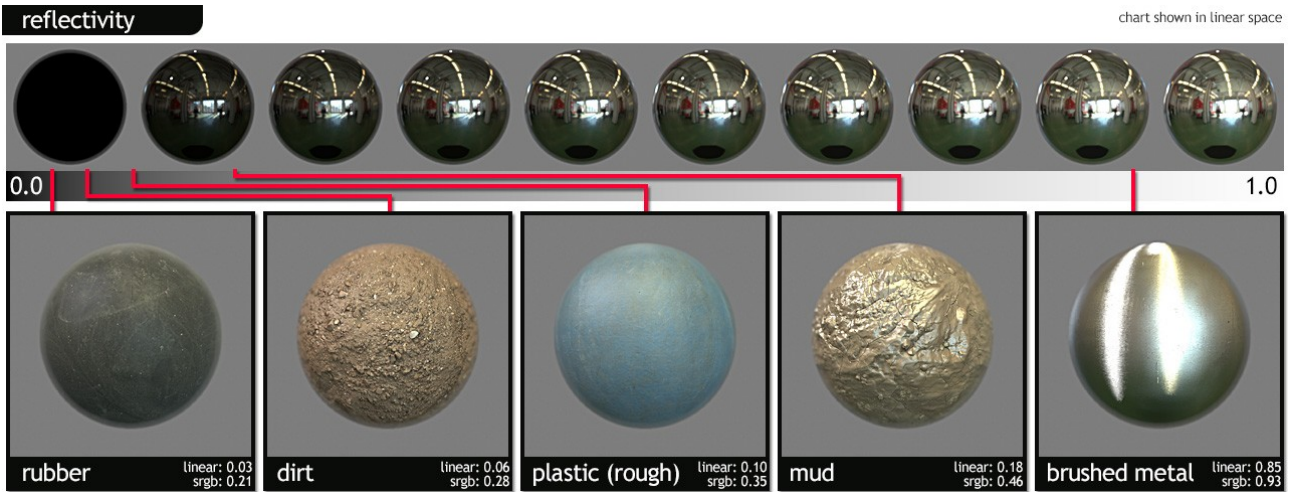




# Metalness

This texture expresses how reflections are affected by object color.

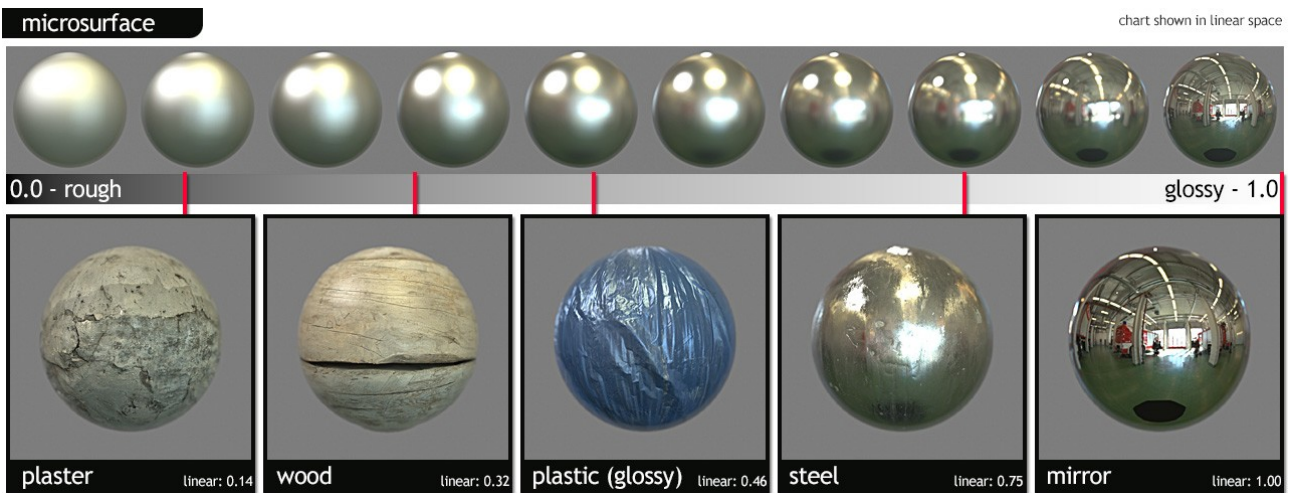


<https://www.marmoset.co/posts/physically-based-rendering-and-you-can-too/>

As a developer, we will only have to wonder if the material we want to represent is made of metal (electrical conductor) or an insulation. For X-Plane the following rule has to be followed for the textures: the more metallic, the whiter.

# Glossiness

This setting is about the surface of the object. Its opposite, roughness, is maybe simpler to understand.
























<https://www.marmoset.co/posts/physically-based-rendering-and-you-can-too/>

In X-Plane we will need the glossiness. Namely, for our textures: the smoother surface, the whiter.


