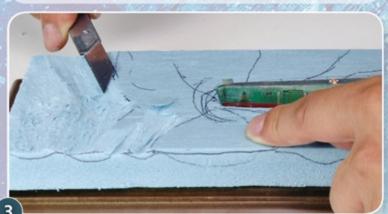


To make a water diorama and connect the model with water, we need a suitable wooden platform XPS foam board cut to the size of the base. Then we place the submarine in the required position, outlining its shape with a felt pen.



manna mi

Then the pocket were the submarine will be located is cut into the material.



After the pocket for the submarine was removed, a marker was used to draw the general direction of the ripples on the surface. A knife was used to cut out the large waves first.



Then we spread hard Mr. Hobby clay over the base, this material provides the overall shape of the waves.

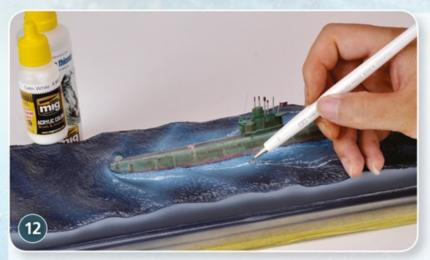






- 9 After confirming that there are no flaws, the base colour of the sea surface begins by airbrushing a base of A.MIG-123 Marine blue (75%) and A.MIG-032 Satin Black (25%).
- Next, we use the base colour from the previous step and add a little A.MIG-103 Medium Blue and A.MIG-047 Satin White into the base paint to spray on the upper area of the waves to create highlights.
- The colour of the churned sea water in the area surrounding the submarine was airbrushed with A.MIG-224 Light Blue.







Once the airbrushing is completed, Satin White A.MIG-047 and a medium-sized brush were used to paint the foam topped waves that surround a ship in motion.



Next, a gloss acrylic gel was use to paint the traces of wave peaks on the water's surface.



Then using A.MIG-2015 Wet Effects enamel, the water base was connected with the hull by applying the appearance of water and wet surfaces.



To further enhance the authenticity of the surface, waves were formed using paper tissues soaked in acrylic still water and slowly applied piece by piece with a tweezers.



Once the previous process is completely dry, a piece of sponge was used to apply Satin White in an irregular way to simulate the white foam wave caps churned up by the water lapping the hull of the submarine.



To give an even more three-dimensional appearance of the sea foam, apply small ripped pieces of white sponge in select areas where the wave foam should be most pronounced.



Finally, the entire sea surface was hand varnished with a flat brush and acrylic gloss varnish to give the surface a deep glossy effect, accurately and beautifully depicting the mighty sea.

















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ON PAVED ROADS WITH MINIMAL DUST





IN DRY ENVIRONMENT ON DUSTY ROADS





IN DRY ENVIRONMENT WITH CAKED MUD





IN WET ENVIRONMENT WITH DAMP/WET MUD





IN WET ENVIRONMENT FULLY COVERED WITH FRESH DARK MUD





IN WINTER ENVIRONMENT WITH SNOW AND ICE



ON PAVED ROADS WITH MINIMAL DUST



Minimal dust effects are necessary for this example. I selected a T26E3 Pershing from Dragon painted using A.MIG-926 Olive Drab Base and tracks painted with Dark Tracks A.MIG-035. This color was shaded by adding Dunkelgrau A.MIG-008, while the rubber pads were painted using Rubber & Tires color A.MIG-033.



Minimal dust effects are necessary for this example. I selected a T26E3 I began by applying a wash of North Africa Dust A.MIG-1404, the light Pershing from Dragon painted using A.MIG-926 Olive Drab Base and tan color creates authentic dusty surfaces very well.



Once the enamel effect has dried, the surface will be ready for pigments. I started by adding Light Dust pigment A.MIG-3002 with a brush.



Once the Light Dust pigment has been applied, I added some oil leak staining on the wheel hub by adding dark color enamel washes mixed with Wet effects A.MIG-2015.



In order to represent a vehicle traveling on paved roads with minimal dust, I added some Light Dust pigment on the rubber T26E3 Pershing wheels using a paintbrush. Next, I sprayed Mr.Color C181 semi-gloss clear to finish the road wheels and shift focus to the tracks.



To begin weathering on the track links, I applied enamel Tracks Wash A.MIG-1002 and Dry Steppe A.MIG-1751 medium density mud splashes, these colors can be mixed to create a realistic range of dark and light brown.



- Once the enamel wash had dried, I polished the raised surface of the tracks to show the surface in contact with the paved ground. An authentic metal impression was created using pigment Polished Metal A.MIG-3021 simply applied by finger.
- 8 I polished the inner tracks surface also using Polished Metal pigment applied with a flat brush, recreating the area in contact with the road wheels.
- The final touches added to the polished inner track surface, I used pencil for a clean dark metal area.
- 10 I added the final highlights of the metal tracks using acrylic color Polished Metal A.MIG-192 applied with a fine paintbrush. Now the tracks have a convincingly realistic metal look.
- 11 Final step was to add some deep dark contrast to the tracks using Tracks Wash A.MIG-1002 and Brown Wash for German Dark Yellow A.MIG-1000. Just remember that the paved roads only require a minimal dust covering.











IN DRY ENVIRONMENT ON DUSTY ROADS



For this example, I used the running gear of a Tamiya Jagdtiger, I began by painting the steel road wheel faces with RAL 7028 DG I Dunkelgelb and the track links were painted with Dark Tracks A.MIG-035 and Dunkelgrau A.MIG.008 for darker tones.



