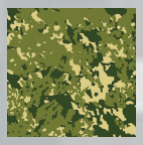
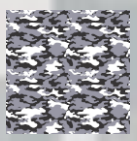
CAMOUFLAGE AND STEALTH

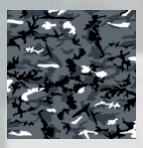
This mod is a framework for providing camouflage properties to apparel. This will affect the ability for pawns being able to see other pawns. This applies when drafted or not.

ARTIC: 

DESERT: 

JUNGLE: 

STONE: 

URBAN: 

WOODLAND: 

So initially you can see there are 6 “specific” camo types involved. (Examples of army styled camo provided).

Camouflage, however, can be gained simply by having the right coloured clothing to better blend into the surroundings, through mimicry, a process of distraction or potentially a combination of these elements. So even the solid snake cardboard box is achievable with this process and the appropriate use of apparel.

You may therefore only deem it necessary to apply settings to apparel that has a purposeful camouflage use. But in principal can be applied in variable strengths to all apparel items.

The process calculates what is on the outermost layer of various body part groups of the pawn and takes an average of these values. Naked being assumed as no camouflage. (Natural animal skins might be accommodated in the future). Yes, it will work on apparel designed for any type of pawn.

COMPCAMO

It works by attaching a comp to the apparel (thingDef) that has a number of camouflage types that have a camo strength applied to them as a factor. (1 being the best and where undefined it will assume 0).

e.g.: (Based on an Army Woodland Camo item)

```
<li Class="CompCamo.CompProperties_GearCamo">
        <ArcticCamoEff>0.32</ArcticCamoEff>
        <DesertCamoEff>0.53</DesertCamoEff>
        <JungleCamoEff>0.70</JungleCamoEff>
        <StoneCamoEff>0.37</StoneCamoEff>
        <WoodlandCamoEff>0.72</WoodlandCamoEff>
        <UrbanCamoEff>0.49</UrbanCamoEff>
</li>
```

It is, therefore, interpretable by mod developers using the above factors to model these associated amounts accordingly. But would stress that the better settings (0.65 to 1.0) perhaps be applied to apparel that has been associated with apparel designed as camouflage items. (0.75 has been recognised as a good benchmark as a setting for army styled camouflage).

The mechanics take into account a number of factors to help determine the effective camo use based on the terrain the pawn is standing on, and in the case of it either being biome related or an undefined piece of terrain it will defer to the biome value to determine this. The mod therefore makes use of mod extensions for terrain and biomes to achieve this.

In the case where an undefined situation occurs, the mod has a caveat process to take an average of all the camo strengths of the apparel, but then also diminishes this strength slightly. But at least this will ensure that some level of camouflage is always in effect regardless.

FACTORS

There are several additional factors to the base comp values that will modify the resulted calculated camo effectiveness:

- **Quality: The quality of the apparel will have a slight impact to camo effectiveness.**
- **Observer: The sight capability of the observer.**
- **Movement and posture: Whether the wearer is moving, standing or downed.**
- **Distance: Camo is more effective proportional to the distance between observer and wearer.**
- **Temperature: Heat haze will increase effectiveness.**
- **Weather: The accuracy stats associated with weather is applied. So, camo is more effective in heavy rain for example, it will also revert to Arctic settings where there is enough snow on the ground at the wearer's position.**
- **Ambient light: the light level at the wearers and observers' position is relative to how easier it is to spot the camo wearer, darkness improving camo effectiveness for the wearer (opposite for observer).**
- **Muzzle flash: The effectiveness of camo is reduced when firing by the muzzle flash value of the weapon, which is further compounded by the burst amount at the time of observation.**
- **Racial Factors: Insectoids will better observe a camouflaged pawn if they are moving, but less effective when stationary. Mechanoid sensors are too advanced with additional zoom, resolution, UV and infra-red vision capabilities, so mechanoids are not affected by passive camouflage use.**

There are mod options to vary some partial effectiveness of the camo effect as well as toggle elements associated with it.

TAGS

To make it even easier for developers to assign camo values to apparel; several pre-sets have been provided that can be attached to the apparel tags.

The convenience of the use of these tags is that you do not need to have patch instructions to load when Passive Camouflage is active, the tag values can be defined and will be applied when this mod is loaded.