# Get the needed gray

To choose those two settings a table as the following one can be used:

**material values chart** [www.marmoset.co/toolbag/learn](http://www.marmoset.co/toolbag/learn)

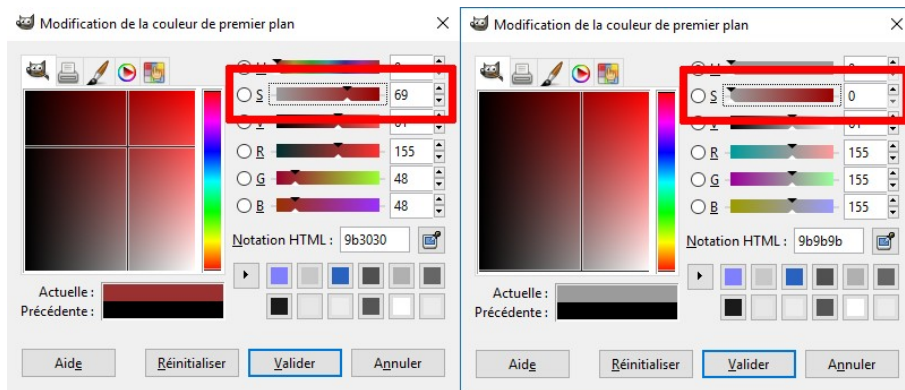
 a m r	 a m r	 a m r	 a m r	 a m r	 a m r	 a m r
 a m r	 a m r	 a m r	 a m r	 a m r	 a m r	 a m r
 a m r	 a m r	 a m r	 a m r	 a m r	 a m r	 a m r

a = albedo (sRGB)
m = microsurface (linear)
r = reflectivity (sRGB)



<https://www.marmoset.co/posts/physically-based-rendering-and-you-can-too/>  
a -> albedo (= diffuse) : base color, m -> metalness, r -> glossiness

These colors can be directly used in Gimp by opening this picture and using the “pipette”. Be careful, it is required to convert these colors to gray by reducing their saturation to zero:



## X-Plane specific operations

Following the previous steps, we can get two images, one showing the metalness of our object and a second one its glossiness. There is still a bit of work to do because X-Plane developers didn't choose to add new textures, but preferred to integrate this information into the normal map (the texture used to create some fake relief by changing light interactions).

A color picture with transparency (such as X-Plane textures) have four canals: red, green, blue and alpha (transparency). The “sum” of these four canals render the final picture (just like our screens' pixels work).

For X-Plane it will be required to replace information in usual normal maps: the blue canal must be replaced by metalness and alpha canal by glossiness.