Enamel pin washes were added using the colors Rust Effects A.MIG-1204 and Brown for Dark Yellow A.MIG-1511. A brush was dampened with Odorless Thinner to blend the washes into and around bolts and nuts while removing the excess and unwanted wash.







- Once the enamel paints have dried, I added pigments Light Dust A.MIG-3002 and Airfield Dust A.MIG-3011, ideal for subjects depicted on dusty roads.
- 4 The pigments are then permanently fixed in place using Pigment Fixer A.MIG-3000



- After the Pigment Fixer had dried, a pin wash added and fresh oil leaks and staining added by mixing brown enamel with Wet effects A.MIG-2015. Once dry, the contact surface of the wheels and teeth of the drive sprocket were polished.
- The Jagdtiger track links first received a layer of light tan dust created by mixing various pigments with enamel North Africa Dust A.MIG.1404 used to apply moderate dust accumulations on the tracks surface.







- Once the first dust effect dried, I added variation by applying dry pigments Light Dust and Airfield Dust. Once the pigments are correctly placed they were permanently fixed using Pigment Fixer A.MIG-3000.
- 8 A basic metal appearance was added by running a fingertip loaded with Polished Metal pigment A.MIG.3021 over the edges of the tracks surface.
- 9 To realistically represent bare metal exposed by the steel road wheels contact with the tracks inner face, I applied Polished Metal pigment.
- 10 The final touches of the dry environment were represented by adding dry pigments randomly creating dusty effects which cover the tracks and wheels.







- I selected the running gear of a Tiger I as the subject for the dry environment with caked mud. The kit is the RFM TIGER I Initial Production 1943. The track runs were base painted with Dark Tracks A.MIG-035 and Dunkelgrau A.MIG-008, while RAL 8020 Gelbraun A.MIG-016 was applied to the wheels.
- Forced air from my airbrush was used to apply a splashed and textured dry soil effect using Dry Steppe A.MIG.1751 diluted with Enamel Odorless Thinner A.MIG-2019.
- Once the yellow brown textured splashed effects have dried, I used the dry brushing technique to blend the wheels while also cleaning the rubber road wheel surface with enamel thinner.
- 4 At this stage, dry mud can be added to the road wheels. Light colored pigment is ideal for creating the effects caused by the desert. I applied Thick Soil A.MIG-1701 mixed with Sand pigments A.MIG-3012 and North Africa Dust A.MIG-3003 to create a foundation of caked dry mud which is applied with a toothpick.
- 5 A dry mud textured layer was applied by adding dry pigments of a similar color, and then removing the effect from the rubber.
- To begin weathering the track runs, I dropped the pigments Sand and North Africa dust over the track links and fixed them in place with fixer and left the tracks to dry.
- Now I added accumulations of dry mud to the tracks using Thick Soil A.MIG-1701 from the Heavy Mud range which features a realistic earth texture and was easily applied to small areas using a toothpick.





IN WET ENVIRONMENT WITH DAMP/WET MUD







- Thick Soil Moist Ground Plant Earth Minist Ground Plant Plant Ing Plant Ing Plant Ing Plant Ing
- The process begins with painting the Panther Ausf G steel wheels and tracks. I used German Standard Colors 1944-1945 Smart Set A.MIG-7141 and used A.MIG-035 Dark Tracks and Rust Tracks A.MIG-034 colors for each track run.
- The initial weathering began with a pin wash of Brown for Dark Yellow A.MIG-1511 and Streaking Grime for DAK A.MIG-1201.
- For this wet environment, I created mud textures using Splashes Effects on the road wheels. First, I applied Turned Dirt A.MIG-1753 by blowing air from airbrush over the brush to create splashed effects. Once dry, the results are impressive.
- 4 Here we can see the results of the damp and wet mud application using various mixtures of Heavy Mud and Pigments. I used Thick Soil A.MIG-1701 for the brown mud color and Moist Ground A.MIG-1703 for darker brown tones. For more varied mud textures and different mud tones, I mixed in pigments using Dark Earth A.MIG 3007 and Airfield Dust A.MIG-3011.
- 5 I used a toothpick for adding mud directly to the road wheels and drive sprocket wheel. Stay focused and be sure to add the mud randomly for a realistic final effect.
- The Panther's track start with a wash using enamel North Africa Dust pigment and Turned Dirt diluted with Enamel Odorless Thinner. These colors recreate a layer of light damp mud covering the tracks.







Once the first wash colors have dried completely, I added the Heavy Mud and the pigment mixture to the tracks focusing on the outer surface of the tracks.



Once the damp mud effects have dried, I added a few final realistic touches by adding A.MIG-2015 Wet Effects onto the wheels and tracks.



To apply a polished metal surface to the tracks, drive sprocket teeth, and edges of wheels, I applied a silver colored pencil to recreate bare metal.



For the worn inner surface of the tracks, I used a flat brush to apply Polished Metal pigment A.MIG-3021.



IN WET ENVIRONMENT FULLY COVERED WITH FRESH DARK MUD





wet environment. I used the Takom Bergepanther Ausf. A. painted with A.MIG-1511 and North Africa Dust A.MIG-1404.