ARMY CAMO TYPE PRE-SETS:

The following pre-sets are recommended to be applied to clothing that is specifically designed to provide army styled camouflage and of the appropriate type, the Low, Med, High part indicating levels of effectiveness.

PassiveCamo_Arctic_Low
PassiveCamo_Arctic_Med
PassiveCamo_Arctic_High

PassiveCamo_Desert_Low
PassiveCamo_Desert_Med
PassiveCamo_Desert_High

PassiveCamo_Jungle_Low
PassiveCamo_Jungle_Med
PassiveCamo_Jungle_High

PassiveCamo_Stone_Low
PassiveCamo_Stone_Med
PassiveCamo_Stone_High

PassiveCamo_Woodland_Low
PassiveCamo_Woodland_Med
PassiveCamo_Woodland_High

PassiveCamo_Urban_Low
PassiveCamo_Urban_Med
PassiveCamo_Urban_High

PassiveCamo_Multi_Low

PassiveCamo_Multi_Med

PassiveCamo_Multi_High

Multi refers to camo types like MultiCam and FleckTarn that are effective as multiple types of camo but not as effective as the more focussed counterpart for the type. Multi types then more an allrounder that is effective in desert, jungle and woodland theatres.

REGULAR CLOTHING PRE-SETS

The following clothing pre-sets refer to all non-military style clothing and are applied based on their dominant colour or shade. In the case of stuffed elements or where the colour of the clothing could be random and/or multiple shades then using the tag "Colour" will determine the closest colour fit and thus the best pre-set to use for the actual article of clothing.

The "Rainbow" value can also be used but is more a Jack-of-all-trades in comparison to the "Colour" tag. All other colours being dedicated to a colour or in the case of light and dark; where the colour scheme can be considered of shades that are light or dark in nature. (It does not relate to lighting or ambient light levels).

(Note: The game will use the first tag found in the list being the value to use).

PassiveCamo_Colour_Set

PassiveCamo_Rainbow_Set

PassiveCamo_Black_Set
PassiveCamo_White_Set

PassiveCamo_Red_Set
PassiveCamo_Orange_Set
PassiveCamo_Yellow_Set
PassiveCamo_Green_Set
PassiveCamo_Blue_Set
PassiveCamo_Cyan_Set
PassiveCamo_Violet_Set
PassiveCamo_Purple_Set
PassiveCamo_Brown_Set

PassiveCamo_Light_Set
PassiveCamo_Dark_Set

ACTIVE CAMOUFLAGE

Active camo is a little bit different to passive camo. It is generally considered a much more advanced and higher tech version than just properties associated with the clothing materials.

The usual interpretation is that the camouflage can be used to render an image behind the target as it's visual layer, thus tricking the observer into thinking that nothing is there. Other interpretations are possible.

All active camo is also considered to be powered and as such there is a gizmo used to toggle active camo on and off. As such it is not sensible to apply for NPC use as it requires interaction from the player.

When on, the active camo properties will be valid, but the energy available will tick down. If it reaches 0, then the active camouflage will break and reset a short while later. Note that EMP damage will also render active camouflage useless for a short duration. When active camouflage is not active then if it didn't break at energy 0 it will begin to recharge. (Thus, it is very similar to how shield belts operate).

Where active camo is turned off or broken then the camouflage can revert to any passive camouflage settings applied as mentioned.

(Note at present there is no visual cue to identify on the pawn the activation of active camo. This is being considered and may be added later, and largely might need to have different effects for different mod lore or preferences. Will wait to see what is required here. And if a generic version or versions can be selected from. Then these will be added to the comp details for authors to configure.)

Using the same comp as before for the passive camo, listed below is an example of active camo use:

```
<li Class="CompCamo.CompProperties_GearCamo">
        <ArcticCamoEff>0.25</ArcticCamoEff>
        <DesertCamoEff>0.30</DesertCamoEff>
        <JungleCamoEff>0.40</JungleCamoEff>
        <StoneCamoEff>0.37</StoneCamoEff>
        <WoodlandCamoEff>0.40</WoodlandCamoEff>
        <UrbanCamoEff>0.65</UrbanCamoEff>
        <StealthCamoChance>0</StealthCamoChance>
        <ActiveCamoEff>0.90</ActiveCamoEff>
        <CamoEnergyMax>1.0</CamoEnergyMax>
        <CamoEnergyGainPerTick>0.15</CamoEnergyGainPerTick>
</li>
```

In addition to the previous properties for passive camo (note can be set for active camo as a fall back when active camo is not functioning) there are a few more properties to consider.