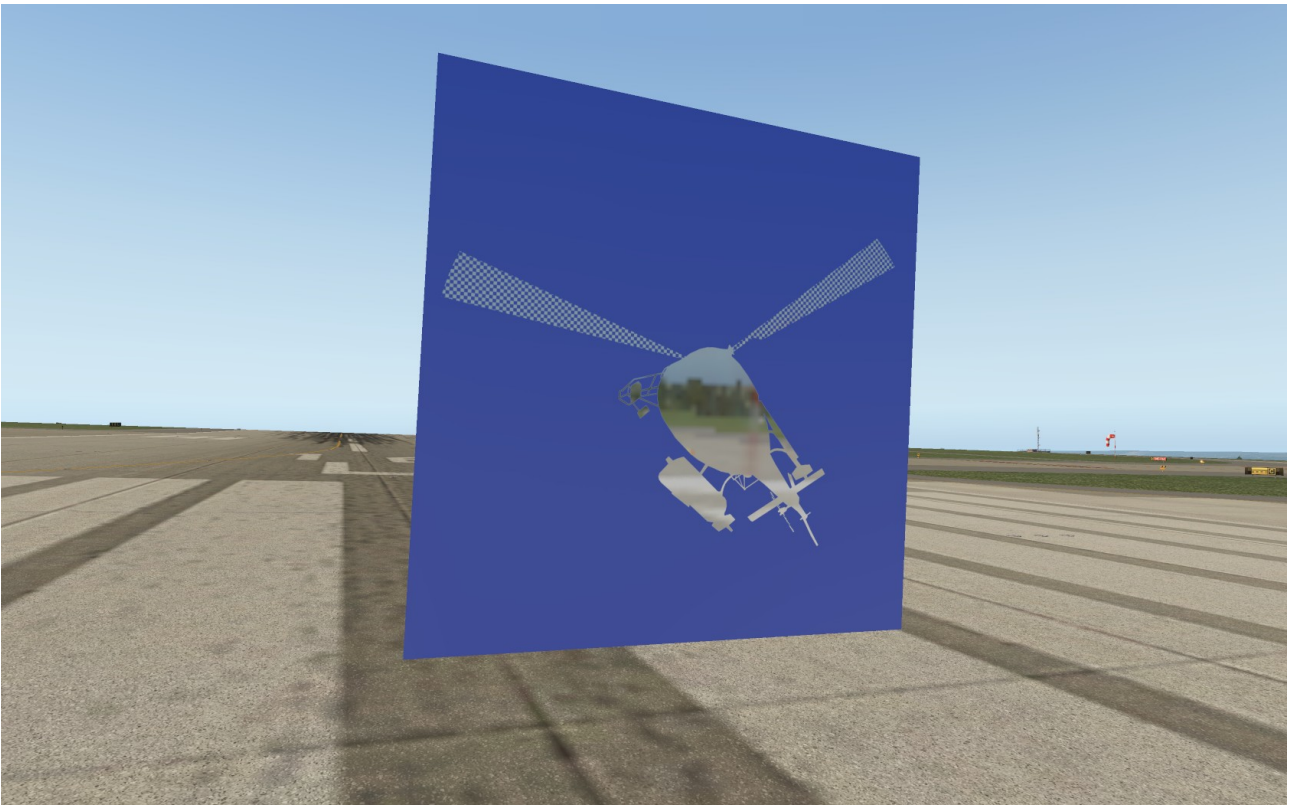
## Modify the normal map using The Gimp

First of all, it is important to remember that a normal map can be “flat”. As a consequence it is not mandatory to add details such as rivets to be able to use PBR.

### Generate a normal map from a bump map

A bump map contains relief data in gray (whiter for bumps, darker for hollows). It is then much easier to generate a normal map from a bump map than drawing it from scratch. One shade of gray will give a “flat” map. You can also bake a high resolution mesh on a low resolution one in Blender to generate your normal map. If you choose to use a bump map, you will need a plugin for Gimp such as [this one](#).

### Goal of this tutorial

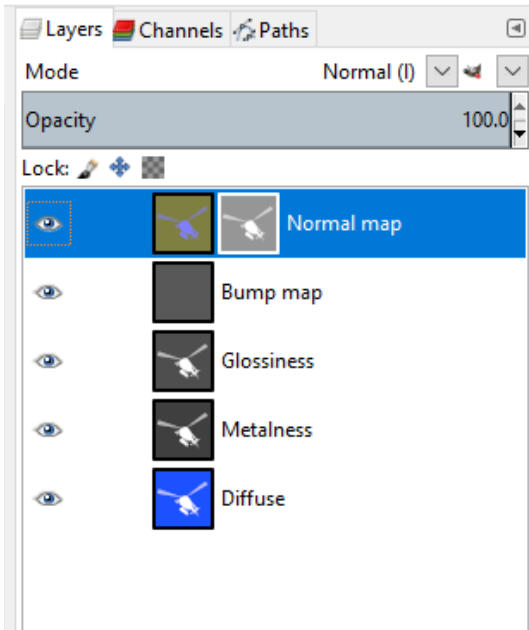


We will create a texture with a helicopter being a perfect mirror placed on a colored rough plastic (producing no reflection).

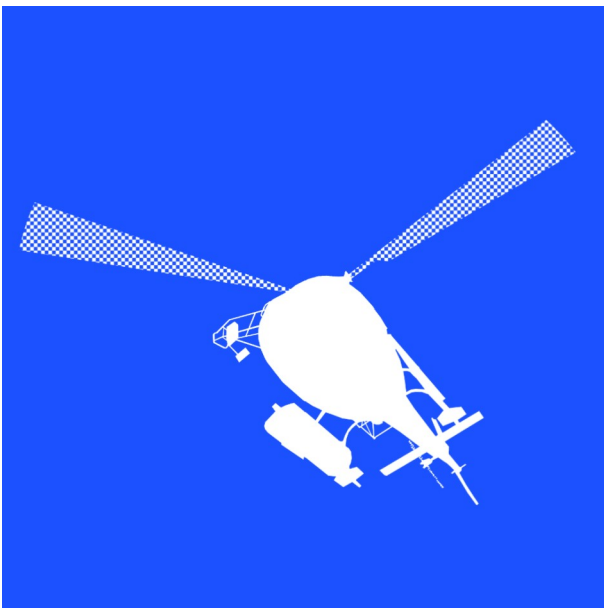
## Preparations in Gimp

We are going to work on a single image in Gimp, in which we will use layers. Of course it would be possible to use several images instead: it is up to you.

