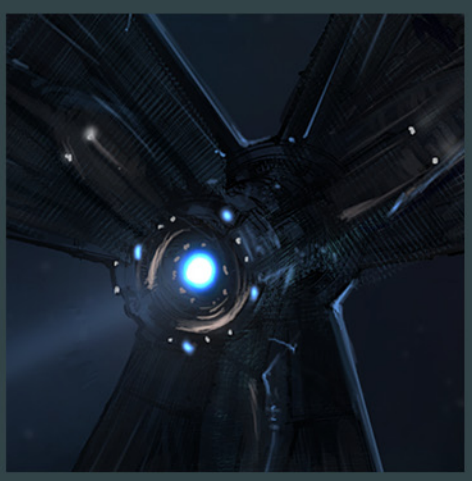
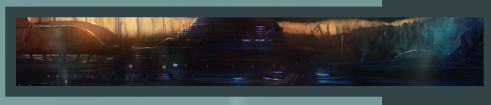
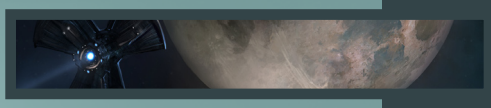
SPACE PAINTING

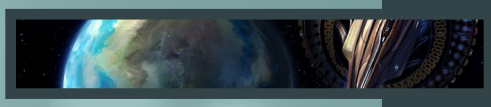
Digital Painting Downloadable Tutorial Series



1 - Planets and Star Fields







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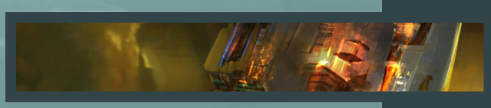
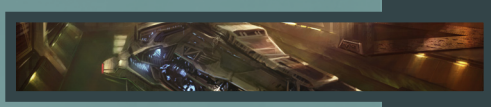
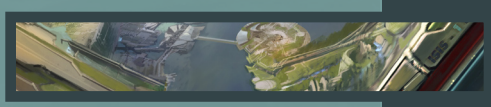




3 - Environments



Chapter 01

STARS AND NEBULAS

SPACE PAINTING
CHAPTER 01: STARS AND NEBULAS

Overview

In essence, painting space art can be said to be no different than painting a natural landscape. Once the basics of art, lighting and colour are applied, the final image produced is all down to establishing the right mood, composition and ambience (applied atmospheric perspective), along with a good dose of imagination!

So to start off this new series of space-related painting tutorials, let us begin with the jewels in the night sky: the stars!

The same feeling of hope and grandiose magnitude that we get from looking up at a night sky can be epitomised by a song called “The Impossible Dream”, from the musical/film “Man of La Mancha” (Don Quixote):

To love, pure and chaste, from afar,

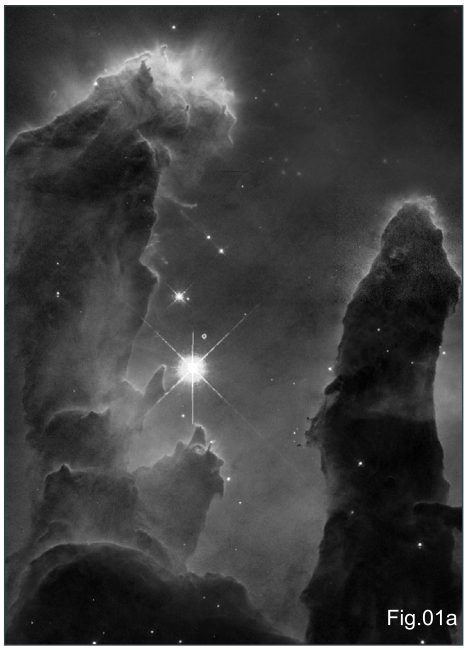


Fig.01a

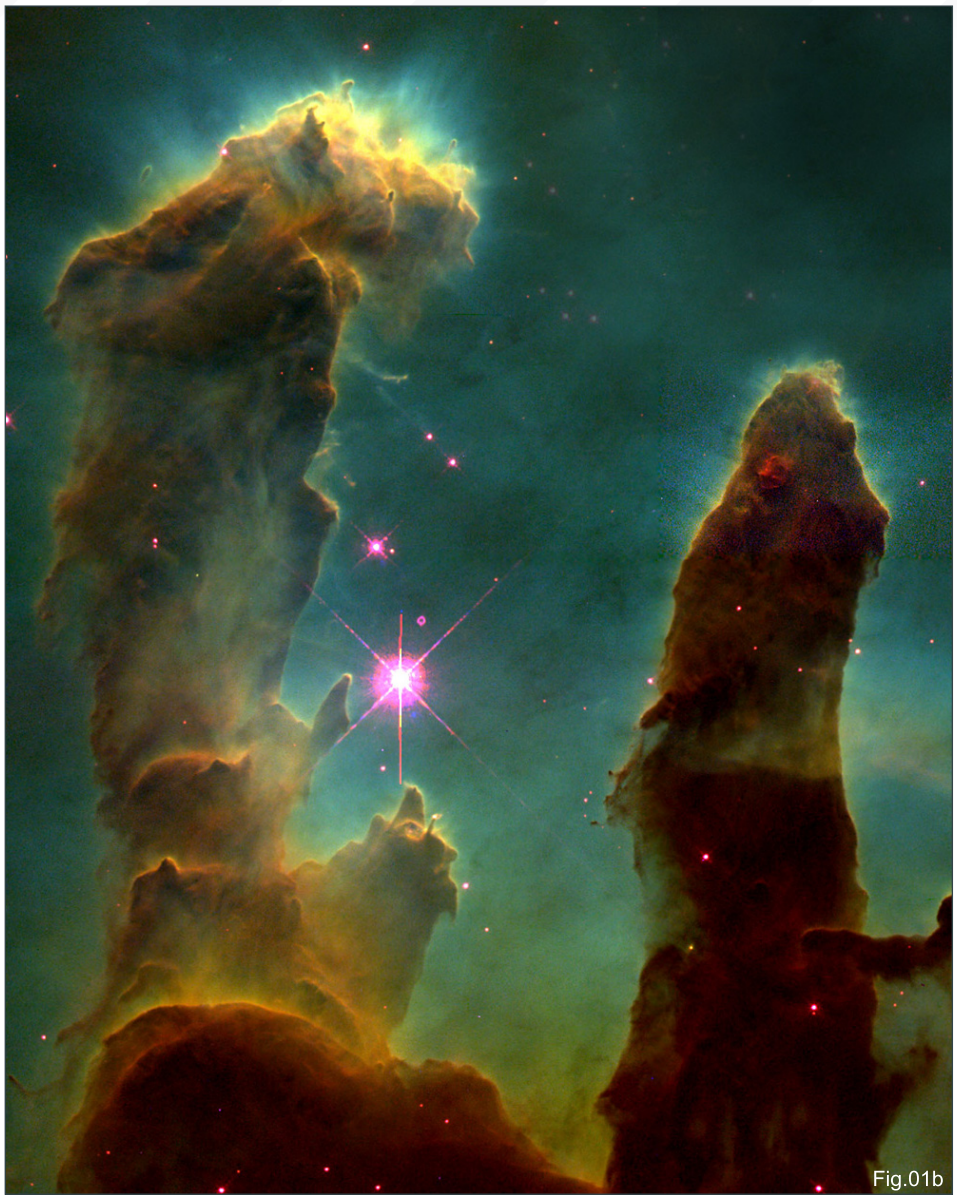


Fig.01b

To try, when your arms are too weary,
To reach the unreachable star!
This is my Quest to follow that star,
No matter how hopeless, no matter how far,
To fight for the right
Without question or pause,
To be willing to march into hell
For a heavenly cause!

Star Fields

The Naked Eye

When observing the stars, one can enjoy the vast heavens on a cloudless night in the countryside with the naked eye. Roughly speaking, and accounting for the atmosphere and dust, one can see approximately 1,500-2,000 stars in a clear night’s sky. Of these, only faint stars of +6.5 magnitude can be explained, and as for the colours these are restricted to only bright stars or planetary bodies. The reason for this is because the human eye primarily utilises rods (used to see in low light conditions), instead of cones (which determine colour, depth and intensity).

Astrophotography & Photoshop

In contrast, the beautiful imagery that we can see from CCD astrophotography, or larger telescopes such as the “IR Spitzer” or the “Hubble” space telescope, are mainly false colour reproductions. Deep space imagery captures black and white pictures using different


Fig.02

filters in order to capture particular wavelengths of light, and is then downloaded via the Deep Space network to form various composites of the same image into a standard file format used by astronomers, called “FITS” (Flexible Image Transport System). This system captures 65,000 levels of greyscale imagery (**Fig.01a** – **Fig.01b**)!

For reproduction into RGB/public consumption, the Public Outreach team helps to reprocess the image via a method called “stretching”, although this means a downgrade from 65,000 levels of greyscale to a 256 colour composite. Additional aspects of noise reduction, sharpening and correction can occur at this stage. Subsequently, they “colourise” each level of value and tone within the image, dot by dot, to a corresponding level in RGB via the use of filters.

By manually adjusting these colours, they produce a composite colour image:

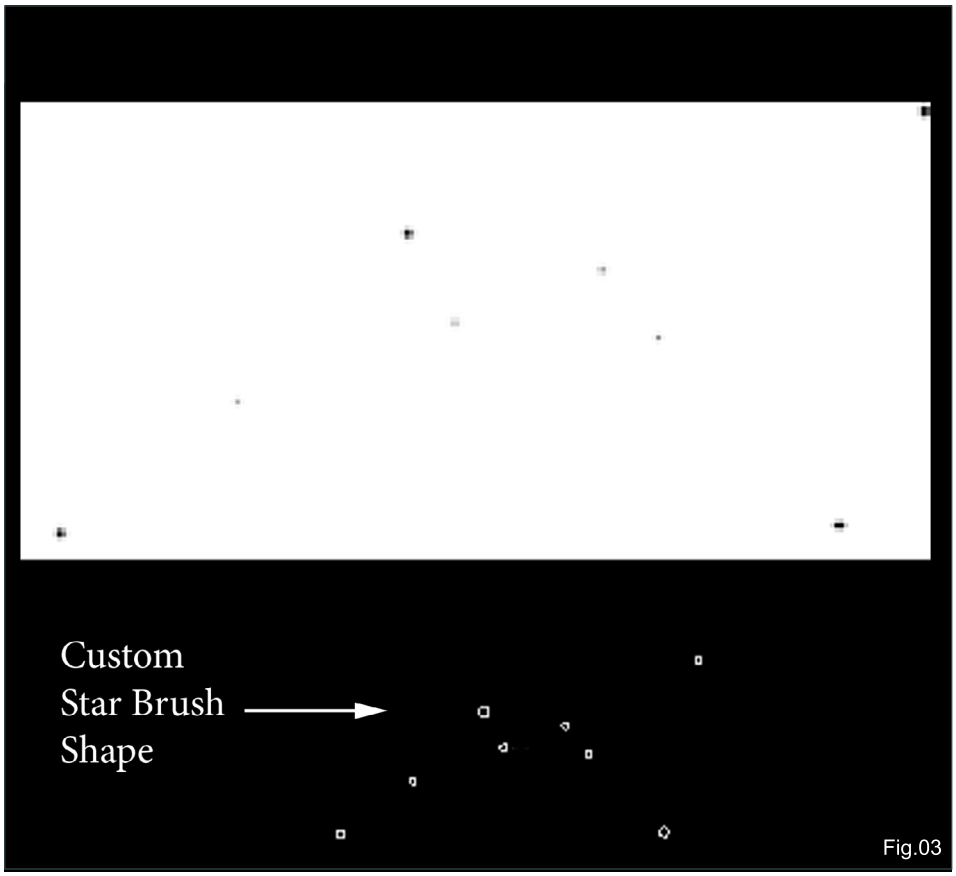


Fig.03

Red – corresponds to the Ha (Hydrogen alpha) emission;
Blue – corresponds to the OIII (Oxygen III) emission;
Green – synthetic Green

For lunar and nearby planetary bodies, the use of your regular webcam is often sufficient to capture detail (the higher the number of frames obtainable per second, the better) within the visual spectrum; therefore false colour need not be added, but rather tweaked to your desired outcome!

Once a composite colour image is produced, the image can then be rotated, cropped and adjusted to one’s own liking, or to suit the best outcome.

References, references, references!

When approaching an unfamiliar piece, or even if the subject matter is well-known to the artist, I would advocate having a visual reference at hand – at all times! By having references at hand, this helps to ensure that the degree of accuracy in reproducing a painting can be that much more believable. This holds true especially when you are exploring an unfamiliar theme, or a new subject matter. Utilising references effectively means that, as an artist, you have done the basic cursory research into your subject matter. By grouping your references collectively, this allows you to

produce studies to familiarise yourself with the topic or brief at hand. Ultimately, if adopted into your regular practice, I believe this will not only improve your "Art Fu", but will also produce a systematic, well-rounded artist that can paint and design from an informed position. And thus be able to re-render and translate the subject matter across media with ease.

Please note that I am not advocating a wholesale copy of an image or artwork here! Moreover, it should be similar to trying to figure out where a limb attaches, or how a pair of ears should be placed on a three-legged alien horse without actually having basic knowledge of what a real horse looks like, or how it feels and moves in real life. So to cut a long story short, some basic study of how stars can be grouped and laid out can be pretty useful in order to reproduce a space scene.