StealthCamoChance:

This allows for potential "uber stealth" with really low chances and relates to the base chance of being spotted in this apparel when the camo is active. This value needs to be set > 0 to be recognised as a type of active camo using full stealth capabilities. (It also needs the ActiveCamoEff to be set). However, gun fire will still effectively reveal the location of the wearer.

ActiveCamoEff:

This is the active camo effectiveness that is applied to all types as per passive camo. Otherwise active camo is also slightly more effective than passive camo. It is perfectly possible to set an active camo effectiveness and not use the stealth camo chance, which relates to an active camo use without the stealth.

CamoEnergyMax: The energy bank available to the camo.

CamoEnergyGainPerTick: The energy recharge rate, which also corresponds to the energy usage rate.

ACTIVE CAMO (CONT.)

In addition to the comp, “active camouflage” also needs to set the “thingClass” and “tickerType” of the piece of apparel. These are fixed definitions applied to the apparel item as nodes:

```
<thingClass>CompCamo.ActiveCamoApparel</thingClass>

<tickerType>Normal</tickerType>
```

There is an example included of how to patch active camo including all the elements needed to allow it to work.

COMPOBSERVER

In addition to camo comp there is the counter behaviour with the use of an observer comp which can be used to attach to apparel or equipment. The setting for which allows you to offset the pawns sight capability.

The comp will use the best setting out of all the potential values available as apparel or equipment as relevant, and then if set will subtract the worst "negative" sight value from this if then also relevant.

The above values are limited to within a range of:

-25% (-0.25) to +25% (+0.25).

An example of the comp use:

```
<li Class="Observer.CompProperties_Observer">
        <SightOffset>+0.05</SightOffset>
</li>
```

This can be applied using appropriate patch work like camouflage.

ADDITIONAL DEVELOPER NOTES

As mentioned, the association of camo use is by a type that can be associated to custom terrain and biomes. Vanilla has been patched accordingly.

The six types are as follows:

Arctic Desert Jungle Stone Urban Woodland

These strings can be used to attach a Mod Extension value to “either” a “BiomeDef” or a “TerrainDef”. It is suggested to add the best fit or most appropriate type for the biome or terrain.

Important Note: Natural terrains like soil or grass do not need to have a definition applied since in this case of not having a definition, they will defer to the biome setting. Some terrains like ice or sand for instance can be given better associations to a camo type. And in the case of no definition found the process will check to see if the cell uses the outside temperature to determine if then to use the “Urban” value instead of a biome value.

In the case of things like carpet, wooden floors, burnt floors, metal floors, bridges etc. then since these are “artificial” terrains, it would be best to apply a setting of “Urban” as a convention. Though there may be exceptions like Concrete where the “Stone” setting might be more relevant. I will leave it to your discretion if you prefer to apply stone slabs as “Stone” and wooden floors as say “Woodland”. In the case of stuffed artificial flooring it’s a case of common sense as to which is most suitable. Rough or smoothed stone floors have been accommodated as “Stone”.

You can review the vanilla biome and terrain patch files of this mod to better appreciate how some of these things have been applied.

The mod extension is as follows: (e.g.)

```
<li Class="CompCamo.CompCamoDefs">
        <CamoType>Urban</CamoType>
</li>
```

OVERLAY INDICATORS

The mod provides optional overlay indication to give a base understanding of the relative effective camo of the pawn. When set in the mod options these will be displayed for colonists:

Using Stealth

Excellent Camouflage

Good Camouflage

Mediocre Camouflage

Poor Camouflage

Appendix: (Example XML Patching):