The goal is to get the following result:

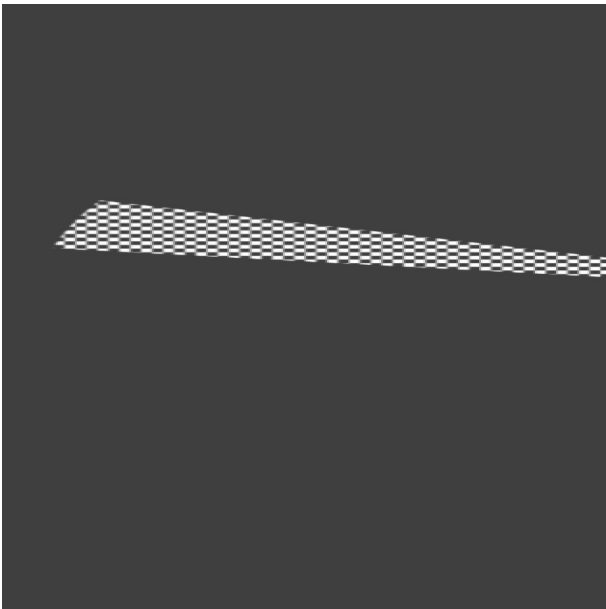


Let's start with the layer for the diffuse map:



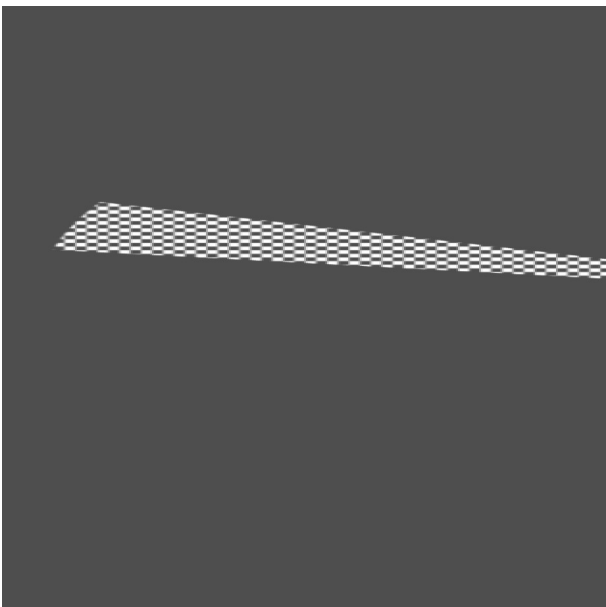
It is simply the helicopter in front of a colored background. The helicopter is white, in order to avoid that the diffuse map “disrupts” reflections in X-Plane. The background will be the color of the plastic.

We then have to create the metalness map using the table of materials previously shown. We get the following:



The helicopter is white because it is a perfect metal and the background is a dark gray since it is made of plastic.

Let's apply the same method for the glossiness map:



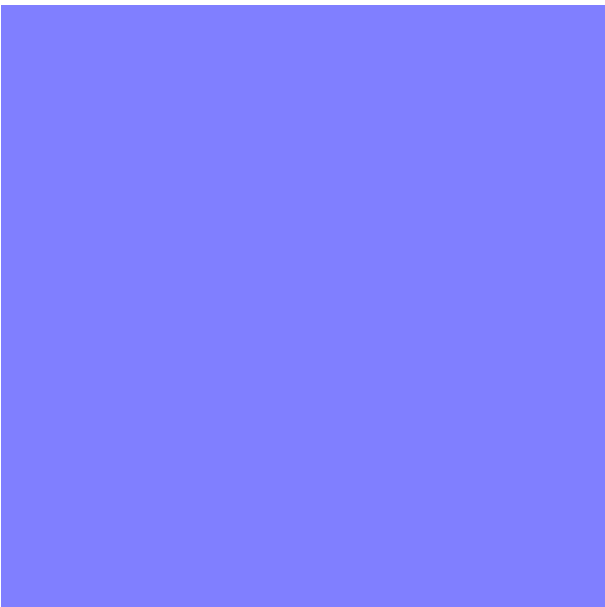
It is very close to the previous one. The helicopter is white because we wish to have a perfect surface with no roughness. At the opposite, the background is gray because a non-glossy plastic, not perfectly smooth, has been chosen. This will strengthen the difference between these two materials and then the clarity of this example.

Then comes the bump map:



It has a single shade of gray to avoid to generate bumps. The shade itself isn't important since what matters during the normal map generation are gray differences.