For this example, we will show how to recreate fresh dark mud in a A pin wash was applied using enamel Brown for Dark Yellow



I have recreated fresh dark mud splashes on the vehicle and running gear. I applied the Medium Density Mud Splashes colors Turned Dirt A.MIG-1753 and Damp Earth A.MIG-1754 to give the appearance of wet and textured mud.



I applied the mixture of mud and pigments Wet Mud A.MIG-1705, Wet Ground A.MIG-1755, Dark Earth pigment A.MIG 3007 and a darker tone of mud was created by adding Russian Earth pigments A.MIG-3014 . I also added some leaves made with a leaf punch and dry grass made from the bristles of an old brush which have been sprayed dark yellow. These materials were mixed and applied to create wet mud with grass and the effects of a wet and muddy environment on the vehicle's running gear.



A close-up shot working to add fresh mud. I carefully used a toothpick which makes the task easy. This variety of combined and layered products look beautiful and create hyper-realistic effects.



The appearance once the mud effects have completely dried. I created a polished metal finish by simply rubbing a silver color pencil on the wheel rim in contact with the guide horns and the drive sprocket teeth.











- Next, we will explore weathering the tracks. I used Damp Earth A.MIG-1754 diluted with Enamel Odorless Thinner A.MIG-2019 which produce a semi-gloss finish accurately depicting wet mud.
- 8 Before the Damp Earth splashed effects were dry, I added dry pigment Russian Earth A.MIG 3014 to the tracks surface.
- The track runs received a heavy application of fresh mud using Damp Earth A.MIG-1754 to represent running gear covered with fresh dark mud mixed with dry grass and leaves.
- 10 The polished metal of the track surfaces was treated to a mix of Polished Metal A.MIG-192 acrylic color and Polished Metal pigments A.MIG-3021 applied with a brush.
- 11 The final effects of fresh mud. I applied Wet Ground A.MIG-1755 splashes randomly over the tracks and wheels.



IN WINTER ENVIRONMENT WITH SNOW AND ICE







- Wet Mud A Property Amount of the Control of the Con
- Wet Mud Programmer Pigment Pig

- For the winter environment example, I selected Panzer IV running gear. The tracks and wheels were painted with the German Standard Colors 1944-45 set A.MIG-7141. The camouflage was airbrush using AMMO acrylic colors RAL 6011 RESEDAGRÜN A.MIG-003, RAL 7028 DUNKELGELB AUS '44 DG I A.MIG-011, and RAL 8017 SCHOKOBRAUN A.MIG-015.
- Next the areas of the drive sprocket worn by metal on metal contact were painted with Polished Metal color A.MIG-192.
- 3 The weathering begins with the dense and realistically textured earth product Wet Ground A.MIG 1755 used to recreate textured mud and splashed effects on the road wheels. The same effect was diluted with Enamel Odorless Thinner A.MIG-2018 to create a wash for the tracks. Once dry, the running gear was ready for the snow effects.
- Here we can see the range of products used to create these realistic effects. I applied Wet Mud A.MIG 1705 mixed with the pigment Russian Earth A.MIG.3014, while the snow was represented with standard baking soda. To recreate a realistic winter environment, I have added dry grass and some leaves. White glue was used as a strong adhesive, while Wet Effects were applied for the final touches of realism on the snow.
- 5 For the winter environment with snow, I create snow mixed with Wet Mud for the base. A toothpick was used to add snow to the mud, while dry grass and leaves were mixed in randomly to create a range of realistic effects.



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Now the full of snow effect can be added, for this task I used baking soda mixed the white glue and continue adding layers of snow on top of the previously applied mud and snow layer. The picture shows the drive sprocket packed with the snow effect.



I added Wet Effect A.MIG-2015 to the snow using a paintbrush, the effect was added directly from the jar. The running gear of the Panzer IV shown in a snowy winter environment with some dry grass and small leaves in place. The rubber surfaces of the road wheels have been slightly cleaned to show the result of contact with the tracks.



The tracks show the effects of snow mixed with wet mud packed into each link, creating the appearance of dampness and wetness.



This image shows snow added on the tracks, realistically depicting snow effects with dry grass in a muddy environment. Select areas of







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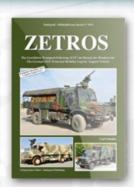
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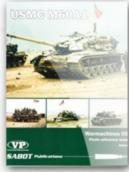
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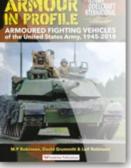
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- The kits base colour was painted with NATO Green A.MIG-0084 and Matt Black A.MIG-0046. Once dry, I applied pin washes with Dark Brown Wash for Green Vehicles A.MIG-1005 and added general stains and weathering effects using several Oilbrusher colours.
- A preliminary dusting was added to the wheels using several colours from the Splashes range Dry Steppe A.MIG-1751, Loose Ground A.MIG-1752, and Turned Dirt A.MIG-1753 each diluted with Enamel Odourless Thinner. This initial dusting serves as a base for the mud effects to follow.
- When the effects have dried slightly, the excess can be removed by gently dabbing the surface with a sponge. This will create an irregular texture that can be tweaked and adjusted to your taste with a paintbrush.
- The tracks and wheels are treated to the same range of effects described above. Be sure to address all nooks and crannies, the inside faces of the road wheels, and all other difficult to reach surfaces that will be visible from certain angles once the model is finished.



An additional dusty layer begins with an airbrushed layer of Scratches Effects A.MIG-2010 on the sides of the vehicle, followed by a coat of Light Grey Matt Humbrol no.94 when dry. Once dry, moisten the surface with water and then lightly drag a brush downwards to remove some of the enamel paint.