1. (To patch a “single” apparel with passive camo that doesn’t have comps).

```
<Operation Class="PatchOperationFindMod">
<mods>
       <li>Camouflage and Stealth</li>
</mods>
<match Class=”PatchOperationAdd”>
<xpath>/Defs/ThingDef[defName=”Apparel_EG”]</xapth>
      <value>
            <comps>
               <li Class="CompCamo.CompProperties_GearCamo">
                      <ArcticCamoEff>0.55</ArcticCamoEff>
                      <DesertCamoEff>0.25</DesertCamoEff>
                      <JungleCamoEff>0.30</JungleCamoEff>
                      <StoneCamoEff>0.15</StoneCamoEff>
                      <WoodlandCamoEff>0.35</WoodlandCamoEff>
                      <UrbanCamoEff>0.65</UrbanCamoEff>
               </li>
            </comps>
      </value>
</match>
</Operation>
```

2. (To patch a “single” apparel with passive camo that does have comps).

```
<Operation Class="PatchOperationFindMod">
<mods>
       <li>Camouflage and Stealth</li>
</mods>
<match Class=”PatchOperationAdd”>
<xpath>/Defs/ThingDef[defName=”Apparel_EG”]/comps</xpath>
      <value>
            <li Class="CompCamo.CompProperties_GearCamo">
                  <ArcticCamoEff>0.55</ArcticCamoEff>
                  <DesertCamoEff>0.25</DesertCamoEff>
                  <JungleCamoEff>0.30</JungleCamoEff>
                  <StoneCamoEff>0.15</StoneCamoEff>
                  <WoodlandCamoEff>0.35</WoodlandCamoEff>
                  <UrbanCamoEff>0.65</UrbanCamoEff>
               </li>
      </value>
</match>
</Operation>
```

3. (To patch a “single” apparel with passive camo, checking for comps)

```
<Operation Class="PatchOperationFindMod">
<mods>
       <li>Camouflage and Stealth</li>
</mods>
<match Class=”PatchOperationConditional”>
<xpath>/Defs/ThingDef[defName=”Apparel_EG”]/comps</xpath>
<match Class=”PatchOperationAdd”>
<xpath>/Defs/ThingDef[defName=”Apparel_EG”]/comps</xpath>
      <value>
            <li Class="CompCamo.CompProperties_GearCamo">
                  <ArcticCamoEff>0.55</ArcticCamoEff>
                  <DesertCamoEff>0.25</DesertCamoEff>
                  <JungleCamoEff>0.30</JungleCamoEff>
                  <StoneCamoEff>0.15</StoneCamoEff>
                  <WoodlandCamoEff>0.35</WoodlandCamoEff>
                  <UrbanCamoEff>0.65</UrbanCamoEff>
               </li>
      </value>
</match>
<nomatch Class=”PatchOperationAdd”>
<xpath>/Defs/ThingDef[defName=”Apparel_EG”]</xpath>
      <value>
            <comps>
                  <li Class="CompCamo.CompProperties_GearCamo">
                        <ArcticCamoEff>0.55</ArcticCamoEff>
                        <DesertCamoEff>0.25</DesertCamoEff>
                        <JungleCamoEff>0.30</JungleCamoEff>
                        <StoneCamoEff>0.15</StoneCamoEff>
                        <WoodlandCamoEff>0.35</WoodlandCamoEff>
                        <UrbanCamoEff>0.65</UrbanCamoEff>
                  </li>
            </comps>
      </value>
</nomatch>
</match>
</Operation>
```

4. (To patch a “single” existing piece of apparel with passive camo that includes checks for the existence of the comp values. A more “involved” patching method but covers a greater number of situations where other mods may add comps with patching work. Can only be done one at a time due to the Test process within it.)

```
<Operation Class="PatchOperationFindMod">
<mods>
	<li>Camouflage and Stealth</li>
</mods>
<match Class="PatchOperationSequence">
<success>Always</success>
<operations>
	<li Class="PatchOperationConditional">
	<xpath>/Defs/ThingDef[defName="Apparel_EG"]/comps</xpath>
	<match Class="PatchOperationSequence">
	<operations>
	<li Class="PatchOperationTest">
	<success>Invert</success>
	<xpath>/Defs/ThingDef[defName="Apparel_EG"]/comps/li[@Class="CompCa
mo.CompProperties_GearCamo"]</xpath>
	</li>
	<li Class="PatchOperationAdd">
		<xpath>/Defs/ThingDef[defName="Apparel_EG"]/comps</xpath>
		<value>
			<li Class="CompCamo.CompProperties_GearCamo">
				<ArcticCamoEff>0.55</ArcticCamoEff>
				<DesertCamoEff>0.25</DesertCamoEff>
				<JungleCamoEff>0.30</JungleCamoEff>
				<StoneCamoEff>0.15</StoneCamoEff>
				<WoodlandCamoEff>0.35</WoodlandCamoEff>
				<UrbanCamoEff>0.65</UrbanCamoEff>
			</li>
		</value>
	</li>
	</operations>
	</match>
	<nomatch Class="PatchOperationAdd">
		<xpath>/Defs/ThingDef[defName="Apparel_EG"]</xpath>
		<value>
		<comps>
			<li Class="CompCamo.CompProperties_GearCamo">
				<ArcticCamoEff>0.55</ArcticCamoEff>
				<DesertCamoEff>0.25</DesertCamoEff>
				<JungleCamoEff>0.30</JungleCamoEff>
				<StoneCamoEff>0.15</StoneCamoEff>
				<WoodlandCamoEff>0.35</WoodlandCamoEff>
				<UrbanCamoEff>0.65</UrbanCamoEff>
			</li>
		</comps>
		</value>
	</nomatch>
	</li>
</operations>
</match>
</Operation>
```