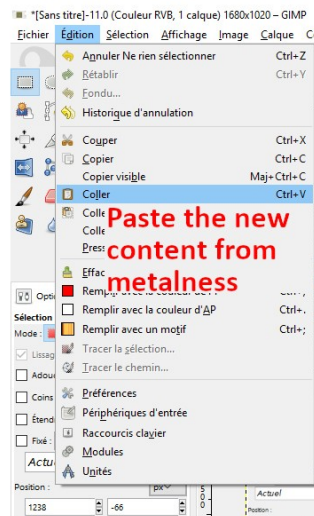
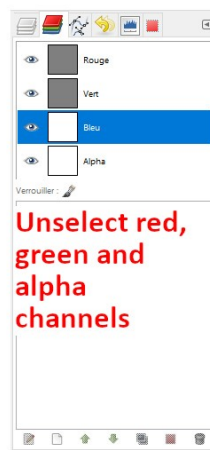
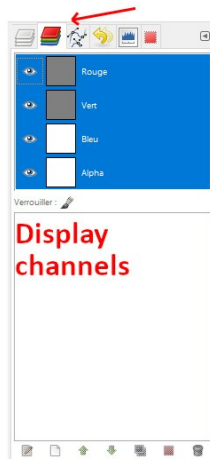
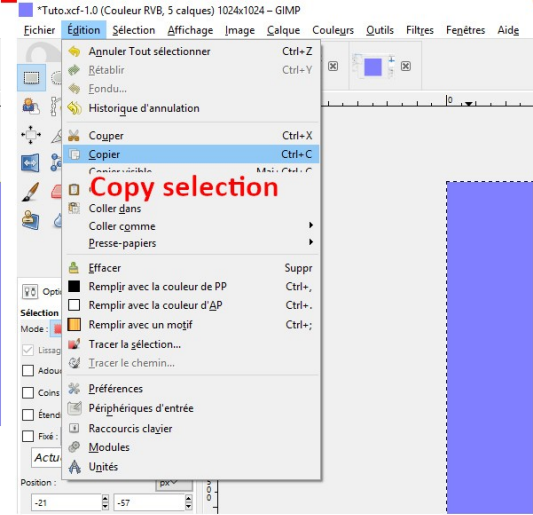
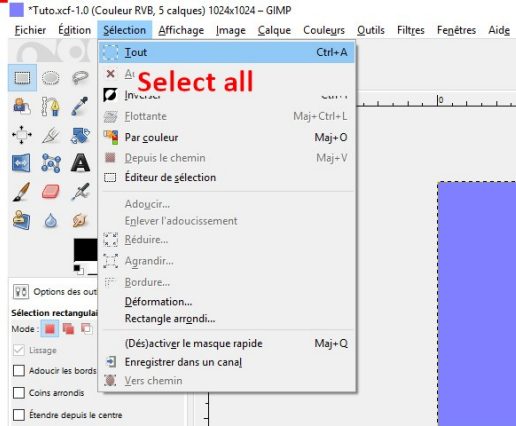
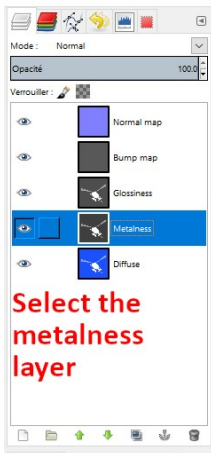
We finally generate our normal map:



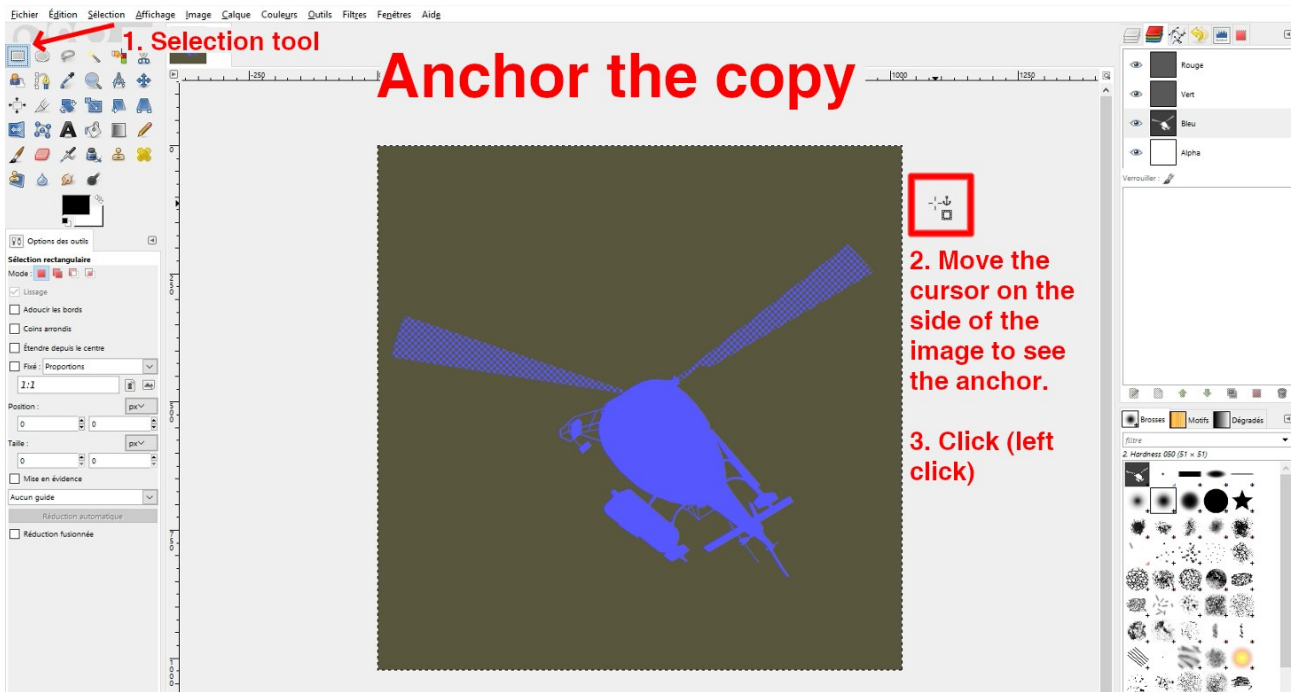
The linked plugin modifying the selected layer, it is highly recommended to duplicate the bump map and rename it "Normal map" before using the plugin. As a consequence the bump map isn't lost and can be modified later.