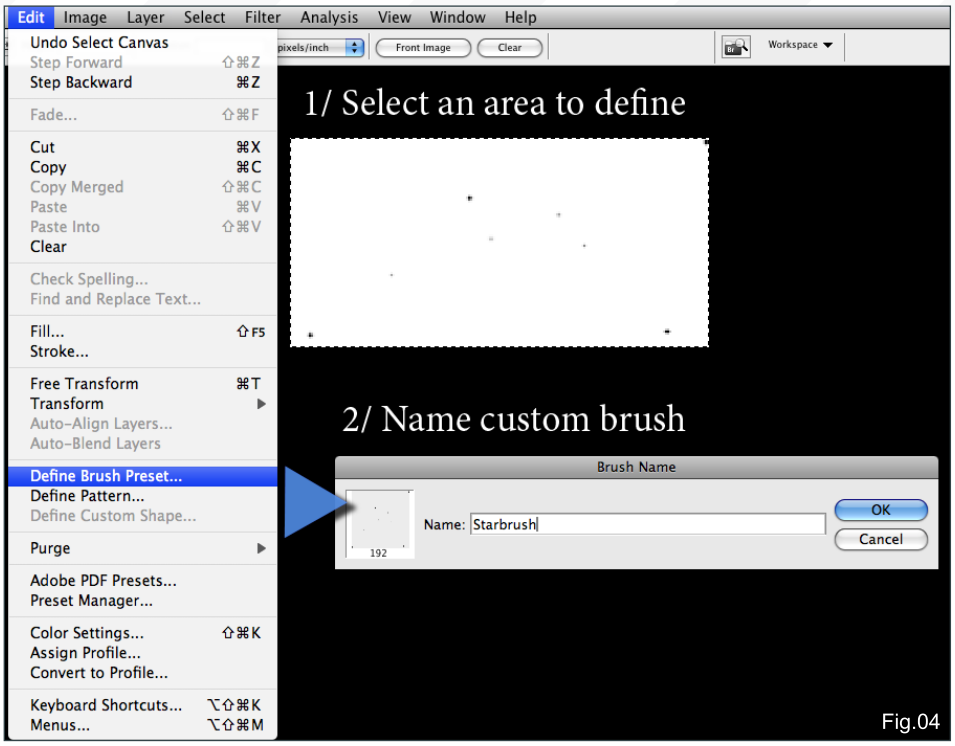


Fig.04

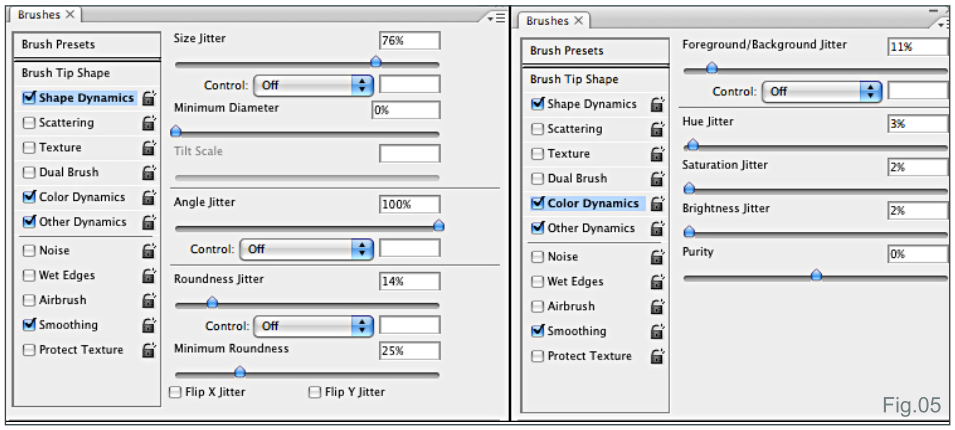


Fig.05

Building a Star Field: The Logical Way!

Upon observation of various star fields, there are a few ways in which to generate a star field in a painting. In essence, star fields tend to be nonuniform in distribution – predominantly a wide scattering of faint stars. Brighter stars are more prominent and few, forming constellations. These tend to show an optical aberration that appears star-crossed in a telescope. Of the numerous ways of produce a star field, let us choose the most straightforward by generating a very simple custom brush (**Fig.02**).

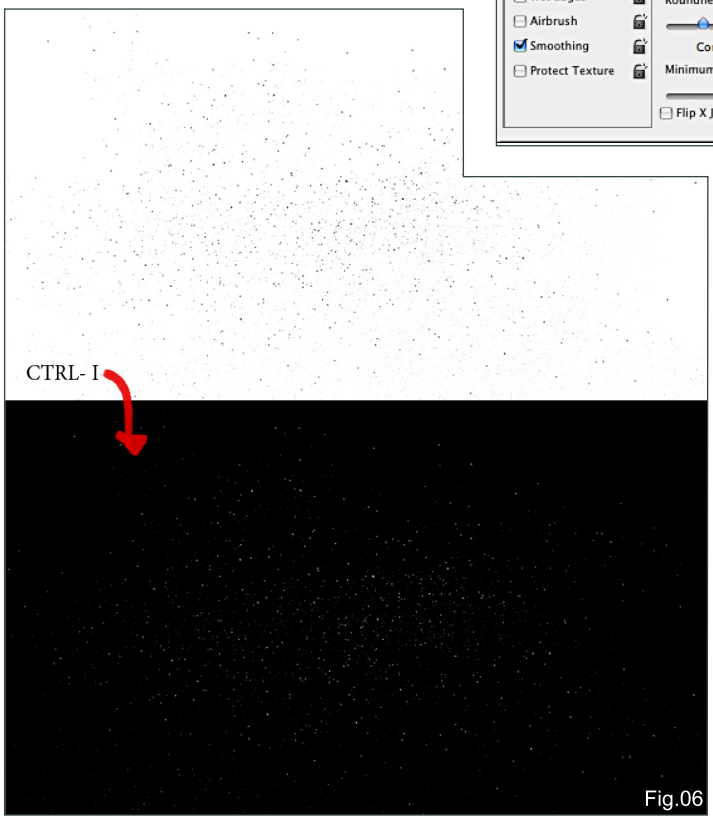


Fig.06

Star Brush (Created in Photoshop)

1. Observation. As mentioned above, a star field is generally nonuniform, so we shall seek to emulate this by generating a very small, economical brush with a few random points on it.
2. I recommend a small white canvas at a size of 200 x 100 pixels.
3. Using an airbrush with a brush size of just a few pixels, apply a few singular dots across your canvas.
4. Apply a minimum of 3 dots to 5 – no more. In this instance, less is more. Using the power of your painting programme engine, the


Fig.07


Fig.08

programme can rapidly fill your canvas with these patterns that you have laid down, with ease.

5. Ensure some are larger and more solid, and some with a fainter, softer feel (**Fig.03**).

6. Once you are happy with the feel, apply the define brush option via Edit > Define Brush Preset, and your brush will now be defined. Now give it a new name, e.g. “Star brush”.

7. Congratulations! Your new custom brush is available at the bottom of your brush collection. Select it and put it to good use (**Fig.04**)!

Tweaking your custom brush

To make your custom brush really useful, a few tweaks are required, so bring up your Brushes palette (from Windows > Brushes). These will present you with a plethora of options.
Here are a list of main things you should consider tweaking (**Fig.05**):

Shape Dynamics

Size Jitter – adjusts the variance of each brush application; larger values produce a greater change in size each time and smaller values have less variance. I’ve set my custom star brush between 60-80% for a large variance.

Angle Jitter – each brush stroke will be rotated at a different alignment, the larger the value.

Flip X/Y Jitter – flips the direction of the jitter, either horizontally or vertically.

Other Dynamics

This allows for a variance in opacity, flow or smoothing. Protect textures and Wet edges are not recommended, in this instance, for a star brush.

Colour Dynamics

Colour dynamics allow variations between the foreground and background colours with each stroke. This is useful in order to distribute a variety of yellow and blue-white stars.

Painting a Simple Star Field

1. Apply your custom star brush liberally onto the white canvas.

2. Using a selection of gathered star references, ensure that you vary the distribution of the dots (stars) so that they appear nonuniform in areas.

3. In certain areas (e.g. in the middle), the dots may be closer together to suggest a star cluster/ nebular/spiral galaxy.

4. Press Ctrl + I (Invert).

5. This reverses the canvas automatically, showing your distribution of artwork.

6. To show the distance between stars farther away and those nearer you can scatter a new layer of dots and lower the opacity, or you can simply apply the blur tool (**Fig.06**).

7. When you’re happy with the overall effect, save and then flatten.

8. To show brighter/nearer stars, manually apply singular dots of light using an airbrush tool (set to Colour Dodge) on a flattened image. Linear Dodge has a similar effect but does not saturate your image (and can work well on a new layer).

9. To finish off a simple star field, you can apply a local nearby star using the default airbrush set to Colour Dodge (**Fig.07**).

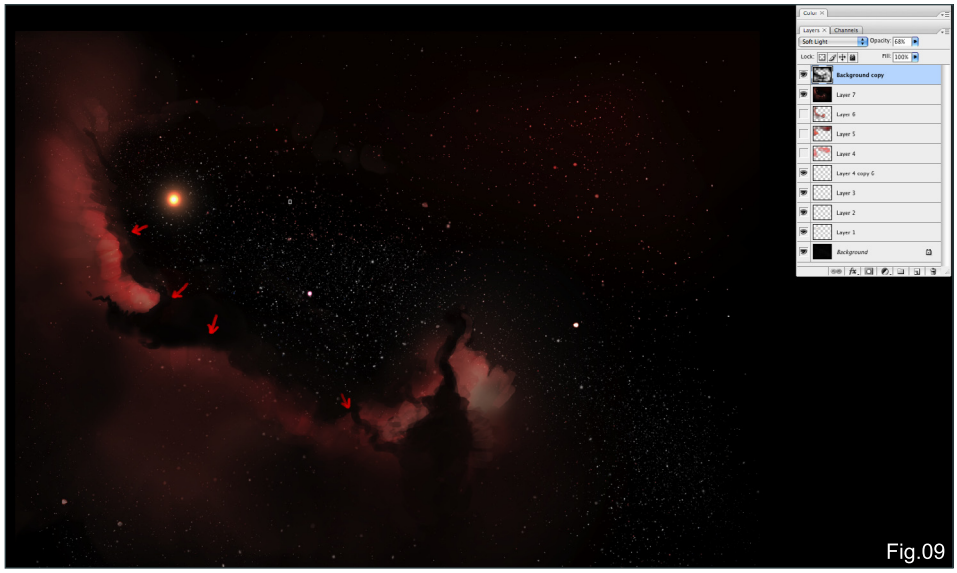


Fig.09

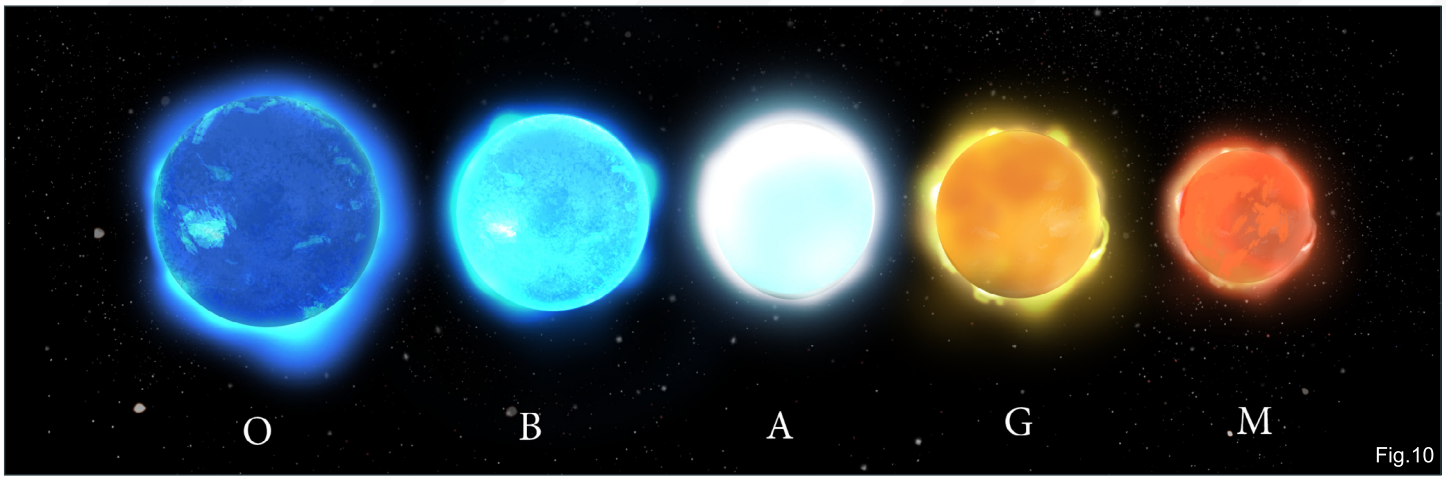


Fig.10

10. And there you have it – your very own basic star field!

From here on, there are numerous options; for example, from a compositional point of view, you could paint a cluster of stars, add a gas cloud or even paint a nebula. So let's see if we can build upon this scene to create something more complex (**Fig.08**).

In **Fig08**, a simple red nebula is painted onto a new layer. Notice that there is a distinct hard edge (red arrows) followed by a soft edge (red wash). We will return and analyse these features again later on in the workshop, but first of all let's take another detour into star systems and galaxies (**Fig.09**).

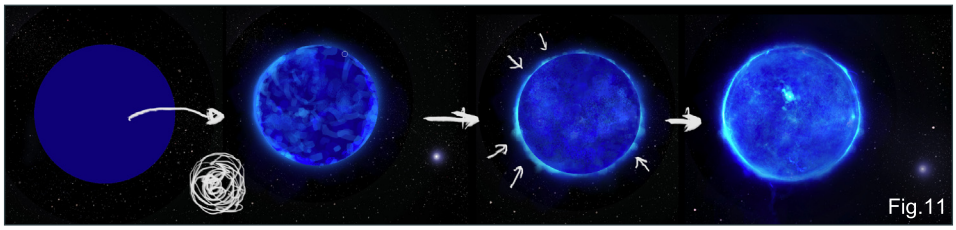


Fig.11

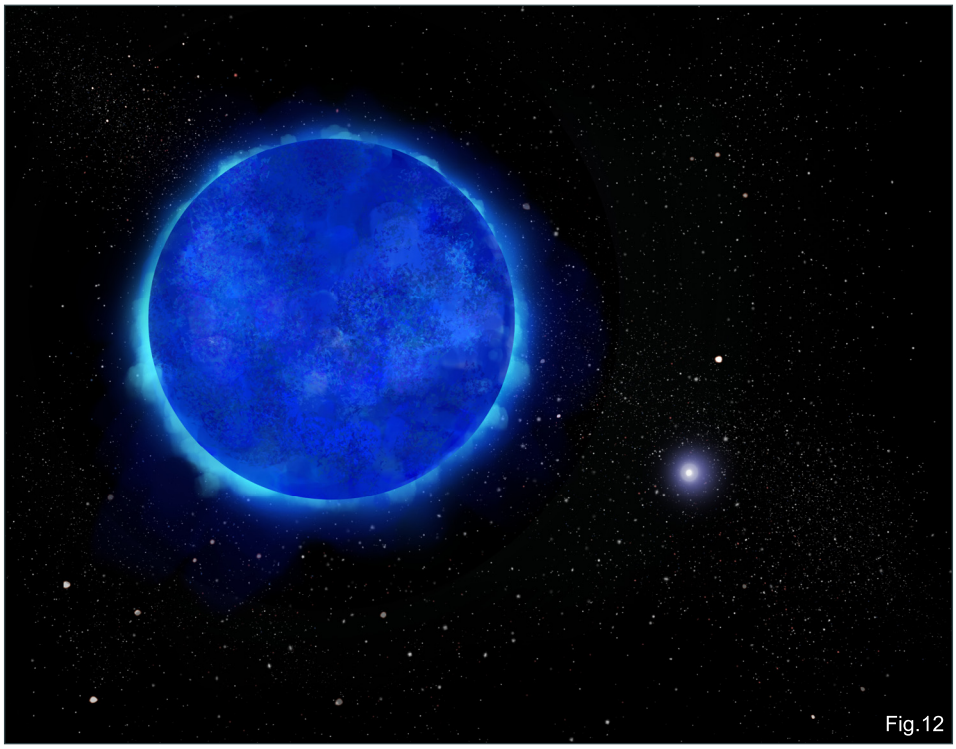


Fig.12

Star Systems

For simplicity, I tend to group stars as active and inactive stars (e.g. black holes, novas and neutron stars). Most ordinary star systems tend to either:

1. be binary star systems
2. contain "hydrogen burning" stars
3. be "main sequence"

Officially, one can categorise stars based on temperature and luminosity:

Temperature: ranges from hot to cool: groups O (blue), B, A (white), F, G (yellow sun), K, and M (orange)

Luminosity (correlating to spatial size from big to small): 0 (hyper-giants) through III (giants) to V (main sequence dwarfs) and VII (white dwarfs) (**Fig.10**)

For the purposes of this illustration, let us add a binary star system to the field of stars.