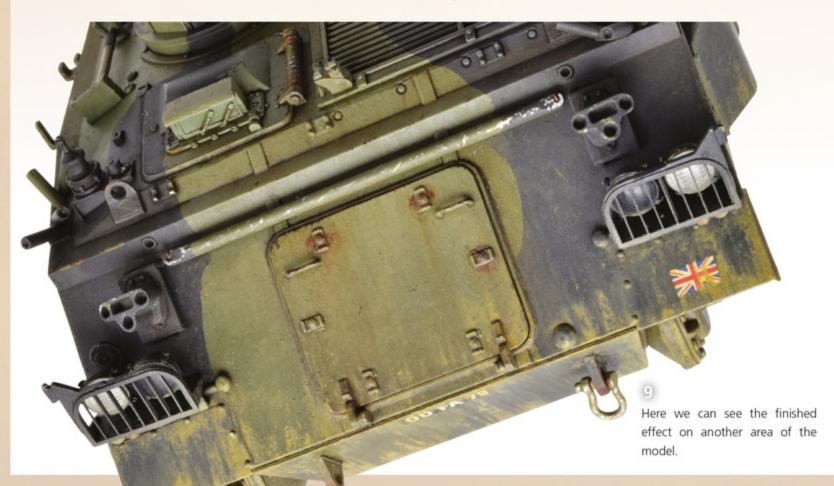
The same areas were moistened with enamel thinner and a brush used to drag the effects downwards while creating both heavy and light mud streaking on the sides.



To emphasize certain areas, vertical streaks were then added using a similar tone to the one used in the previous step.



The effect will begin to dry within minutes and then the excess can then the excess can be removed and the effect blended from the bottom to the top using a brush moistened with Enamel Odourless Thinner A.MIG-2019.





Work began on the lower areas of the FV432 to recreate mud using Thick Soil A.MIG-1701 with a brush, applying a random pattern for a natural look.



Once the effects have partially dried, I began adding textures with a pair of tweezers by drag them back



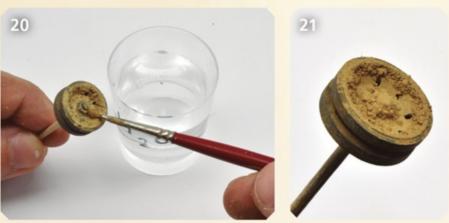


16

- The same product must be applied to the running gear, focusing on corners and crevices where mud and earth tends to build up on the real vehicle.
- To avoid tide marks, the edges have been blended with enamel thinner and any excess removed from the surface.
- 14 We can also use a crackle medium in specific areas, this provides an authentic presents of dried and crackled mud. This technique is somewhat difficult to control but with some practice, you can create really eye-catching and highly realistic effects.
- 15 After the previous mud layer has dried, mud splashes were applied over the running gear with colours from the Splashes range ranging from the lightest to the darkest.
- 16 This process was repeated on vertical areas of the model and limited to the specific areas where the tracks tend to kick up and throw lots of mud only.









- 19 Next, a mixture of an earth acrylic colour, plaster, a small amount of fine dirt, and crackle medium was applied to the edges of some wheels.
- For the intermediate areas of the wheels, the previous mixture was thinned with water to create the consistency of very loose mud. The outer edges maintain the thicker accumulations created in the previous step.
- 21 Once dry, you can see how the authentic cracks start to show up on the surface, accurately imitating dry mud.
- Earth tones can be added to the wheel hubs with enamel products Earth A.MIG-1403 and Dark Mud A.MIG-1405 and blended to remove any hard edges.
- 23 In order to maximize contrast, a different earth tone was applied to the wheels as shown on this drive wheel, where Turned Earth A.MIG-1702 was applied.



real dirt was applied

the effect.

over the tracks; the dirt adds another texture to



Next, plumber's hemp fibres were dyed with Green Base A.MIG-0916 and added to the tracks, then fixed in place using Sand & Gravel Glue A.MIG-2012.



Once the glue has dried, the grass was blended into the tracks using the washes and earth-coloured splashes used in the surrounding areas.



The upper surfaces of the model received applications of products from the Splashes range as well. The colours are diluted and mixed with pigments and a little fine dirt added to recreate dust and sand build-up in specific zones.



Next a base was made with a piece of blue board which is extruded polystyrene. Then a fine layer of modelling clay was added to create the basic shapes of the groundwork.



Work continued with marking the area where I wanted the road to be. Then texture was added to the vegetation area with real dirt and pebbles which were fixed in place using Sand & Gravel Glue.



Acrylic mud product Light Soil Ground A.MIG-2102 was applied onto the road, covering the entire area and imprinting the basic shape of the track and tire marks left by vehicles.





Another mixture of acrylic paint, plaster, dirt, and crackle medium was used to accent the outer edge of the tire and track marks. These areas must end up showing a dried and cracked mud aspect, just as observed in references and in reality.



The groundwork was then painted with acrylic earth tones followed by washes to highlight the soil texture.



White glue can be used to fix any type of vegetation you choose for the scene.

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Finally, the model was glued in place with Slow Dry Cyanoacrylate A.MIG-8013 and the tracks tied into the groundwork with applications of Loose Ground A.MIG-1752 and Dry Steppe A.MIG-1751.