# Modifying the normal map

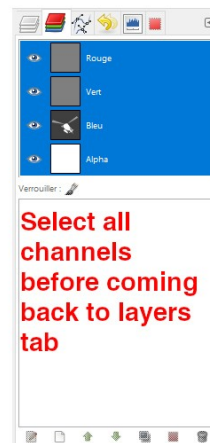
In order to “talk” to X-Plane, we will need to modify our normal map. Steps to follow are detailed on the screenshots below:







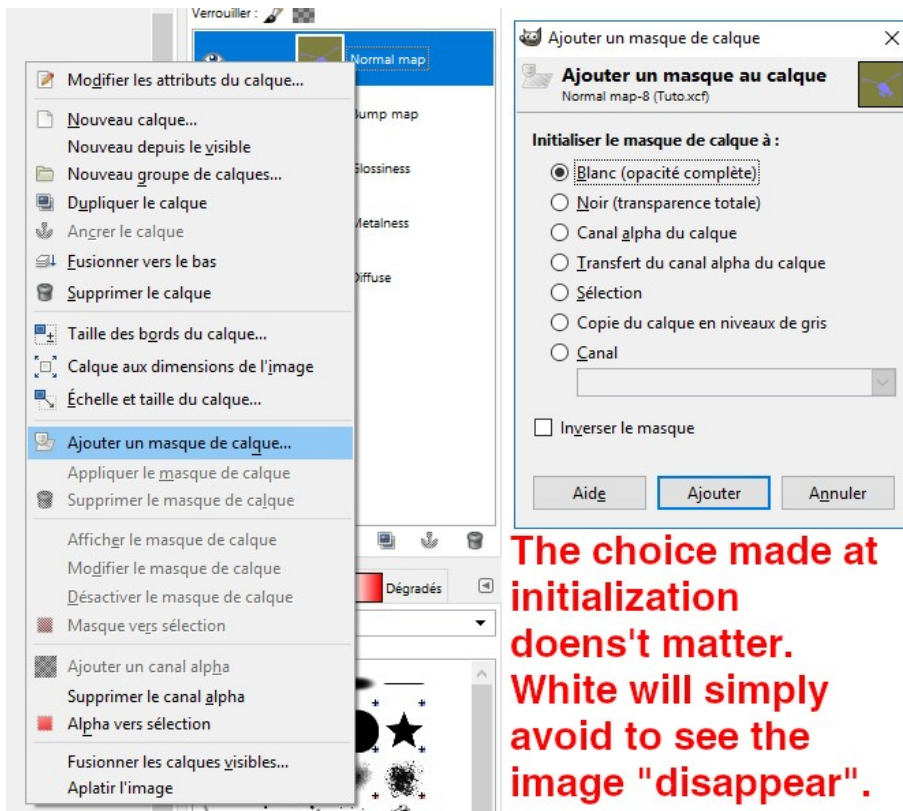
**Center image became like this :**



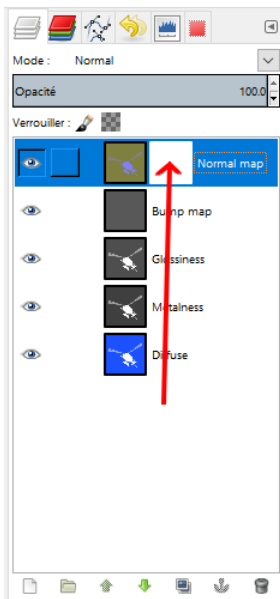
Our metalness texture is now included in the blue channel of our normal map. We now only need to transfer the glossiness map in the alpha channel of this texture.

Just as for the metalness map, we need to select the glossiness layer, then select the entire image and copy it.

We are now going to add a mask to the normal map layer in order to add transparency.