Binary Star

1. Block in a large and a smaller elliptical sphere using the elliptical marquee tool (M).
2. Using a flat colour, let us fill the larger sphere with a bluish-white (B luminosity) colour and its companion star with a duller luminosity (white to yellow). A brighter star is often denoted as the "Primary" star (**Fig.11**).
3. For the primary star an even white-bluish tint is applied across the image. In areas with coronal ejection, a pure white can be used.

To paint the area around the primary star (the corona) invert the marquee selection and, using a fine airbrush, apply an evenly saturated grey-blue around the periphery using Colour Dodge. In one or two areas, a small coronal ejection can be suggested (**Fig.12**).

4. For the companion star, we can use a more familiar pale yellow, or a light blue feel, using Colour Dodge (Ctrl + Brush mode to select).

5. To finish up, the feel of that brilliant blue glow can be produced by various simple methods, as follows:

– Duplicate the layer and set it to Overlay or Colour dodge. The lighter colours will become even brighter and the darker areas can be erased or masked out subtly with your standard airbrush.

– Under Layer Options > Curves, drag your slider to the far left. This will make the overall image brighter. This forms a black/white mask, allowing you to paint out areas that are undesired and leaving certain areas brighter (**Fig.13** – **Fig.14**).

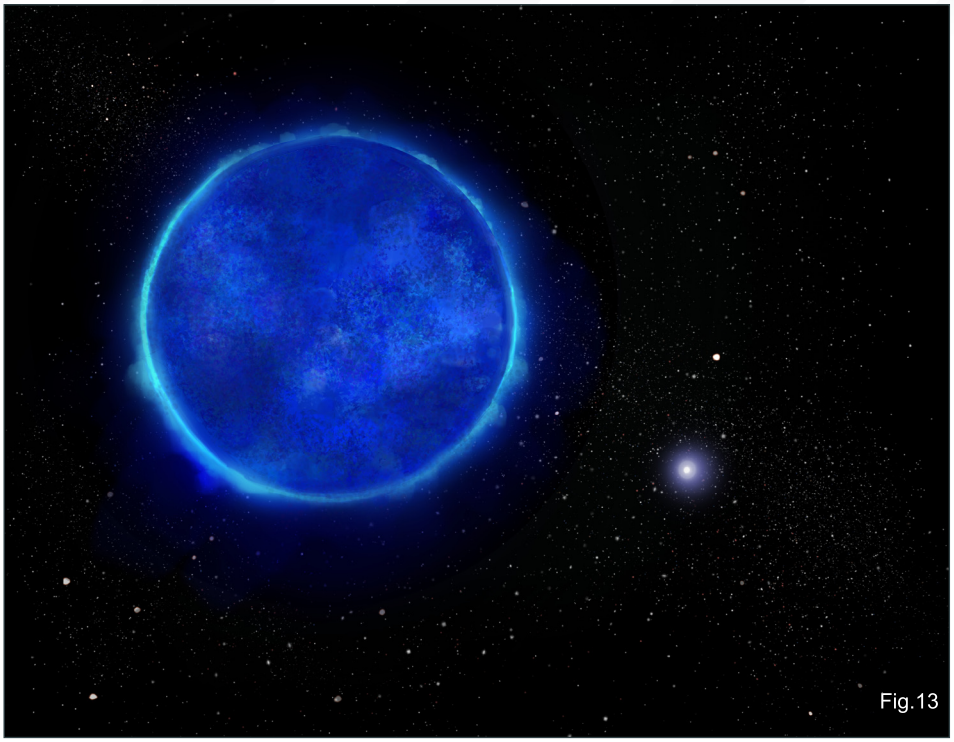


Fig.13

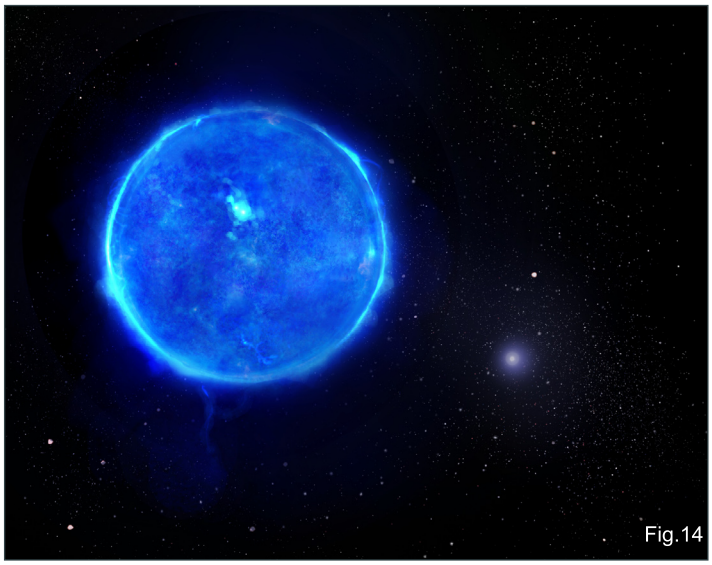


Fig.14

Nebulas

As an oversimplification: “If you can paint clouds, you can paint nebulas!” The way to approach painting nebulas is to think of them as multicoloured, layered clouds (an interstellar cloud of dust, hydrogen gas and plasma) that represents a birthing pool of stars. Most famous of all is the Eagle nebula and the image of the “Pillars of Creation” (**Fig.15**).

For the finer details of nebula edges, the fundamental and crucial aspect that will sell your space imagery is in the depth of your studies of clouds, cloud formations, fluidics and smoke. The way in which clouds and smoke form small whirls, currents, spiralled patterns and move in a tumultuous


Fig.15

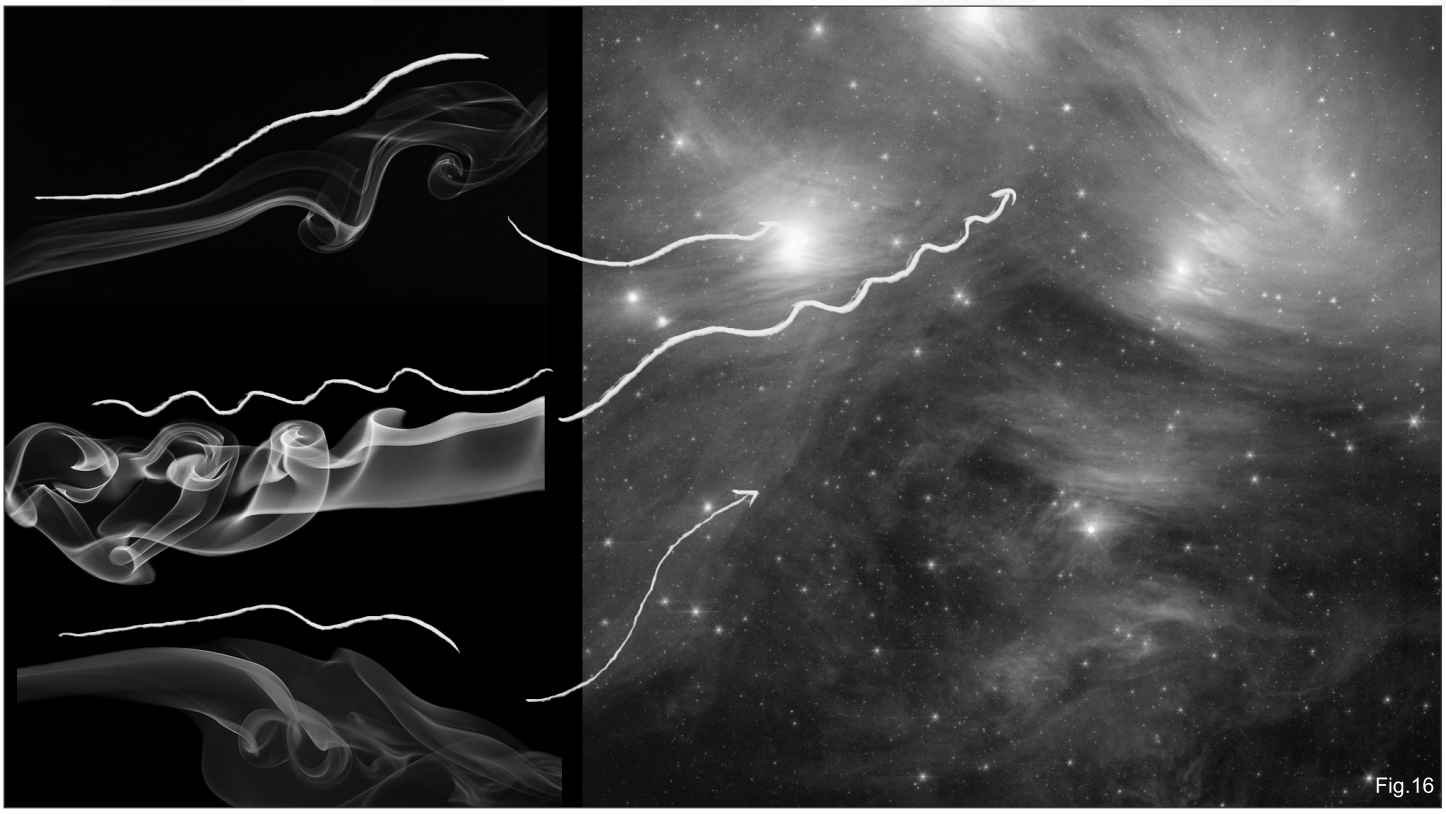


Fig.16

manner, can be effectively translated across to your nebula paintings.

As a simple experiment, try pouring a moving viscous fluid into a lesser one, e.g. cordial into water. Alternatively, observe the smoke that trails from a lit cigarette or an incense stick.

It is fair to assume that, unlike stars, when one is painting nebulas you are able to be less constrained by reality, and basically be able to paint as abstractly or creatively as you wish. Nebulas and clouds are as such one of my favourite types of images to paint. For where else can one paint a rainbow cloud and get away with it as reality disguised as fantasy disguised as abstract art (**Fig.16**)?

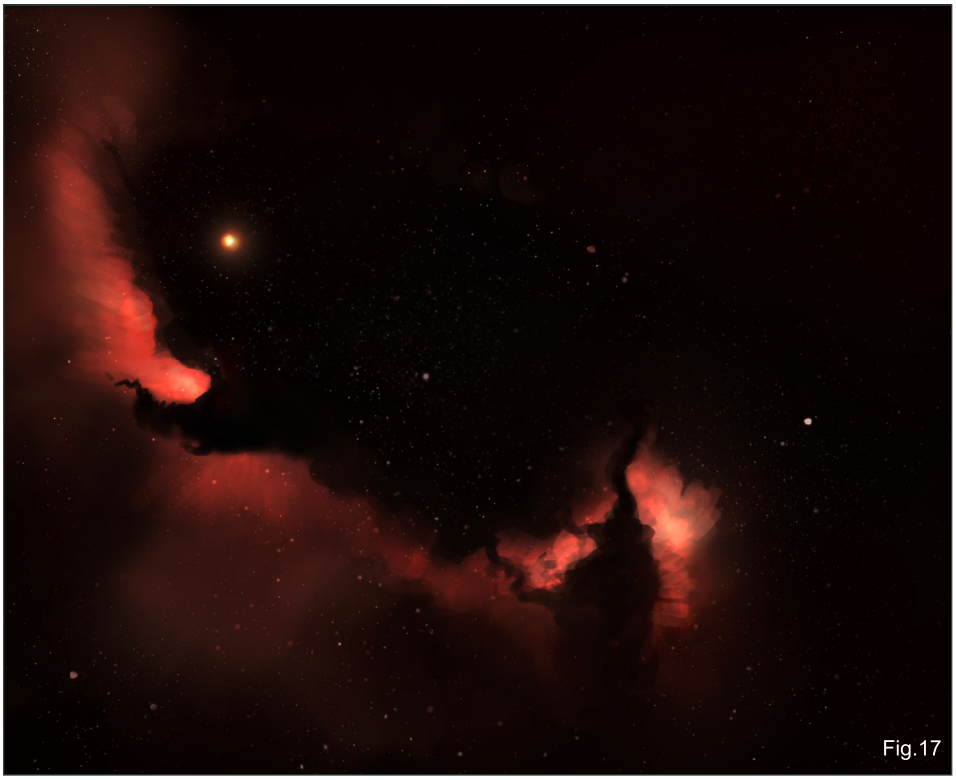


Fig.17

Preparing for the Painting Bit!

In this workshop, let us recreate similar images to the Eagle and Crab Nebulas. Analysis of these images presents artists with a nice choice of the entire spectrum of their colour palette:

Primary: red – green complementary as the main colour palette

Secondary: orange/yellow – blue/green

For professional illustrations, or client work, I tend to paint at least at 3,500 pixels wide and above. The DPI can be arbitrary, so let us start the image with a blank canvas with the main aim of blocking in the initial complementary colours, followed by the secondary colours.

First of all, before we get stuck in, let's first analyse clouds and whorls!

Space Clouds

Studies of clouds and smoke will suggest that there is a hard and soft edge to each form.

Similarly, nebulas can be likened to space clouds, with a few things to note:

– Dense areas tend to glow brightest or eliminate all light (darkest) as dark matter.

– Only the brightest stars or spiral galaxies will shine through within or in front of a nebula.

– Nebulas have hard edges (that tend to be brightest/denser) with an adjacent darker area and a soft opposing area (**Fig.17**).

With these basic points to note, let us have some fun with the following image!


Fig.18

Nebula Image

1. Start the initial canvas with purely the rough colours worked in. Any hard brush will do! For personal preference, an ideal brush that has a mix of a hard edge with some soft elements would be useful to act as a cloud brush.

2. **Basic lighting and detail:** Simply apply a brighter area of colour and establish your lighting so that it recedes into a darker area, as this can be helpful, for example establishing a gradient in order to stimulate the way in which light falls off from bright to dark. In addition, this also helps to establish a wider and even range of values to work with (**Fig.18**).