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Daniel Morcillo

In this article we will see how to make two completely opposite weathering effects by covering desert environments and humid forest settings, both begining from the same base. For this we will use the legs of a RGM-79 'GM' from the gundam universe. Nothing better to perform this tutorial given the all-terrain nature of this unit.



Both legs were painted in the same way while applying slight highlights to the centers of panels and a satin finish.



The leg to be used for the desert environment receives a second and more intense highlight in the center of the panels to represent paint bleached by the sun.



All surfaces received Ultra-Matt Lucky Varnish to represent the erosion suffered by the surface of the paint from continuous contact with the abrasive desert sand. The leg to be depicted in a humid forest remains its original satin finish.



6/7

The next step is to add signs of dirt being dragged by the rain in a humid environment. This effect is very simple to depict, first apply several dots of oil of different colors like green, brown, and gray and let them dry for 5 minutes before using a flat brush slightly moistened in enamel thinner to drag the dots downwards in the direction of gravity.



A.MIG 3501

mig

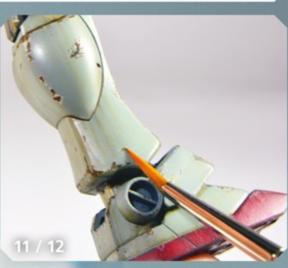


Oilbrushers can also be sued to increase the impression of paint faded by the sun. A little white oil color was applied to the surfaces to be highlighted and blended with a brush dampened with thinner.



The differences betweeen the two examples is clear, each indicating what weather and environmental conditions the subject has been exposed to.





A striaghtforward application of Streaking Rust Effects A.MIG-1204 was applied to both examples.



The next step was to add dirt and grease staining to the upper mechanical part of the legs. For the leg depicted in a humid environment, the Engine Grime product A.MIG-1407 was sipled into place. Once dry, a damp brush was used to drag the effect in the direction of gravity.



For the leg depicted operating in a desert climate, the Scratches Effects product was airbrushed in place, followed an fine airbrushed layer of Engine Grime. Once allowed to dry for 15 minutes, the area was moistened with water which lifts areas of the effect leaving a realistically varied effect.

Next an effect of grease and fresh dirt was applied to the legs in 15 a humid climate and the effect of dry grease and dirt on the legs in a desert climate.





To simulate dust accumulations, the same technique used for the dry grease on the upper leg was again used. First the Scratches Effects fluid was airbrushed in place, once dry a thin layer of North Africa Dust effect was airbrushed in an irregular way to avoid a uniform appearence.



A mixture of Sand pigment and Kursk Soil product was applied to the recesses to simulate areas where dirt and dust have accumulated into deeper features. The effect was softened using a brush moistened with thinner to blend the effect and integrate it into the previous effects.







Finally Sand pigment was applied dry over the entire surface to unify all the dusting work.

20 / 21
Returning to the leg depicted in humid weather, first apply Earth Effect product using a brush and a tapping motion. Once dry, the effect was dragged in the direction of gravity with a brush moistened in enamel thinner.





Splashed earth was depicted using the textured effect Turned Dirt product placed first to represent older deposits of dry mud and then Wet Ground product for the most recent and wet splashes. They were applied by dipping the brush in the product and then blowing air across the brush with the airbrush. If the stains are too large or you don't like how they are arranged, they can be blended or removed with a brush moistened in enamel thinner.





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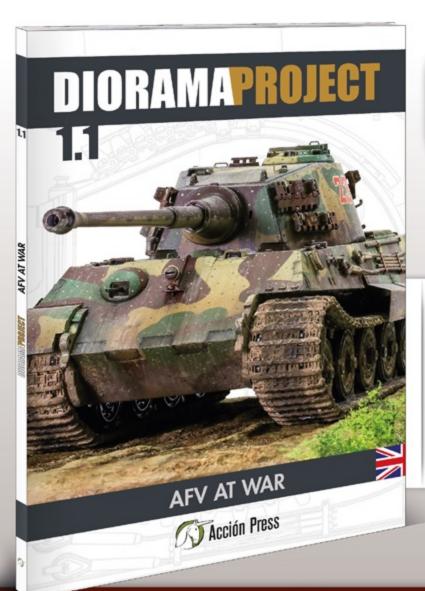
Finally, Wet Ground effect was applied into the recesses to represent accumulations of fresh mud. Before this enamel effect dries, a dusting of Russian Earth pigment was dusted over the surface. Once dry the excess pigment was simply removed with a brush. With these layered effects, the impression of drying textured mud in various states of dampness is convincing.



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Here we can see clearly how when beginning from the exact same base, the choice of colors, textures, and effects used must be specific to your subjects setting. Always have a clear understanding of the correct colors and layered effects to be used for the most convincing and realistic results.

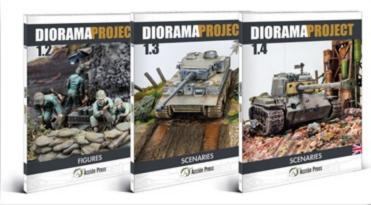




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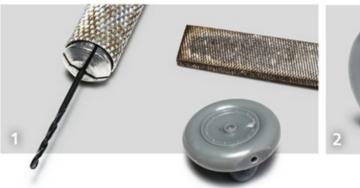
Depending on the aircraft type and airstrip being modelled, the wheels must be weathered accordingly. Aircraft operate from concrete runways as well as the sand and gravel surfaces of improvised landing strips in arid areas, muddy terrain, and grass fields. All these different ground types affect the final appearance of the wheels.