5. **(To patch multiple or a series of apparel with passive that have comps)**

   {Similarly, can be modelled as a sequence for those without comps and a series of conditionals as in previous examples (1-3). Example 4 will not work in a sequence due to the test within it.}

```
<Operation Class="PatchOperationFindMod">
<mods><li>Camouflage and Stealth</li></mods>
<match Class="PatchOperationSequence">
<success>Always</success>
<operations>
      <li Class="PatchOperationAdd">
      <xpath>/Defs/ThingDef[defName="Apparel_EG1"]/comps</xpath>
            <value>
                  <li Class="CompCamo.CompProperties_GearCamo">
                        <ArcticCamoEff>0.55</ArcticCamoEff>
                        <DesertCamoEff>0.25</DesertCamoEff>
                        <JungleCamoEff>0.30</JungleCamoEff>
                        <StoneCamoEff>0.15</StoneCamoEff>
                        <WoodlandCamoEff>0.35</WoodlandCamoEff>
                        <UrbanCamoEff>0.65</UrbanCamoEff>
                  </li>
            </value>
      </li>
      <li Class="PatchOperationAdd">
      <xpath>/Defs/ThingDef[defName="Apparel_EG2"]/comps</xpath>
            <value>
                  <li Class="CompCamo.CompProperties_GearCamo">
                        <ArcticCamoEff>0.55</ArcticCamoEff>
                        <DesertCamoEff>0.25</DesertCamoEff>
                        <JungleCamoEff>0.30</JungleCamoEff>
                        <StoneCamoEff>0.15</StoneCamoEff>
                        <WoodlandCamoEff>0.35</WoodlandCamoEff>
                        <UrbanCamoEff>0.65</UrbanCamoEff>
                  </li>
            </value>
      </li>
</operations>
</match>
</Operation>
```