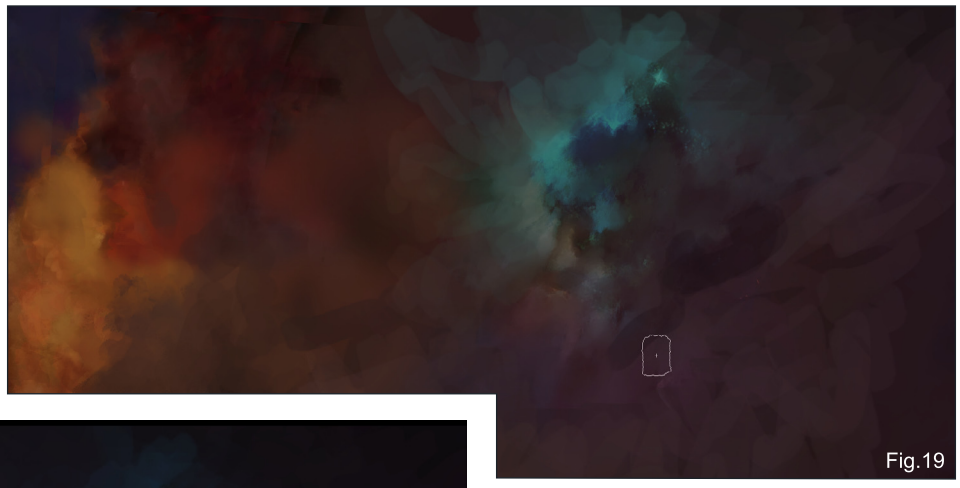


Fig.19

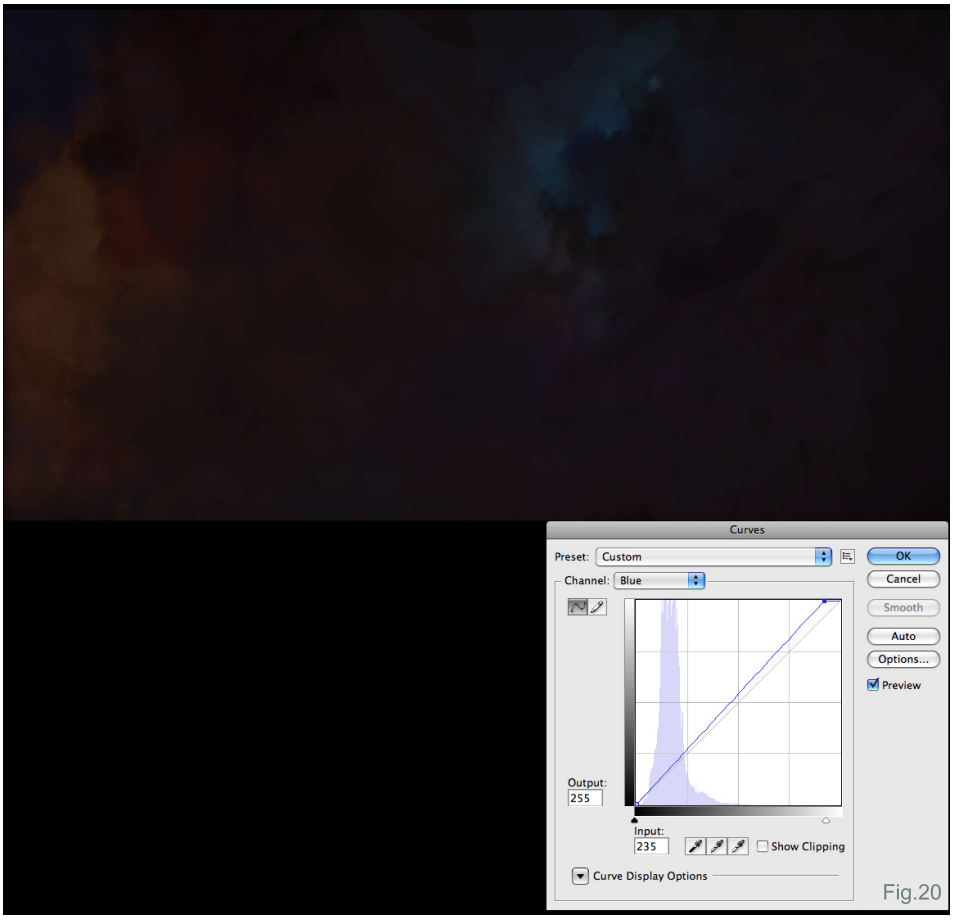


Fig.20

3. **General glow**: Subtle use of Colour Dodge in areas where your main light emissions are, will help you to provide a brighter source of light. Imagine a bright Omni spot light emerging just behind a cloud layer! A nebula is similar in principle.

4. **Secondary light source**: In this instance, I introduce an alternate light source that is complementary (in colour scheme), to show a subtle difference. (**Fig.19**)

5. **Establishing contrast:** To provide an even more dramatic effect, we will need to provide contrast between a light and darker area. In Photoshop, I find the easiest method to do this is via the Curves layer function. I can darken the overall lighting by dragging the slider downwards (and to the right). Subsequently, to

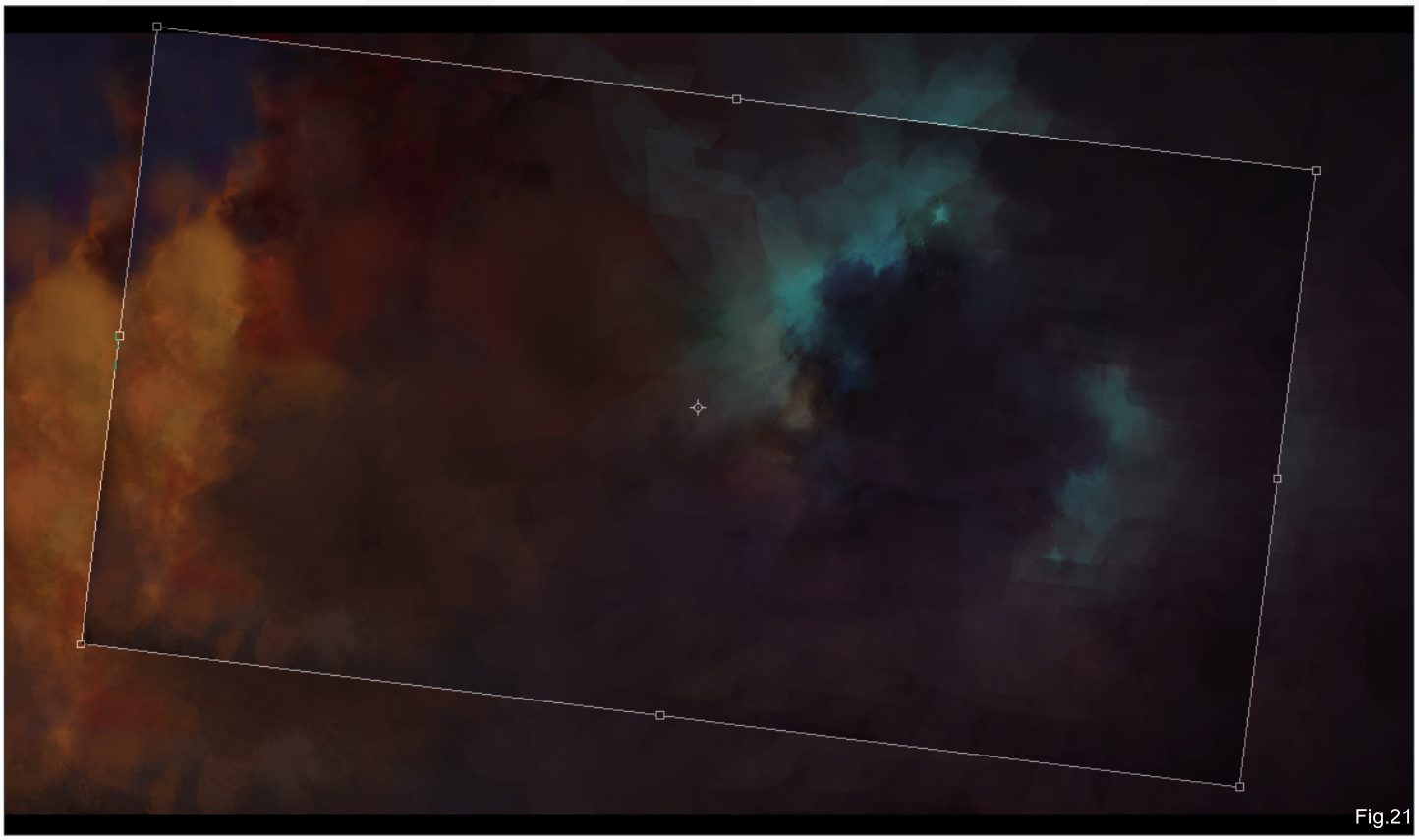


Fig.21

re-establish a lighter side you can just paint in the original image in the layer curves option. By using this method it is quick and efficient (and does not destroy your established painting).

6. Alternatively, if you are unfamiliar with layer options, then you can simply erase out the darkened area to paint the underlying lighting into the overall image.

7. Flatten the image and save at this juncture (**Fig.20**).

8. **Composition:** To establish a larger and wider shot, we should now consider how the nebulas themselves form an aesthetically pleasing composition. Simply duplicate your overall image and apply the free transform tool (Ctrl + T) to rotate and shrink the overall image. You can repeat this step a few times, until you re-establish a more pleasing overall image (**Fig.21**).

9. **Dark and Light:** This next step is important in order to provide a realistic feeling. Colour-pick various values from the light side and paint them into the adjacent darker side, and vice versa. Repeat this until you achieve an overall, even blending. By doing this in every area of contrast (between dark and light, hard and soft edges), you will start to establish a more realistic nebula cloud appearance and feel.

10. **Re-establishing stars:** On a new layer, add a few bright stars in by hand across the whole image. Try to imagine how light penetrates behind a cloud or a fog. However, in this instance, just remember that areas which are the lightest (well lit and bright) have the highest density of stars. And in a nebula region – only the brightest stars are prevalent (**Fig.22**).

11. **More bright stars:** On another new layer, paint a scattering of yellow and white-blue stars, faintly. Reduce the layer opacity to around 30-50% and erase out areas that appear too uniform so that these points of light are subtle, soft and nonuniform.

12. The resulting image is a rough composite. It is by no means finalised, but some people may choose to stop here (**Fig.23** – **Fig.24**).

Tidying Up!

The main issue to improve the overall image is the understanding and observation of edges. From here on, the whole process is about tidying up, correcting basic shapes and applying


Fig.22

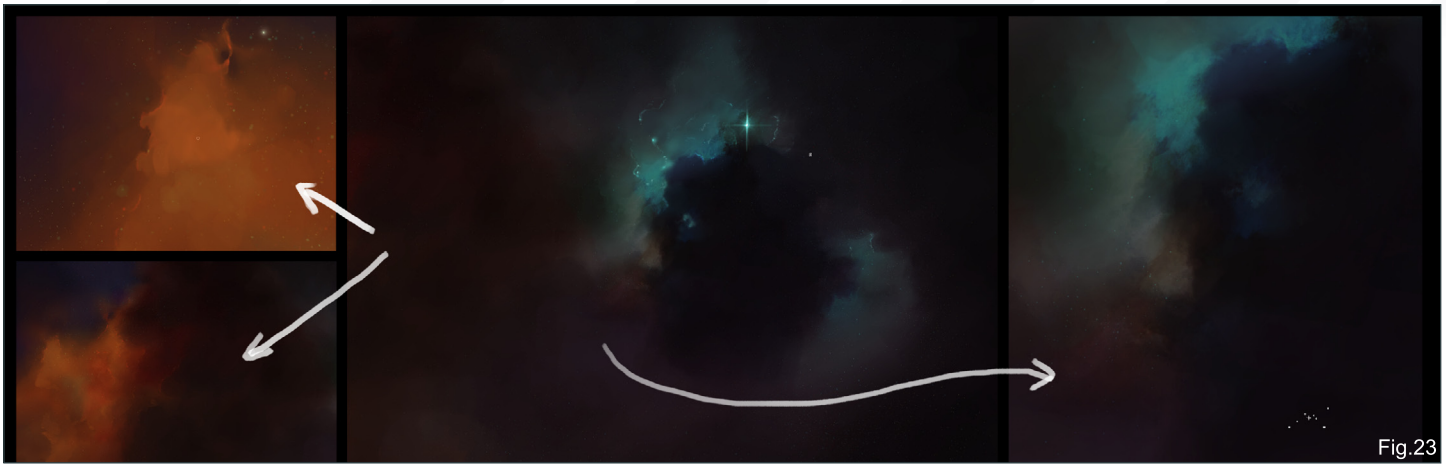


Fig.23

hard and soft edges whilst subtle colours tweaks are added (**Fig.25**).

Refer to **Fig.25** and work your image from left to right, as follows:

– Tidy up the whorls and observe the edges of clouds as having a hard form (in front of a softer backdrop), and this will read as a being in front. Adding a thin cast light that curves around the edge will help us to read it as a 3-dimensional shape.

– Ensure that the forms are sinuous and follow the movement of a heavier gas within a lighter gas form (i.e. a thicker, dense or viscous mass moving within a lighter, more liquid environment).

– Ensure certain stars shine brighter than other focal points of light. For the brightest points of light, add a soft focal glow with your airbrush. This is a very subtle thing as it is easy to overdo the colour dodge option and produce a hard circular ball of light, instead of mimicking the stars that can be seen through telescopes.

Staring at my image long and hard, I decided that I really hated the overall image and composition. It lacked spontaneity. All of the subtle flows of hot and cold gasses were simply lost as tiny details. To paraphrase Ian McCaig: "Time to murder yer lil darlins..." (**Fig.26**)

So again, working from left to right:

– Rotate the image 90 degrees clockwise. This allows us to analyse the image in a new perspective and pick out errors or differences not seen before.

– In this new view I decide that the overall image needs work on the overall composition. Firstly, let's expand the canvas to almost twice its width. Duplicate the original layer and flip it horizontally. Now paint everything out with a hard brush. Do not worry about being tight or precise; use the biggest size you think you're comfortable with and then make it even bigger and paint in big, large strokes.

– Liberally apply large swathes of colour and value from within the canvas. Do this until a new, natural feeling of form takes place. Then start adding areas of light and shadow where you feel there is ambient or focal light. As before, try to observe the natural flow of shapes and forms.

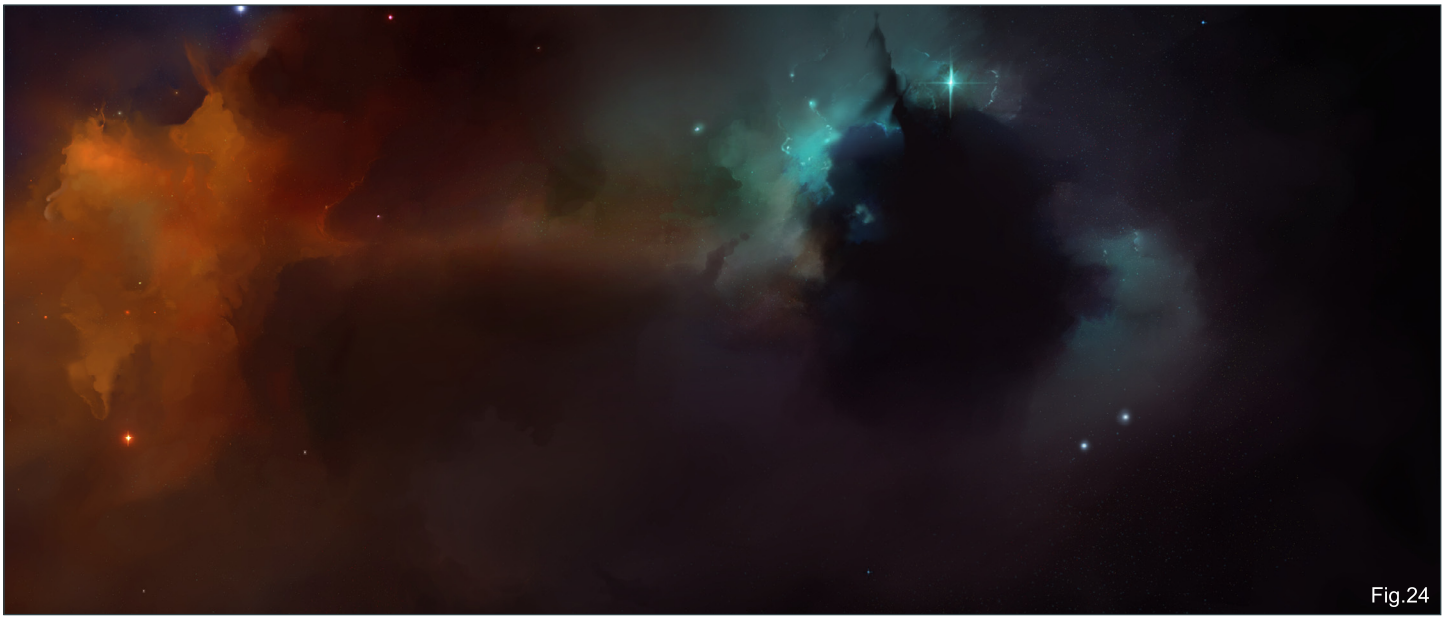


Fig.24

– The overall image now appears like the way the thunderhead of a hurricane may look (but in space).