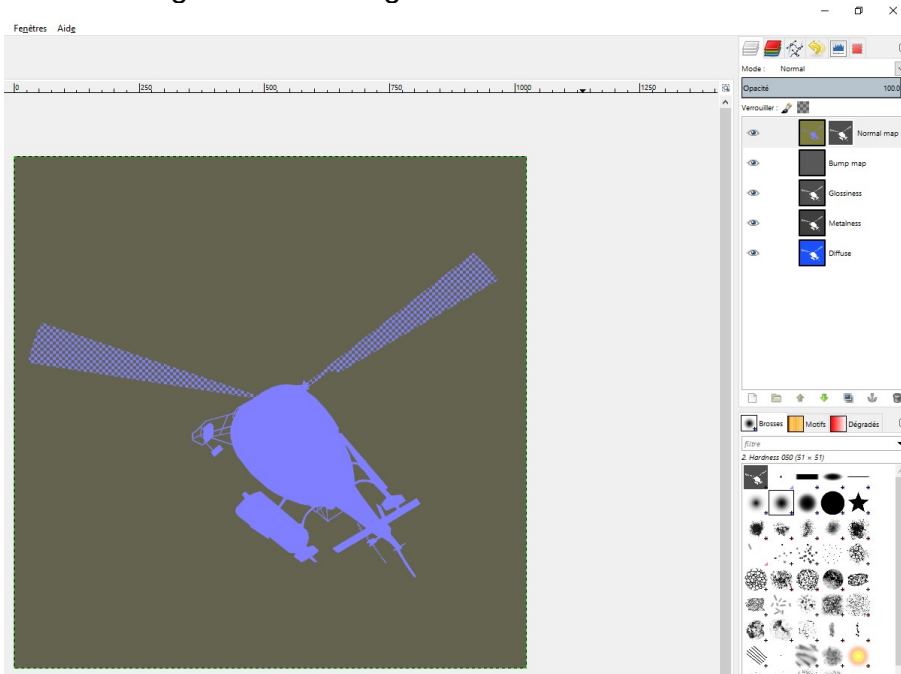


Then select the mask itself.



As we did for the metalness map, we paste the previously copied content. Do not forget to click near the sides of the image (anchor)!

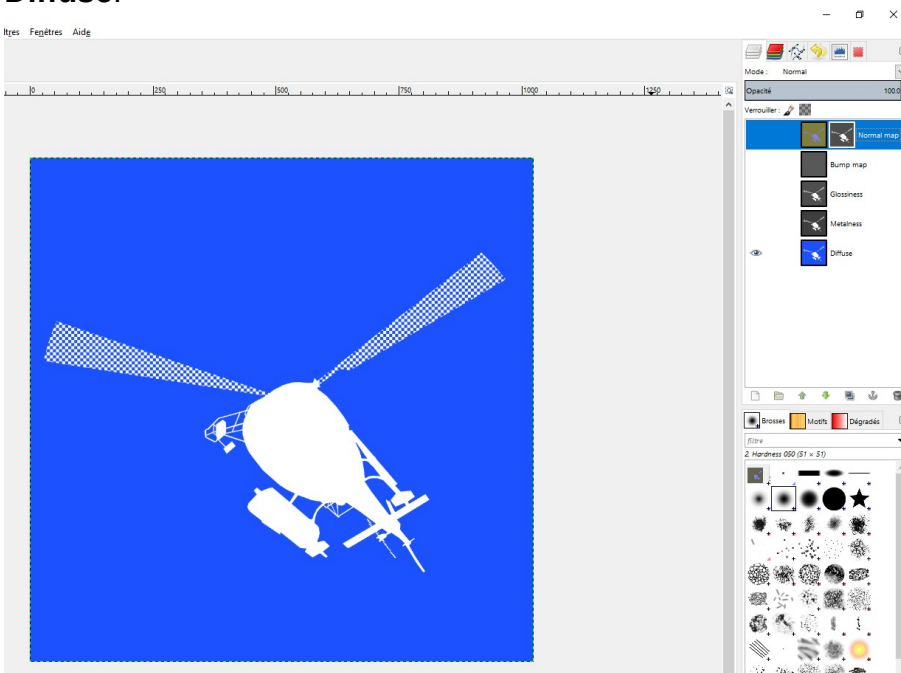
You should get the following result:



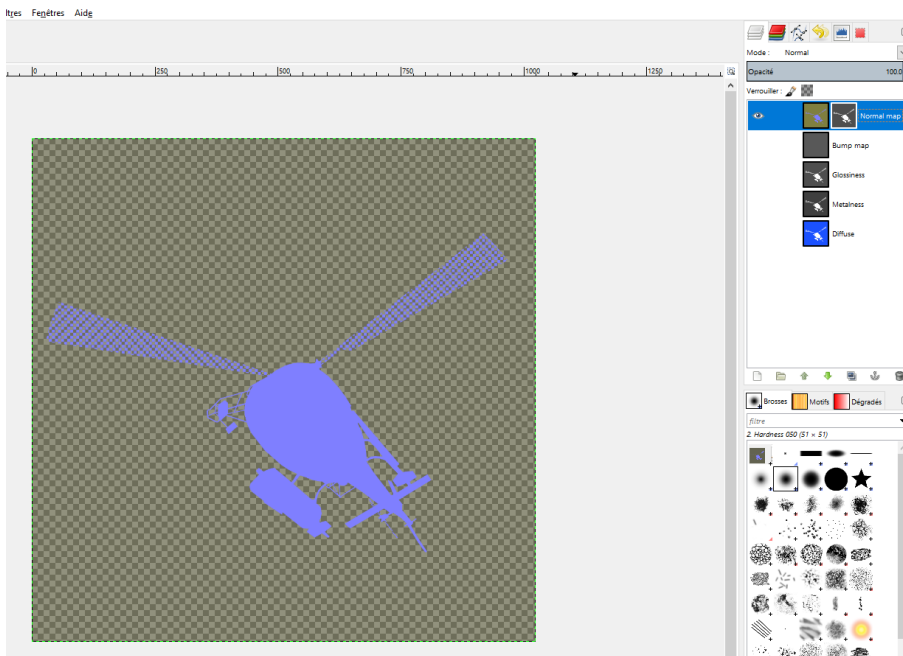
## Save both textures

We now have to save our two textures. We simply need to think about hiding the layers that we don't need, using the "eye" icon near layers, before exporting the result as a png file.

### Diffuse:



## Normal map:



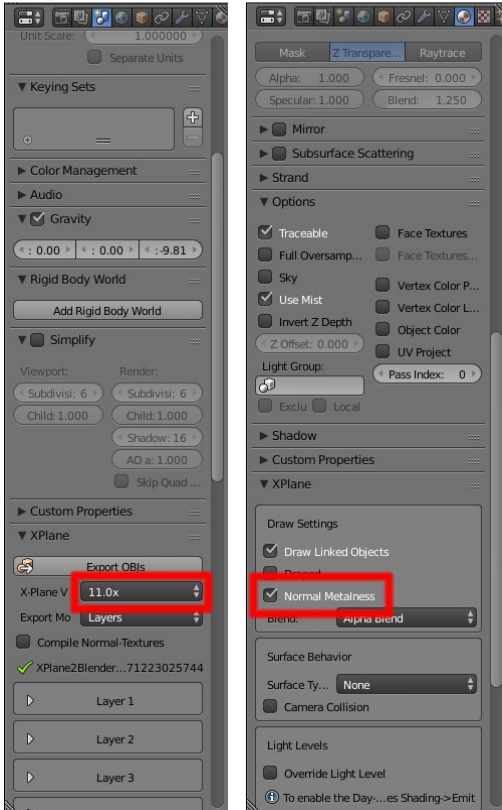
We did everything we needed in Gimp. You can save your Gimp project to be able to edit it later, then close this software.

# Settings in Blender

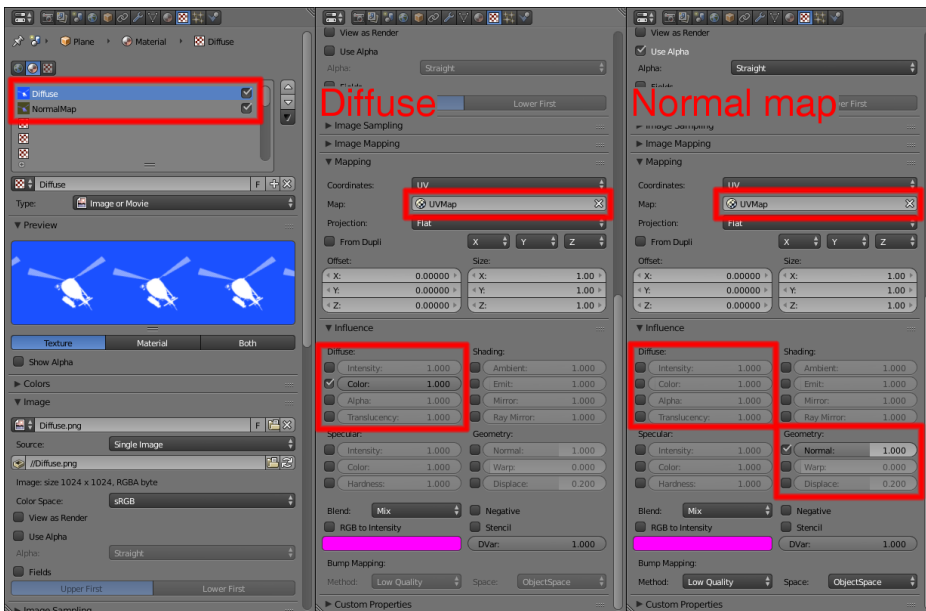
In this part I only show the important settings to use your new texture. I suppose that you already have basics using Blender, among for the export plugin. If you don't, I highly recommend you to look for tutorials at first in order to get used to Blender. You can then refer to the [export plugin documentation](#).

## Scene tab

## Material tab



## Textures tab:



## Conclusion

I hope that this tutorial gave you the basics about using PBR textures for X-Plane 11.

You can now exploit this to go further. Here are few ideas:

- For a painted metal, you can add scratches. These are showing the underneath metal (whiter metalness and glossiness).
- For all materials, some "dirt" can be added using darker metalness and glossiness maps.

March 2018  
Camille Bachmann