6. **An example of a more involved patching process to patch a piece of apparel in readiness for use as an "<u>active</u>" camo item:**

```
<Operation Class="PatchOperationFindMod">

<mods><li>Camouflage and Stealth</li></mods>
<match Class="PatchOperationSequence">
<success>Always</success>
<operations>
<li Class="PatchOperationConditional">
<xpath>/Defs/ThingDef[defName="Apparel_ACEG"]/comps</xpath>
<match Class="PatchOperationAdd">
      <xpath>/Defs/ThingDef[defName="Apparel_ACEG"]/comps</xpath>
      <value>
        <li Class="CompCamo.CompProperties_GearCamo">
              <ArcticCamoEff>0.25</ArcticCamoEff>
              <DesertCamoEff>0.30</DesertCamoEff>
              <JungleCamoEff>0.40</JungleCamoEff>
              <StoneCamoEff>0.37</StoneCamoEff>
              <WoodlandCamoEff>0.40</WoodlandCamoEff>
              <UrbanCamoEff>0.65</UrbanCamoEff>
              <StealthCamoChance>0</StealthCamoChance>
              <ActiveCamoEff>0.90</ActiveCamoEff>
              <CamoEnergyMax>1.0</CamoEnergyMax>
              <CamoEnergyGainPerTick>0.15</CamoEnergyGainPerTick>
        </li>
        </value>
</match>
<nomatch Class="PatchOperationAdd">
      <xpath>/Defs/ThingDef[defName="Apparel_ACEG"]</xpath>
      <value>
        <comps>
              <li Class="CompCamo.CompProperties_GearCamo">
                    <ArcticCamoEff>0.25</ArcticCamoEff>
                    <DesertCamoEff>0.30</DesertCamoEff>
                    <JungleCamoEff>0.40</JungleCamoEff>
                    <StoneCamoEff>0.37</StoneCamoEff>
                    <WoodlandCamoEff>0.40</WoodlandCamoEff>
                    <UrbanCamoEff>0.65</UrbanCamoEff>
                    <StealthCamoChance>0</StealthCamoChance>
                    <ActiveCamoEff>0.90</ActiveCamoEff>
                    <CamoEnergyMax>1.0</CamoEnergyMax>
                    <CamoEnergyGainPerTick>0.15</CamoEnergyGainPerTick>
              </li>
        </comps>
      </value>
</nomatch>
</li>

.
.
.
```

```
<li Class="PatchOperationConditional">
<xpath>/Defs/ThingDef[defName="Apparel_ACEG"]/thingClass</xpath>
<match Class="PatchOperationReplace">
      <xpath>/Defs/ThingDef[defName="Apparel_ACEG"]/thingClass</xpath>
      <value>
        <thingClass Inherit="false">CompCamo.ActiveCamoApparel</thingClass>
      </value>
</match>
<nomatch Class="PatchOperationAdd">
      <xpath>/Defs/ThingDef[defName="Apparel_ACEG"]</xpath>
        <value>
        <thingClass Inherit="false">CompCamo.ActiveCamoApparel</thingClass>
        </value>
</nomatch>
</li>
<li Class="PatchOperationConditional">
<xpath>/Defs/ThingDef[defName="Apparel_ACEG"]/tickerType</xpath>
<match Class="PatchOperationReplace">
      <xpath>/Defs/ThingDef[defName="Apparel_ACEG"]/tickerType</xpath>
        <value>
              <tickerType Inherit="false">Normal</tickerType>
        </value>
</match>
<nomatch Class="PatchOperationAdd">
        <xpath>/Defs/ThingDef[defName="Apparel_ACEG"]</xpath>
        <value>
              <tickerType Inherit="false">Normal</tickerType>
        </value>
</nomatch>
</li>
</operations>
</match>
</Operation>
```

7.

7. (To patch a single terrain)

```
<Operation Class="PatchOperationFindMod">
<mods>
	<li>Camouflage and Stealth</li>
</mods>
<match Class="PatchOperationSequence">
<success>Always</success>
<operations>
	<li Class="PatchOperationAddModExtension">
		<xpath>/Defs/TerrainDef[defName="RimicaTile"]</xpath>
		<value>
			<li Class="CompCamo.CompCamoDefs">
				<CamoType>Urban</CamoType>
			</li>
		</value>
	</li>
</operations>
</match>
</Operation>
```

8. (To patch a couple of biomes)

```
<Operation Class="PatchOperationFindMod">
<mods>
	<li>Camouflage and Stealth</li>
</mods>
<match Class="PatchOperationSequence">
<success>Always</success>
<operations>
	<li Class="PatchOperationAddModExtension">
		<xpath>/Defs/BiomeDef[defName="Savanna"]</xpath>
		<value>
			<li Class="CompCamo.CompCamoDefs">
				<CamoType>Desert</CamoType>
			</li>
		</value>
	</li>
	<li Class="PatchOperationAddModExtension">
	<xpath>/Defs/BiomeDef[defName="Wasteland"]</xpath>
		<value>
			<li Class="CompCamo.CompCamoDefs">
				<CamoType>Desert</CamoType>
			</li>
		</value>
	</li>
</operations>
</match>
</Operation>
```

FURTHER HELP

If you require further advice on patching or any other aspect of how camouflage works then feel free to ask, but worth pointing out that there is also a useful channel on the Rimworld discord that can be helpful for mod development. There you will also find other mod developers who can help you with the xpath patching process.

https://discord.gg/rimworld

https://rimworldwiki.com/wiki/Modding_Tutorials/PatchOperations

CREDITS:

Author: Pelador

Advice: Chicken Plucker