Using a Nebulous Backdrop

Finally, the last aspect of this workshop tackles drawing objects near a nebula.

By basic definition, man-made objects – even with advanced shielding – are anticipated not to be able to withstand the extreme ionising radiation and space radiation within a nebula. Nevertheless, if you had to depict or film a story about space travelling folk, then there is a real problem with showing atmospheric perspective, distance and scale, as follows:

Scalar Problem: A 100 kilometre shape and a one metre shape can both have the same scale relative to a viewer, because of a lack of atmosphere/dust to distinguish the two.

Lighting problem: If we were to hypothetically travel beyond the existing lunar orbit and be in a sea of space, all that will be seen are tiny fractions of diffused pin-point lights. A vessel passing by will subsequently obscure these lights to form a negative space.

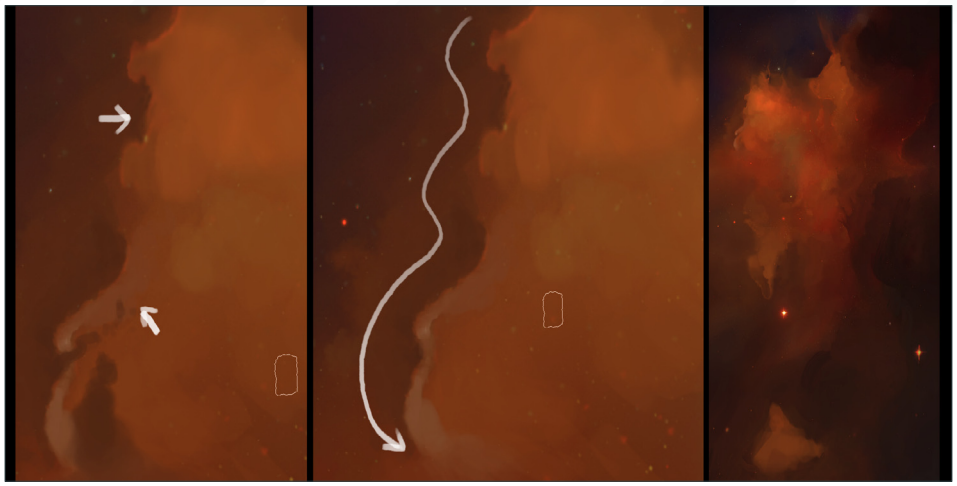


Fig.25

So how would we best illustrate space vessels and such?

1. Realistic: One solution is to affix local lighting on your space vessel – enough to suggest an outline of the vessel. This was suggested for the original series of Star Trek and is still used to this day.
2. Semi-Realistic: Utilise nebulas or ringed planets as a backdrop of your space scene to provide distance and atmosphere. As long as the nebula is not within a dangerous range, this can suit the issue of perspective perfectly. However, many sci-fi shows (e.g. Battlestar Galactica, the opening sequence of Star Trek Voyager, and so on) depict the movement of spaceships through nebulous space clouds and gasses, which in all probability would be 99.99999% impossible. Often, more realistic space writers will talk of star ships having to take a detour around a nebulous region to avoid the intense space radiation.

3. Fantasy: Ignore scientific technical and physical limitations, and utilise space to be always containing weird coloured gasses, dust clouds and/or asteroid fields at every given opportunity!

For our purposes, and to achieve an aesthetic quality, let us use a remnant derelict vessel in space as our final piece. Imagine this derelict vessel exposed and battered, travelling hundreds of light years in space towards a nebulous region, from a period from whence mankind first started space exploration (a bit of

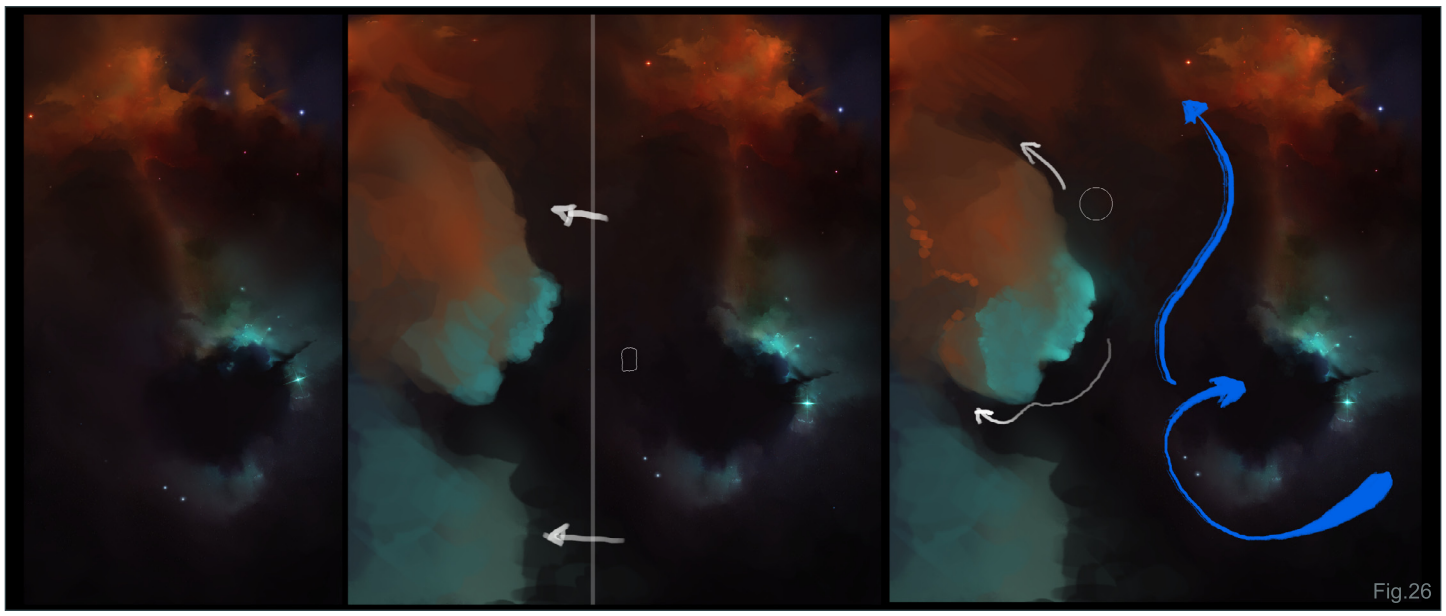


Fig.26

an old world and retro feel which contains large, chunky, cylindrical shapes) (**Fig.27a – Fig.27c**).


Fig.27a


Fig.27b

1. Block it in: On a new layer (Ctrl + N), decide beforehand how large and where you would like to locate this object.

2. Using the Lasso tool (L), roughly scribble multiple concentric shapes (in relative perspective) and block in the overall shape as a flat, backlit silhouette. In this instance, I use a dark saturated colour (not black) in order to emulate a backlit object drifting in space.

3. Dark side/light side: Lock the transparency on your new layer. This will allow you to paint freely within the blocked-out shape without worrying about straying beyond into the background.

4. Use an airbrush and ever so lightly ghost in a faint, saturated red from the surroundings (but ensure that the overall colour is still dark and distinct from the background).


Fig.27c

5. Now paint in a lighter colour from the ambient surrounding. Use flat strokes to describe the angle and shape of the overall form.

6. Blend: Now soften everything by working those two values back and forth to gradually show only the stronger light source (from the left), and faintly add a rim light (from the far right). To accentuate the overall form, you can lighten the immediate background around the derelict vessel in order to make it read better.

There isn't much more to say on this subject at this juncture, so let's flatten, save and tidy up, and it's a job well done!

If you have found this to be useful, feel free to let me know. Otherwise, I hope to see more varied, interesting and abstract nebulas in the future within the larger art community. And, if you do choose to paint in a more abstract, semi fantasy/realistic manner, at least you are now painting and conceptualizing from a position of knowledge and power (**Fig.28**)!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08'

Fig.28

Chapter 02

BARREN WORLDS

SPACE PAINTING
CHAPTER 02: BARREN WORLDS

Overview

Welcome to the second chapter of our 12-part space and sci-fi art series. In this second chapter, we will look at planetoids and worlds with minimal-to-no atmosphere, and how they are affected by the lack of atmosphere (or rather, how the lack of atmospheric perspective may throw our normal artistic senses awry!) (**Fig.01a**).

Knowledge of atmosphere, and the lack of, accounts for how accurate and realistic our depiction of any Earth-like (blue) environment versus an alien unknown climate (for example an atmosphere with high methane content resulting in a green sky). As such, we will focus primarily on our companion – the Moon – to provide a basis and working understanding for us to transfer to other exotic environments.

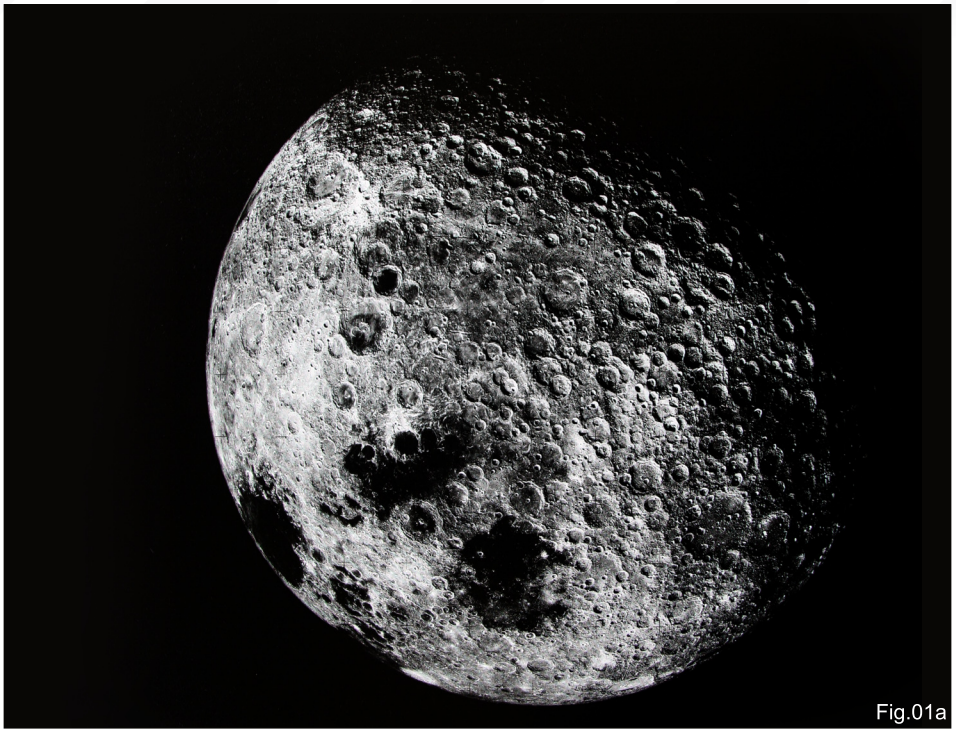


Fig.01a

In **Fig.01b**, notice that there is a great amount of detail from the foreground to the mid-ground, and that the darkest values are evenly distributed throughout. Normally within an atmosphere, the darkest values recede with distance and objects in the distance become lighter.

Planetoids with minimal or no atmosphere would be akin to looking at a distant landscape (at sea level, with supernaturally clear vision limited to 2.9 miles by the curvature the earth). But first of all, let's talk about the building blocks of an environment from a rather abstract and Zen methodology (**Note:** you may choose to skip though these basics and come back at a later juncture).

Environment Basics

A Zen Approach – "Form is void, Void is Form"

The fact is, our ancient forefathers studied and dissected the universe in intimate detail and thus concluded that everything can be simplified into a circle (**Fig.02**). The Zen practice

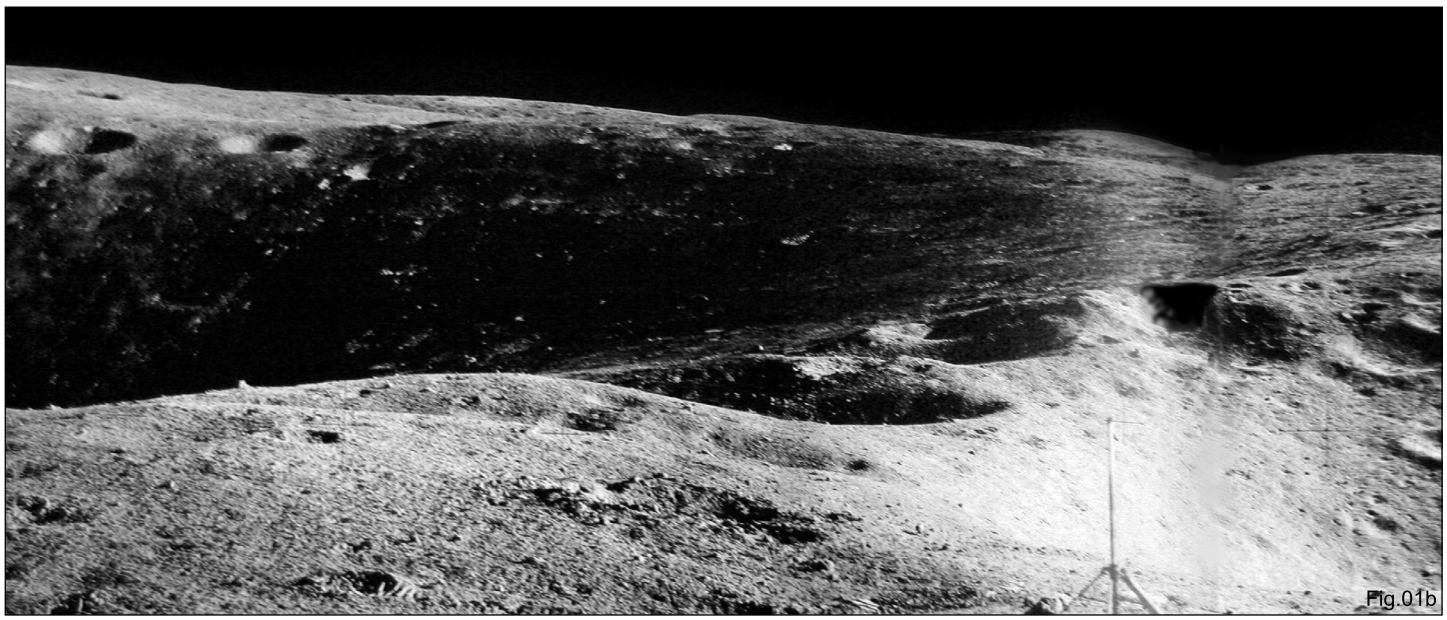


Fig.01b


Fig.02

of meditation takes many forms and guises. In particular, the Zen Circle, known as the “Enso”, talks about void and form being interdependent – their mantra being “Form is void, Void is Form”. Looking at it with a Zen approach, one could say of the Enso (**Fig.02**) that “A circle becomes like the universe.”