Next, we are going to see the most frequently used surfaces onto which aircraft have operated throughout history, as well as the fading and weathering effects they generate.

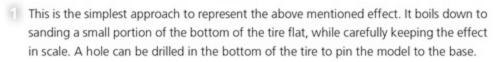
MODERN SURFACES _ CARRIER DECKS

WEIGHTED AIRCRAFT TIRES:

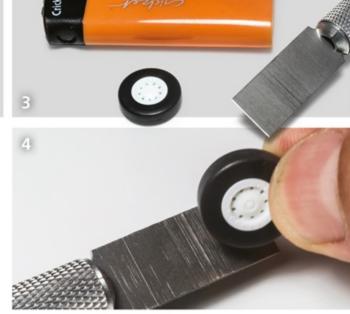
One important detail is the bulging created in the tires by the weight of the plane. This effect is normally more pronounced on carrier-based aircraft, on these examples the tires tend to have reduced air pressure to help dampen the shock during landing, especially on WWII planes which had a less developed shock and strut than those fitted to modern aircraft.







- If the effect is correct, the wheel will rest level and flush with the ground with no deviation.
- Another option used to recreate weighted tires is heating up a small metal plate and / immediately pressing the wheel down onto the heated surface. This method is somewhat risky because it can ruin the part if either too much heat or excessive force is used. Performing a few tests and practicing first using scrap parts is highly advisable.
- 5 In our opinion, the best representation is achieved using epoxy putty. Apply a small amount of putty to the point where the wheel contacts the ground to create the bulging effect. The correct shape can be modelled with a brush moistened with water. Once it has hardened, we can refine and correct the shape with sandpaper.





WEATHERING:

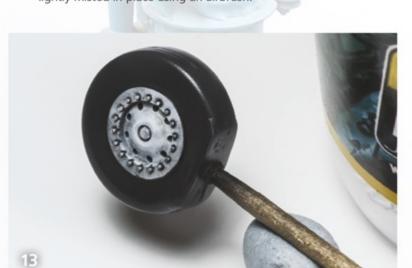
Carrier decks don't tend to accumulate lots of dirt, but in the real world there are no completely clean surfaces. Salty residue from seawater, suspended dust, and even the wearing of the tire itself can lighten the colour on the tread pattern.





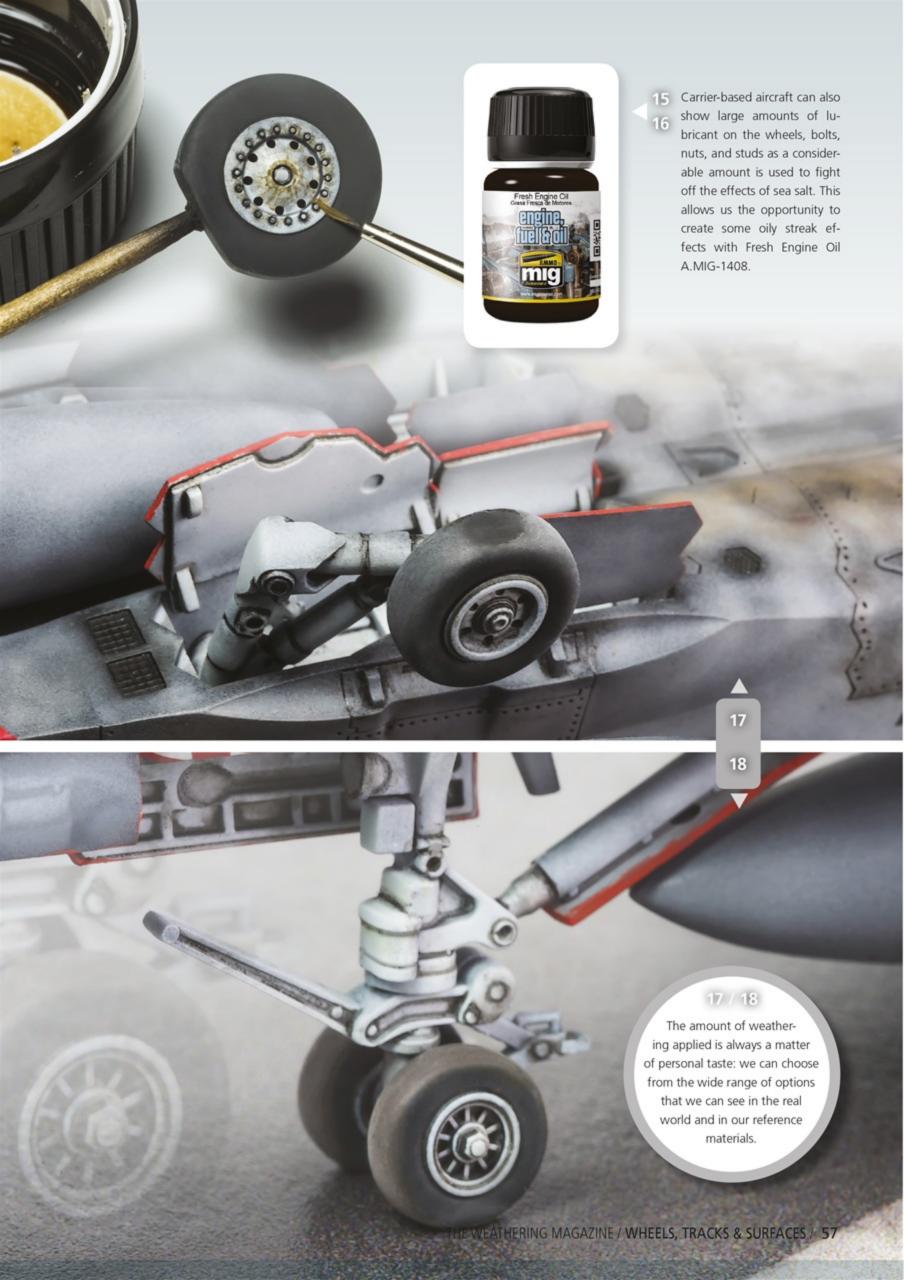
- The entire wheel is first primed in black with One Shot Primer Black A.MIG-2023. Then the tire is painted using Satin White A.MIG-0047 without completely covering the surface which allows the black primer to create some shading. Finally, the entire surface of the tire receives two coats of Rubber &Tires A.MIG-0033 using a brush.
- Next, a wash of PLW Black Night A.MIG-1611 was applied to get more depth around the details.
- Pigment colour Concrete A.MIG-3010 was used to depict dust and dirt on the tire and fixed in place with a small amount of Enamel Odourless Thinner A.MIG-2019
- First apply the pigment over the tread using a brush and a gentle rubbing motion.
- Then the area is moistened with Enamel Odourless Thinner which is lightly misted in place using an airbrush.







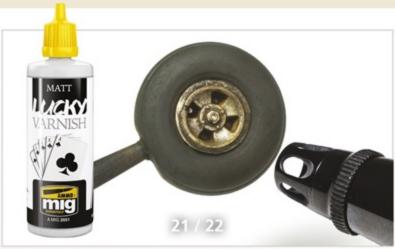
The intensity of the effect will be toned down a bit as the thinner dries. We can repeat the process in order to enhance the dust or alternatively gently scrub the surface with a brush to subdue it until we get the desired effect.



DESERT AND DRY EARTH AIRFIELDS

Now we are going to see how to apply the distinctive weathering effects created in dry and dusty bare earth landing strips, typical of desert and arid zones. Encrusted dust will be the main weathering feature on the tires, as well as the mixture of dust with oil and grease effects combined onto specific areas of the landing gear.







19 / 20

Once the wheel has been painted, an earth colour wash of Kursk Soil A.MIG-1400 diluted with Enamel Odourless Thinner was applied. Once dry, a second wash was added this time using PLW Black Night A.MIG-1611. This combination accurately represents a realistic mixture of dust and lubricating fluid.

21 / 22

Then we apply a matt coat using Lucky Varnish Matt A.MIG-2051; this varnished surface provides good grip for the pigments.

23 / 24

Start by adding a dark pigment tone such as Dark Earth A.MIG-3007 to the entire surface of the tire.

25 / 26

Next, apply the lighter shade North Africa Dust A.MIG-3003 over it, focusing more on the tread to create a more varied dirt pattern. Rub a clean dry brush onto the surface until only the amount of dust and dirt that we want remains on the surface.



Finally we seal the pigments with a mix of 30% Pigment Fixer A.MIG-3000 and 70% Enamel Odourless Thinner A.MIG-2019.





DAMP EARTH AIRFIELDS

For representing aircraft using airfields located in humid areas, like those of Europe and Asia during WWII, earth and mud can produce irregular stains of different tones depending on the amount of dampness and local soil. Let's see how to represent this type of weathering on landing gear.















- Begin by applying a generous coat of Enamel Odourless Thinner A.MIG-2019 which will serve to fix the pigments in place.
- 31 While the thinner is still wet, proceed to apply small quantities of a dark pig-
- ment tone randomly by using a fine brush; for this example Russian Earth A.MIG-3014 was used.
- 33 These simple steps create a nice pattern of random and irregular staining. Before continuing it's necessary to wait until the pigment is completely dry.
- 34 Once dry, the surface was moistened again with Enamel Odourless Thinner, but
- this time using the airbrush to avoid disturbing the already applied pigments. Then more pigments were added in the same fashion using a lighter colour like Europe Earth A.MIG-3004.
- 36 When the thinner dries you can see how many stains of different tones mixed together appear, creating a realistic effect of a layer of earth with varying amounts of dampness. The contrast can be softened by applying the correct pigment tone dry. Alternatively, the wheel can be cleaned up a little by rubbing it with a dry brush.
- 37 The weathering of the wheel continues by applying
- a random wash of Earth A.MIG-1403. Once dry, a dark wash is added into crevices and around details using PLW Deep Brown A.MIG-1618.



With these easy steps, you can accurately represent the irregular stains characteristic of wet earth airfields.



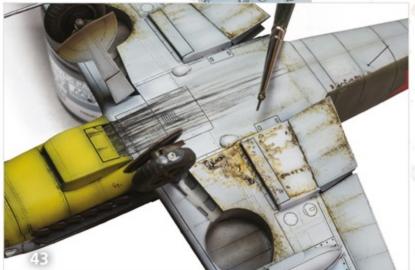
MUD SPLASHES ON THE LOWER SURFACES

The wettest landing zones drenched with rain water and lousy with puddles, causes the wheels to splash mud over the lower surfaces of the wing and fuselage, leaving distinctive earth stains and rooster tails. This effect is quite often forgotten by modelers building planes operating in winter or in humid areas. Don't make the same mistake!