Breaking these down further, one could stipulate that the building blocks of the universe have been further derived from the square, triangle and circle (**Fig.03**). This concept has been exceptionally distilled and beautifully rendered by the Zen monk, Gibon Sengai (1750-1837).


Fig.04

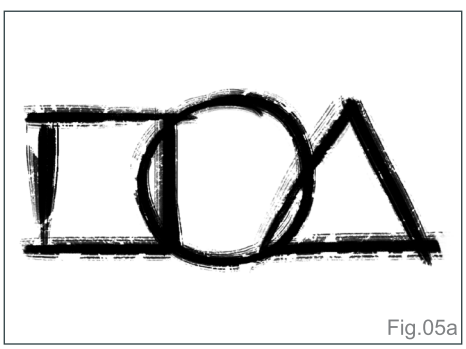


Fig.05a

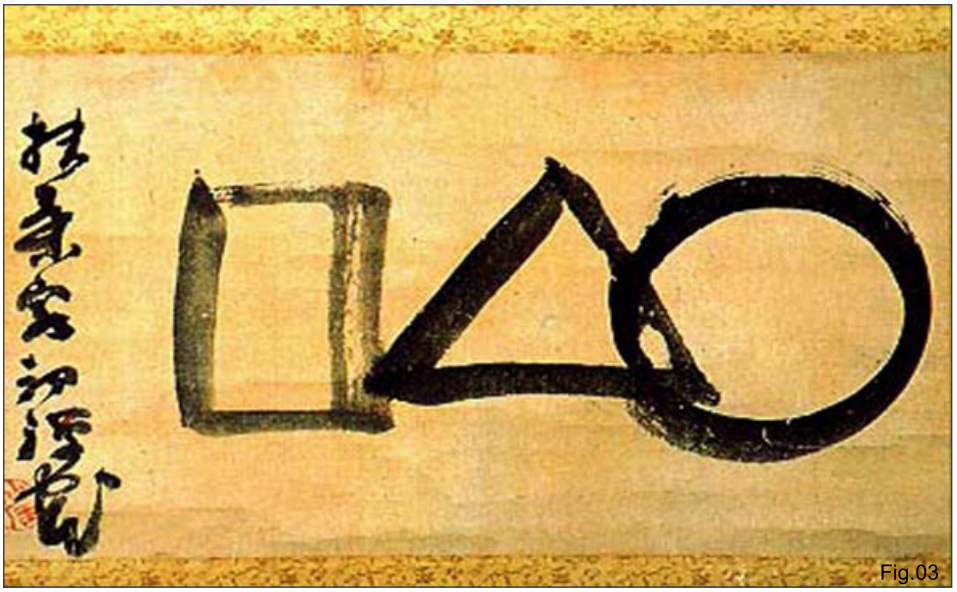


Fig.03

When you combine all of these elements together, they reform roughly the great circle that represents the form of the universe – giving form from a void (**Fig.04**).

Form - Square, Triangle and Circle

Symbolism is used quite regularly in the east, with the average Japanese citizen using the following for instructions:

X Cross = “No good” or “Cancel”

Δ Triangle = “Average”

○ Circle = “Good” or “Affirmative”

□ Bulls-eye = “Excellent”

Note: The circle is the equivalent of a tick (meaning “Correct”), and thus is used to confirm an action. However, when Japanese products are introduced into the western field of influence, they sometimes choose to ignore this symbolism and go as far as to reverse them (e.g. PlayStation controllers have “X” and “○” buttons which have been reversed for European and North American products).

It will perhaps make more sense that, with these everyday geometric symbols found on your average Japanese instructions (or PlayStation controllers), you have all the symbolism you require to draw or create life (art and new worlds). In fact, when you translate the square, triangle and circle into perspective, they rapidly form useful and familiar shapes. Therefore, the forms can be rapidly rearranged to form a cube, sphere and a pyramid (**Fig.05a & Fig.05b**).

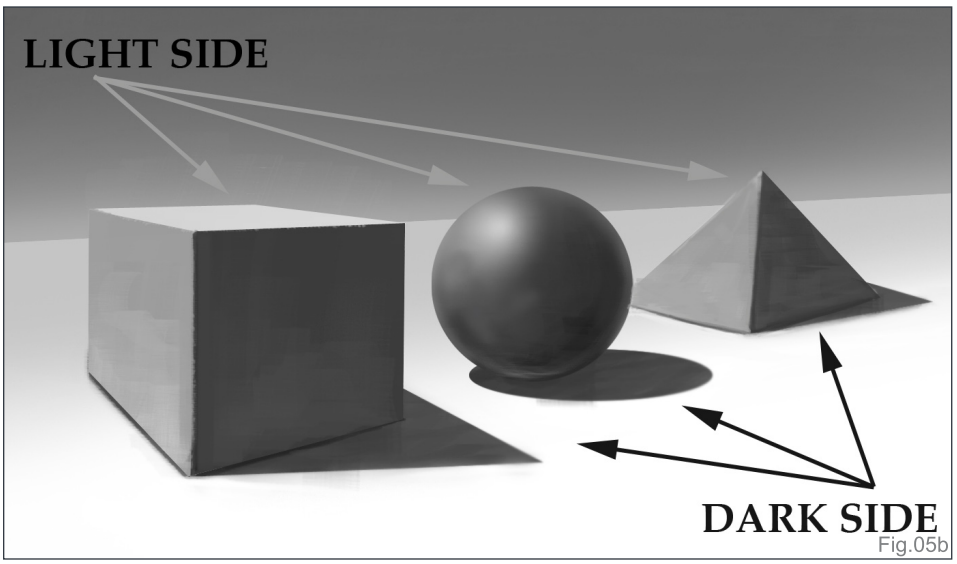


Fig.05b

In relation to using these within environments, they can be applied to hills, planes, rocks and props in equal measure. Each form will have a dark and light side to provide a simple readable shape. To go that extra mile – for in reality, there will be a core shadow, or an area of higher contrast, where an edge turns. The area furthest from the edge of the core shadow tends to have bounced or reflective light (**Fig.06**); i.e. the core shadow is the edge which is absolutely perpendicular to light.

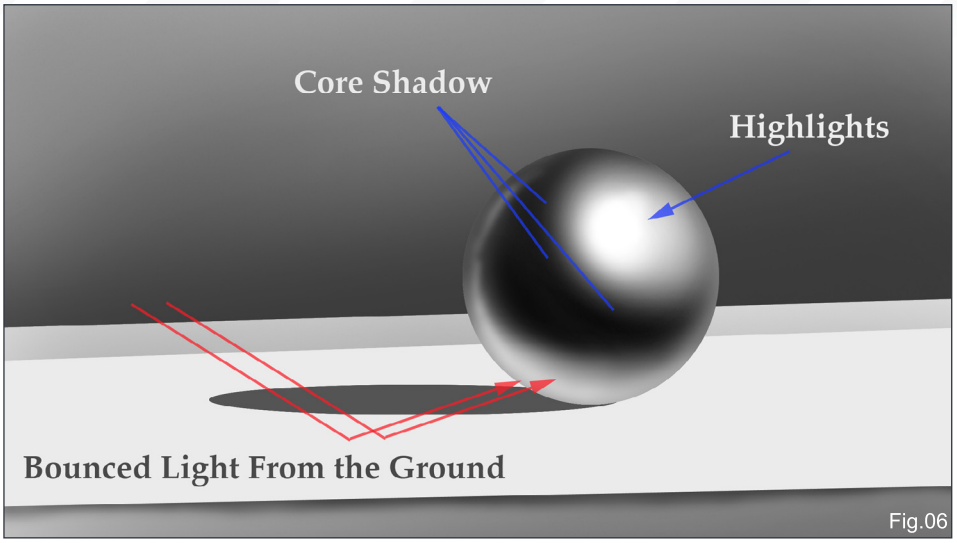
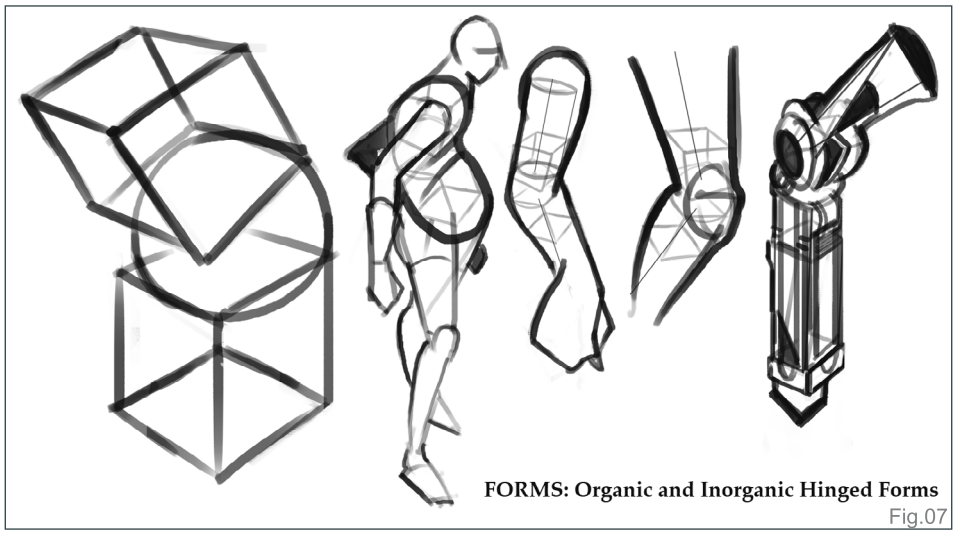


Fig.06

In general, these forms can be applied to both organic shapes (characters/creatures) and inorganic shapes (props/environments), and especially joints (which best characterise the soft and hard forms that may twist and bend as well) (**Fig.07**).


FORMS: Organic and Inorganic Hinged Forms
Fig.07

Composition and Atmosphere (…or the Lack of Atmosphere)

Using the same basic shapes, I'd like to quickly describe atmospheric perspective here (**Fig.08**).

In **Fig.08**, I've used the same objects to produce human-sized dwellings. Notice that objects standing within a shadow have exactly the same tone of shadow as any of the larger objects obstructing the main light source. In terms of perspective, if you have two objects of a similar height, then the further away it is the smaller it should be.

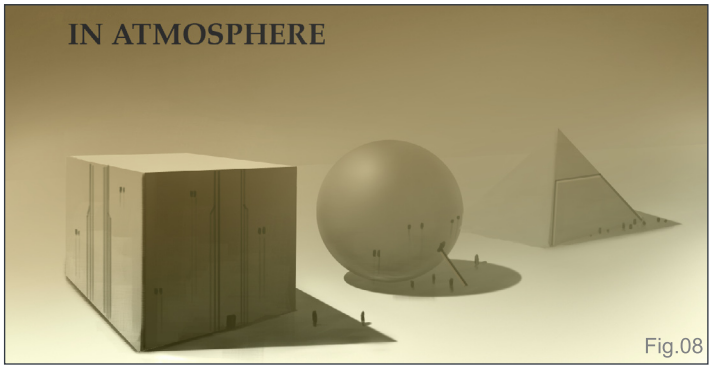


Fig.08

Your Challenge: Try replicating the same exercise using similar shaped objects for your own benefit. Something so simple can be challenging in itself and immensely useful for teaching one about rendering, form and lighting – even for the veterans (some experienced artists have gotten far without learning the basics, and it is that fundamental grasp of basics that distances the super pro. artists from the experienced artists) (**Fig.09**).

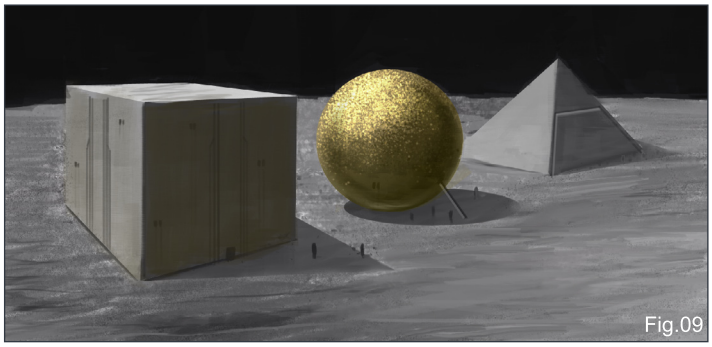


Fig.09

In **Fig.09**, notice how much more lacklustre and unrealistic the image appears. Without atmospheric perspective and (minimal) colour, painting lunar landscapes can be a truly daunting experience! As such, one has to judiciously add some colour elements – be it the image of the earth, local man-made objects, etc. In this instance, I've added a gold coloured sphere (similarly used on the Apollo mission lunar modules!).