First, recreate random stains produced by old splashes, which have accumulated around nuts, bolts, and corners over time. We will use three earthen oil shades to represent different intensities, for this example Oilbrushers: Dark Brown A.MIG-3512, Dark Mud A.MIG-3508 and Summer Soil A.MIG-3534.



Start off by applying the three oil colours with a fine brush, apply the darkest tone to the areas where you want to accent the dirt and grime, and the lightest onto the areas that require subtler staining.



With a fine brush moistened in Enamel Odourless Thinner A.MIG-2019, a stippling motion was used to feather the oil dots in order to blend them as well as to remove the excess.



The oil paint can be worked at ease until an irregular pattern of dirt stains is created, with more earth and mud built up in certain areas than others, particularly on the inner sides of the wheels.



Don't forget the stains sprayed by the tail wheel, which can even reach the lower surfaces of the stabilizers.

- 47 Now to explore how to apply more recent splashes that still maintain their shape and texture. AMMO's products from the Splashes series are perfect for this effect. In this example the reference Damp Earth A.MIG-1754 was used.
- 48 It's a good idea to make a few test runs on a piece of paper or an old model first. Load a large brush, round or flat, with the splashes product and flick it with a finger from a distance of a few inches away from the surface.









- 49 Once you have the hang of it and have figured out the right flicking distance for an accurate spray pattern, you can begin applying the splashes onto the entire wheel area, focusing on the area behind the gear.
- 50 Any unwanted splatter marks can easily be cleaned and removed using a brush moistened with Enamel Odourless Enamel Thinner.
- The two splashed effects -old and newer stains- can be combined and layered in any way that you choose. Don't forget to also weather the wheels as shown in the section dedicated to damp earth airfields.



MODERN AIRBASES

The dirt and grime of the more modern airbases can vary a great deal. From wet and damp surfaces that leave a clean tread pattern on the tires, to more dusty strips found in arid locations. We must choose our weathering type according to the area of operation for the aircraft being modelled. Let's see how to depict the most common type of weathering effects, where dust in the air and on the landing area ends up embedded in the treads to a greater or lesser extent. In this case, the most adequate course of action is weathering just the tread using a light dust shade accurate for the airfield's loction.





- 54 First the wheel is painted following the process demonstrated in the section about carrier decks.
- 55 Then a dark wash was applied to
 56 the tire to represent the accumulation of grease and oil in the nooks
 and crannies. For this model PLW
 Blue Black A.MIG-1617 was used
 for this step.



57 / 58

Once dry, continue by airbrushing the enamel weathering product Light Dust A.MIG-1401 to apply the dust effect onto the treads. It can be done freehand by simply spraying the tread pattern head-on, with a little care you will not even need to mask the sidewalls.



If some overspray effects the sidewalls or the effect is way overdone and out of scale, we can clean it up with a brush dampened with Enamel Odourless Thinner A.MIG-2019. Finally, another dark wash was applied into the tread pattern using PLW Blue Black A.MIG-1617 in order to add some depth to the sunken details.



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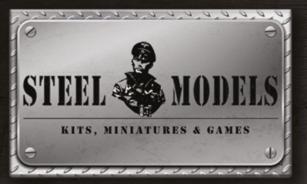
















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IN THE NEXT ISSUE...

By Sergiusz Pęczek

MODERN WARFARE

This year, we celebrate the 100th anniversary of the end of the First World War - the first war influenced by the innovations of aerial warfare, the first conflict in which the cutting-edge technology of tanks and artillery would revolutionize warfare.

We also celebrated another anniversary, it has been 73 years since the end of the largest conflict the world has known. The conflict commonly referred to as the Second World War consumed tens of millions of lives. The epic struggle also revolutionized warfare and spurred the development of new types of weapons, technology, and strategy. I remember the first-hand stories told to me by my grandfather when I was a little boy. At the time I was very excited to learn of the details he had kept in mind regarding the guns and vehicles with which he had contact as a soldier, while simultaneously terrified by the prospect of seeing history repeat itself. I grew up during the final years of the Cold War in Poland, a country belonging to the Warsaw Pact. The spectre of the approaching American ballistic missiles was very bleak. Despite the rivalry and tension between the superpowers my childhood passed calmly. As I grew up, the threat of a global apocalypse gave way to a secure calm. That was until the now symbolic date of June 4th, 1989, when after more than four decades of life in the communist native semi-independent go-

country - the Poles elected a transformative semi-independent government. Could I boldly proclaim to live in a time of peace? Really! Approximately 2,500 minor and major conflicts including civil wars have occurred since the end of World War II. Some of them have been going on for decades, claiming more victims every year. When we look at the history of wars, we must honestly say - people have been and will likely continue to engage in and revolutionize warfare. The countless resources invested in the advancement of AFV's, aircraft, unmanned vehicles, and smart weapons are the proof. In the next issue of The Weathering magazine, we want to bring you the contemporary achievements of military technology in scale. Recent years have brought us a glut of model kits depicting most modern military equipment. Sometimes models of the most up to date tanks appear a few months after the official presentation of real ones! These cuttingedge kits combined with the limitless supply of reference materials make the ideal ingredients for modelers, even those primarily focused on other subjects.

History leaves no illusion as to future possibilities, but I am hopeful that the world will only experience modern weapons as models on shelves and dioramas and not in person.



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