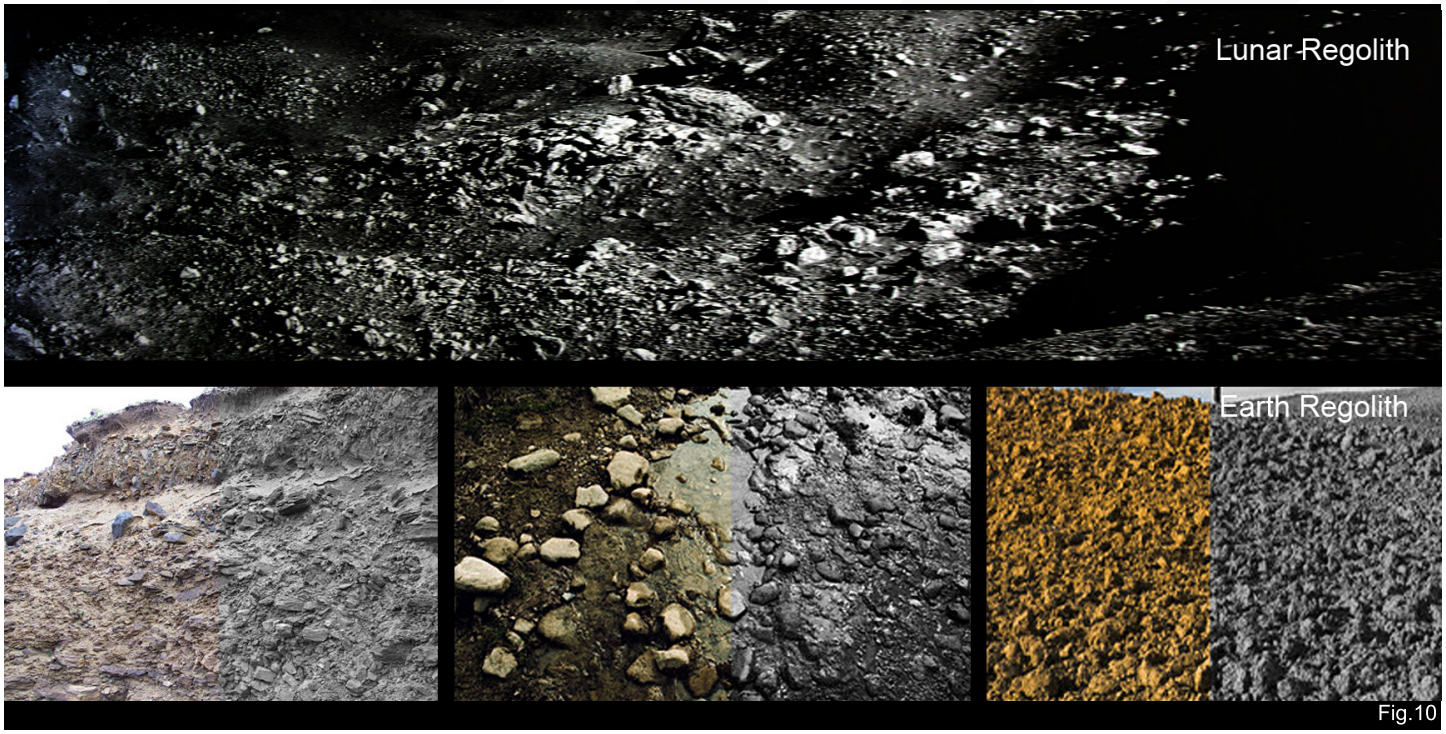


Fig.10

Lunar Landscape

Finally, having dispensed a quick recap of the basics of environmental form and composition, we can get into the meaty part of this workshop!

The lunar landscape is firstly said to have generally no atmosphere. There are traces of gasses, such as radon, from out gassing or micrometeorites. In addition, the solar wind can charge (a photoelectric effect) fine layers of moon dust that may present as electrostatic levitated dust. Coupled with exposure to cosmic rays, solar flares and solar wind, and the frequent impaction of micrometeorites, this presents a hostile and relatively harsh, demanding condition!

Closer inspection of the lunar landscape shows (**Fig.11**):

- A grey coloured surface;
- Loose overlying debris covering most of its surface, otherwise known as “regolith”;
- A fine scattering of lunar dust

In **Fig.12** we can see:

- Dark patches, known as “maria”/”mare”, (“seas”) formed from ancient solidified lava;
- Terrae (“land”), which includes the highlands of the moon and are lighter in colour and pockmarked with craters. They represent the areas between various seas of maria but are not officially used in lunar nomenclature;
- Very thin atmosphere (contrary to popular belief) but insufficient to block out solar radiation, wind and cosmic rays; therefore the issues presenting a painter are minimal atmospheric perspective, i.e. a thin non-visible haze;
- The temperature varies: 400K – 100K (127 – 173 degrees Celsius) and changes rapidly from sunrise to sunset; for comparison purposes, an industrial-sized deep fat fryer cooks just slightly hotter at 180-200 degrees Celsius (356 – 400 Fahrenheit), and so, in short, the surface of the moon in the day is hot enough to cook a perfectly boiled egg, but not enough for a crispy fish and chips!

Note: Lunar soil composes primarily of:

- Regolith: a layer of loose rock resting on bedrock measuring roughly 5m on the mare areas (**Fig.10**) (lt. Maria: large, dark, basaltic planes on Earth’s moon, formed by ancient volcanic eruptions that appear as dark patches to the naked eye) and 15m on the more exposed highland areas (refer to **Fig.10** to see the similarity between terrestrial and lunar regolith);
- Lunar dust: composed of dust particles in constant motion; once heated up it may result in electrostatic levitated dust;
- Maria: dark patches of the moon containing

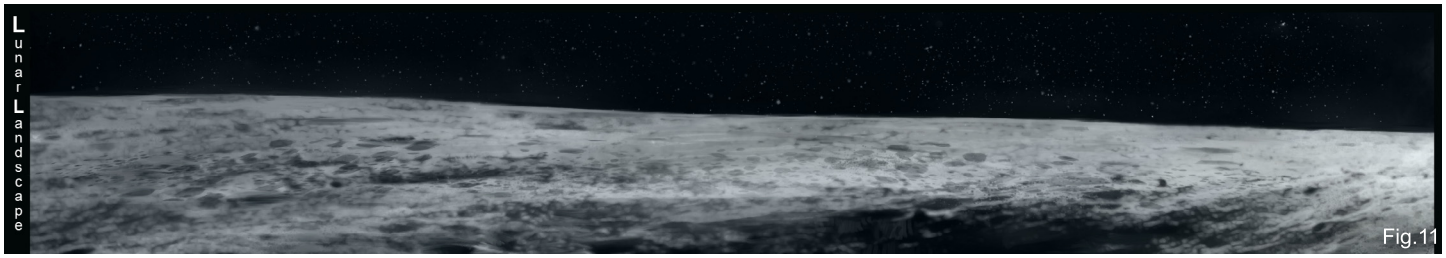


Fig.11

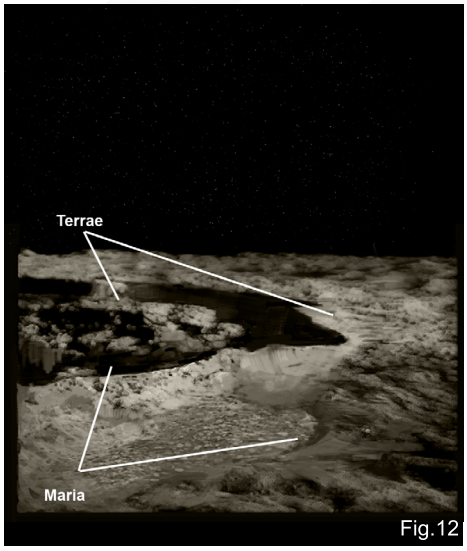


Fig.12

various formations, known as “dorsa”, “dorsum” or “promontorium” (headlands)

Lunar Craters

The “Barringer Crater”, which was discovered in the 1920s, is probably the most famous and most well-recognised terrestrial impact crater. For comparison purposes, our terrestrial craters tend to be complex craters varying from a modest 10-20km, to some of the largest impact craters such as the Manicouagan Crater in Quebec, Canada (**Fig.13**).

If you have the opportunity, do visit a meteor canyon, or the Barringer Crater itself, as it will be a sight to behold of sheer devastation, power and beauty all at once – which is unrivalled by photography! And this brings me to another point about first-hand references. Since not many of us will have the opportunity to visit the moon or more barren, desolate objects in space, then being able to study and paint first-hand from these majestic earthbound places will provide us with lots of visual data that will fill our memory banks – on both conscious and subconscious levels!

Fig.13

Lunar craters come in all shapes and sizes, but generally fall into two categories (**Fig.14**) – simple and complex. In **Fig.14**, notice how the larger the crater is, the more complex it becomes. A simple impact crater will contain debris within the crater floor (breccias and impact melt), plus a lot more ejected debris (impact ejecta) within the impact area. Whereas a complex crater can become tiered (falloff from multiple ejecta) around the crater rim, or can form a central uplift/peak within the centre. These may even have secondary craters within them!

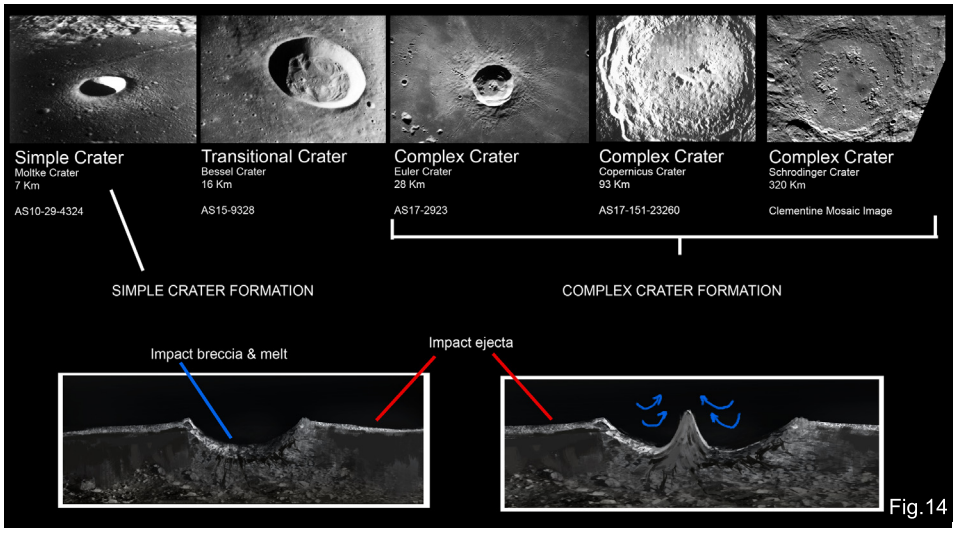


Fig.14

Note: Additional Lunar Terminology

- **Breccias:** flattened layers of melted rock fused into a single matrix of different angular-shaped elements


Luna 9: February 3, 1966 - First spacecraft to sucessfully land on the moon
Fig.15

- **Impact Melt:** a sheet of layered material and breccias
- **Impact Ejecta:** a layer of ejected material resulting from shattered material outside the crater rim

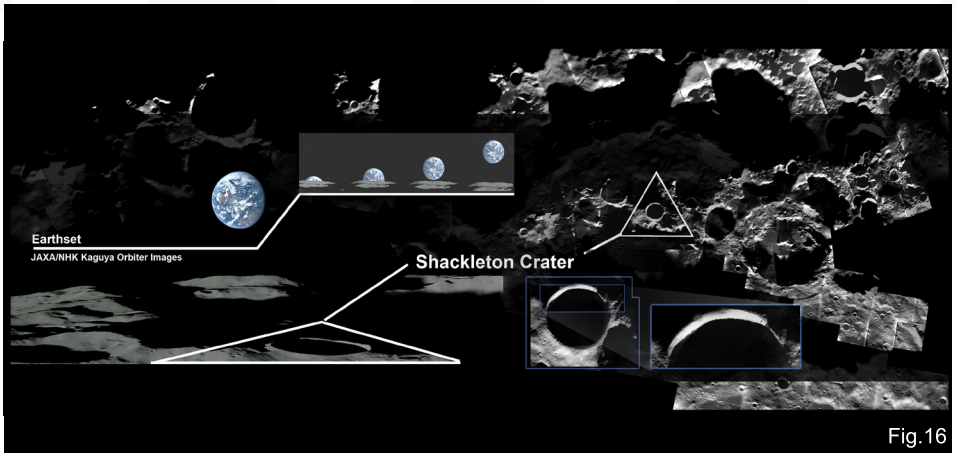


Fig.16

The Dark Side of the Moon: The South Pole – Aitken Basin

(**Fig.15** – Panoramic shot of the surface of the moon from Soviet Luna 9).

For the purposes of this workshop, let's imagine that we will be colonising the moon in the near future. Assume for the moment that the sheer logistics to get mankind into orbit and onto the moon is fairly achievable, and from here onwards the future colonisation of the solar system, near earth objects and space beyond is a real possibility. So how do we go about setting up a permanent, habitable base on the moon?

The first thing to consider is a suitable location for a base. For mankind, it will probably be easiest to locate a base within an area that is protected from sunlight, but also within easy reach of solar radiation (for solar-based power) and study/research on the transition zone between light and dark.

For this, the lunar south pole of the Aitken basin is ideal; it contains a small number of illuminated ridges within 15km of the pole, each of them much like an island of no more than a few hundred metres across in an ocean of eternal darkness. Of particular interest is the almost perfectly circular Shackleton crater, which NASA plans to colonise in the near future.

The key features of the Shackleton crater are:
- A band of PELs (Peak of Eternal Light) on its crater rim which describes a point on a body eternally bathed in sunlight, therefore allowing for external power generation and studies of solar activity;
- A low-temperature interior functions as a cold trap that may capture and freeze volatile sheds during comet impacts on the moon;
- A permanently dark central core which is ideal for building a semi-covered base within (to account for radiation and exposure).

In **Fig.16** we can see:
- On the left: Courtesy of Japan Aerospace Exploration Agency (JAXA) and NHK (Japan Broadcasting Corporation) from the SELenological and ENgineering Explorer "KAGUYA"(SELENE) – 18th October 2007

- On the right: ESA/NASA – SOHO/LASCO. SMART-1 via advanced Moon Imaging Experiment (AMIE)

In other words, the ideal location for an off-world base with no atmosphere would be to build a set of structures deep within a well-secluded and sheltered location – ideally covered with a robust exterior and burrowed deep enough to withstand further bombardment from micro meteorites and cosmic radiation!

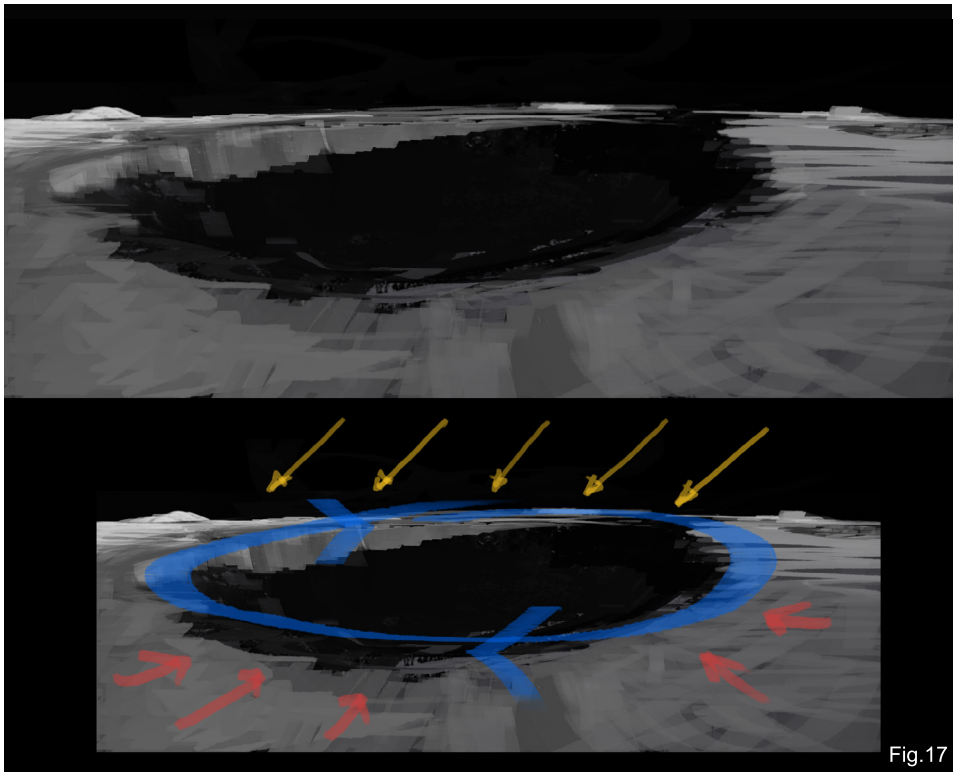


Fig.17

Painting a Lunar Crater

1. In painting a crater such as can be seen in **Fig.17**, the Ellipse tool (M) can both be informative and helpful – yet also crippling, for it is far too easy to leave a perfectly circular rim and not bother replicating the randomness and

irregularity found in nature!

2. Painting such bleak landscapes is a good way to hone and refine one's values and structure, since it will be primarily the value of greyscale that is involved.

3. My approach towards starting to paint such a landscape is to produce a few studies of lunar rocks and terrestrial crater landscapes to get a feel for the subject. In addition, research into various lunar craters, views and topography can give a fairly accurate rendition in the final illustration.

4. As a general rule, craters form oval-shaped depressions which are more circular nearer the viewer and more elliptical the further away they get.

5. In the initial rough, a simple hard-round brush is used to cut in flat parallel planes that are slightly raised towards the rim of the crater depression.

6. Lighting is quite uniform, and in this instance comes from the top right, hitting the inner rim of the crater to recreate the band of PELs (**Fig.18**). This would appear as a brighter band of light, achieved with the judicious use of colour dodge on a low opacity.

7. In contrast, everything within the crater rim is otherwise a uniform dark shadow (as the moon is tidally locked in relation to the Earth; i.e. there is always only one side facing the earth permanently, and all other areas facing away are known as the "dark side of the moon").

Building a Lunar Base

Once you have dealt with the main concern of locating a suitable site for prolonged habitation, there is a list of formidable issues to address.

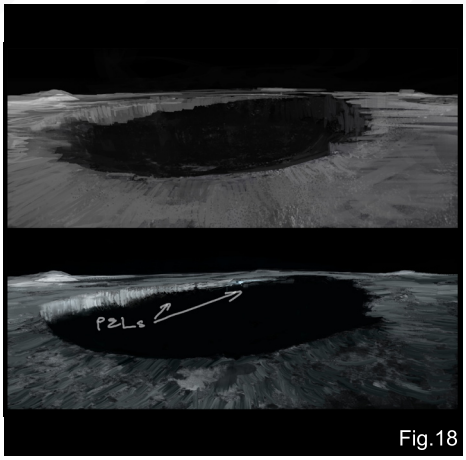


Fig.18

These key concerns would include:

- Radiation: cosmic rays and solar flares;
- Debris: micrometeorite impact and space dust;
- Solar winds;
- Duration of exposure to the elements of space;
- Long-term effects of weightlessness and microgravity;
- Long-term effects of exposure to cosmic radiation: will there be a form of "space cancer"? How will prolonged life in space affect mortality, morbidity, birth rates and potential genetic defects...?
- Long-term effects of living in confined spaces or non-terrestrial areas: will there be a form of space mania or other mental health issues?

All these general issues will probably not concern the average painter, and yet these considerations can both inform and affect the way one designs habitable life support systems, ecology and robust transport systems. And ultimately, we perceive, realise and depict space in the popular imagination of the masses.


Fig.20

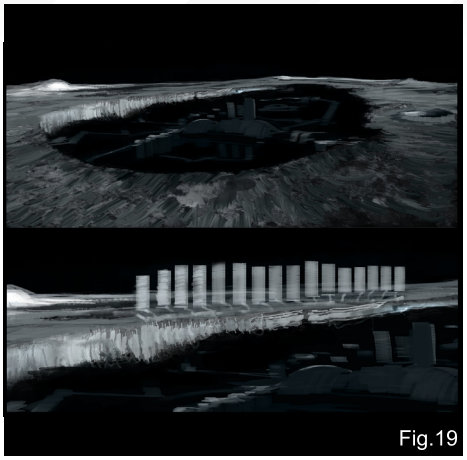


Fig.19

Lunar Base Design – Mood Board

My idea for this was quite basic (**Fig.19**). The base depicts semi-cylindrical living quarters being slowly installed within the dark centre of the Shackleton crater. Each cubicle is interlocked by short, sealed rings. The main premise is that the lunar colonists are mining for Helium 3 (He3) for basic fusion reactors, as an alternative, cheap, abundant and extremely lucrative energy source. Let us assume for the moment that the basic Deuterium He3 reactors have been proven feasible and lucrative (estimated to a net profit of $300-400 USD billion per 100 tonnes of He3 – not accounting for the current increasing energy bills, so the net may increase even further!).

Extraction would involve heating up lunar soil to above 600 degrees Celsius and therefore evaporating other volatiles in the soil.

1. In **Fig.19**, I blocked in a loose shape of various interlocking cylindrical shapes; because the base is sited in an extremely dark environment, the most that can be delineated may be local lighting and some bounced light of various forms.

2. Ideally, we go into it with a solid design on pen and paper before depicting it in an illustration; however, in this instance, let's aim to produce a loose mood piece initially, and if we're successful then we can then go further in-depth with a refined design (as a rather back-end

approach towards design and illustration).

3. Sometimes, for game and movie production, one is asked to produce a 'mood board' early in pre-production to explore different ideas prior to narrowing and specifying a detailed workup.

4. Another consideration would be solar energy farms – this helps us to achieve various goals, namely:

- A continuous external source of energy via solar panels;
- A bright source of focused light

5. So far, our dilemma has been in that there is no additional lighting other than the band of PELs on the crater rim, and a uniform well-lit surface of the moon. This in itself would not provide sufficient bounced light to penetrate through the shadow of the crater and produce bounced light onto the moon base. In fact, it would look kind of dull, with just a faint twinkle of various local lighting – much like small LEDS. On top of the lack of atmosphere, our painting will look very plastic, unrealistic and strange overall.

6. The surface of the lunar crater would tend to be similar to a mixture of dark basal and carbon/titanium dusting, resulting in a dark orange/gold tint in places. Film and HDRI imagery would record a more bluish image of the moon, due to a wider range of colour (**Fig.20**).

7. To provide some local lighting and colour to the bland lunarscape, I have included some neon blues for the living quarters, faint green glows for pathways, and yellow/red for landing hangars and loading bays; in addition, a reflective gold/orange tint is given to the solar panel farms and the additional coatings (which provide protection from the direct solar radiation) (**Fig.21**).

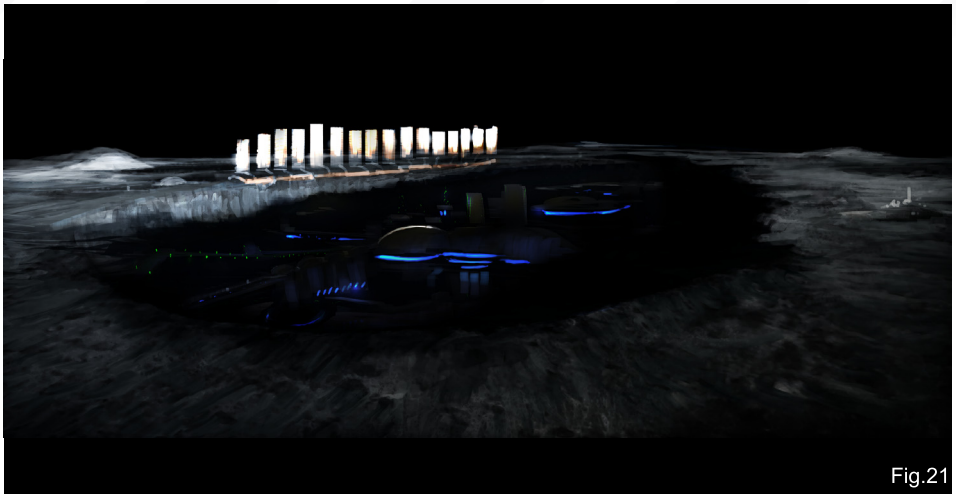


Fig.21

8. Additional bounced light from the solar panels will allow us to provide a nice blend of saturated colour on the primarily white moon base design.

9. All that remains now is to add more definition to the foreground and mid-ground cracks, breccias and impact craters within the surrounding (**Fig.22**).

Redesigning the Moon Base

After the initial mood board, the next goal is to produce and refine the feeling and atmosphere of the moon base. So going back to pen and paper here (**Fig.23**), I redesigned the moon base. To me, the current mood board did not show off how mankind would colonise the moon. It did not show the scalar issues (due to its large crater size and relativity). In other words, the initial composition did not work effectively in order to show off a lunar crater!

Why Pen and Paper?

There is something very simple and straightforward about analogue methods of design:

- There are no batteries required;
- It cuts out hours of fluff, by focusing the brain on simplifying and translating a complex shape into a clear line drawing;

In the top half of **Fig.23**, I started with a side view plan. A side view allows for a rapid layout of the living quarters and the consideration of what the practicalities of constructing them may involve (having to burrow most of the base within the crater and under the lunar regolith). The bottom half of the drawing shows a more refined graphic design approach, producing a more idealised version of the moon base.

I also took the liberty of considering an external power source/reactor that relies on He3 Deuterium fusion, assuming that the shielded reactor cores on the far right were relatively safe. In the main quarters, habitation is serviced by a dome-like structure with a central lift system to connect all levels of the base together. And finally, on the far left of the drawing, both a research and advanced propulsions works unit is coupled with the external hangar bay/transport bay area.

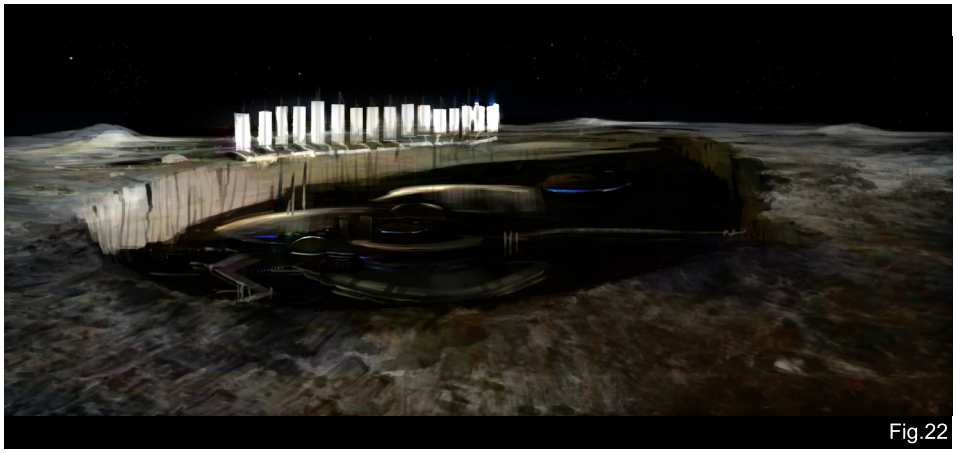
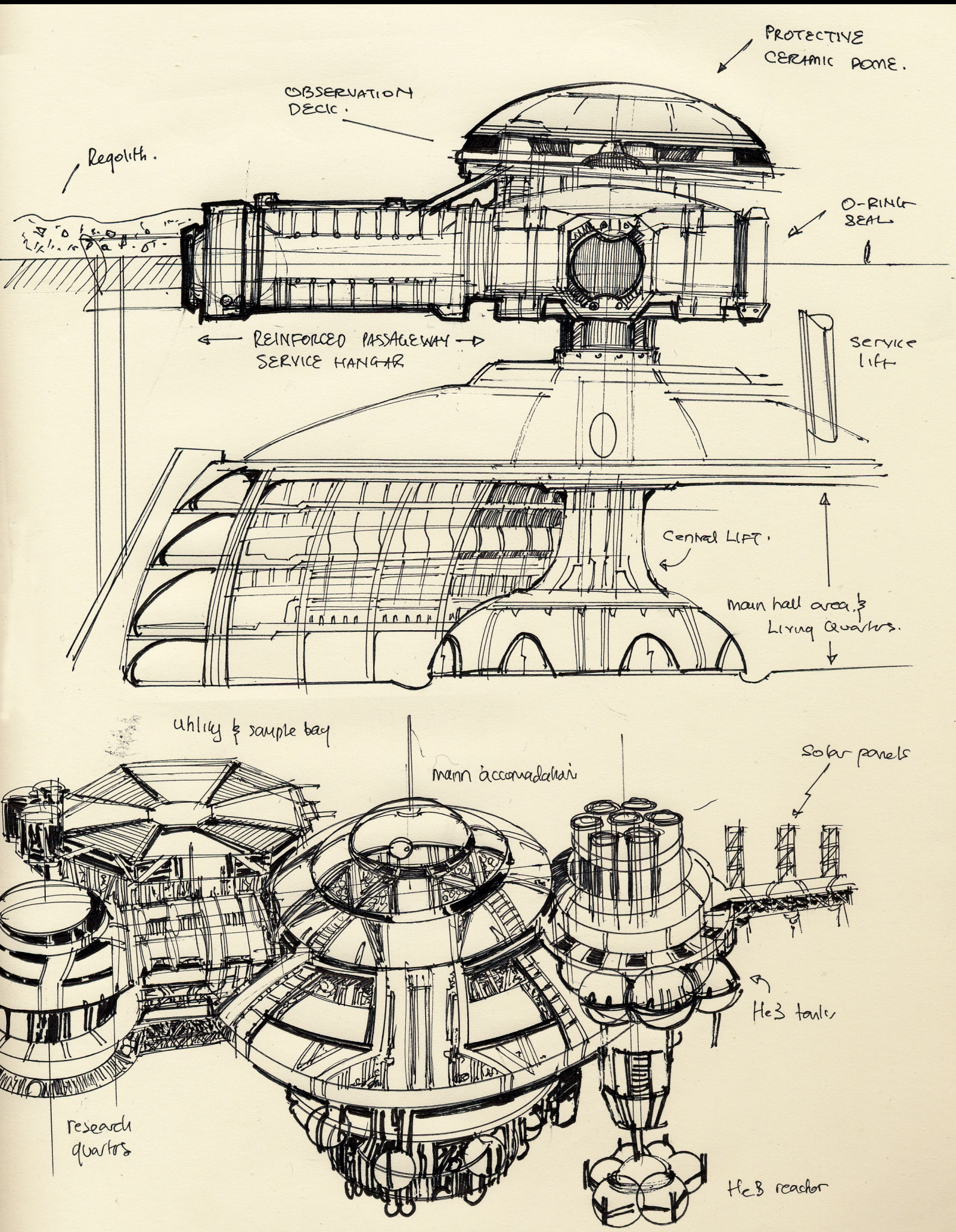


Fig.22


PROTECTIVE CERAMIC DOME.
OBSERVATION DECK.
Regolith.
O-RING SEAL
REINFORCED PASSAGEWAY
SERVICE HANGAR
service lift
Central LIFT.
main hall area & Living Quarters.
Utility & sample bay
main accomodation
Solar panels
He3 tanks
research quarters
He3 reactor

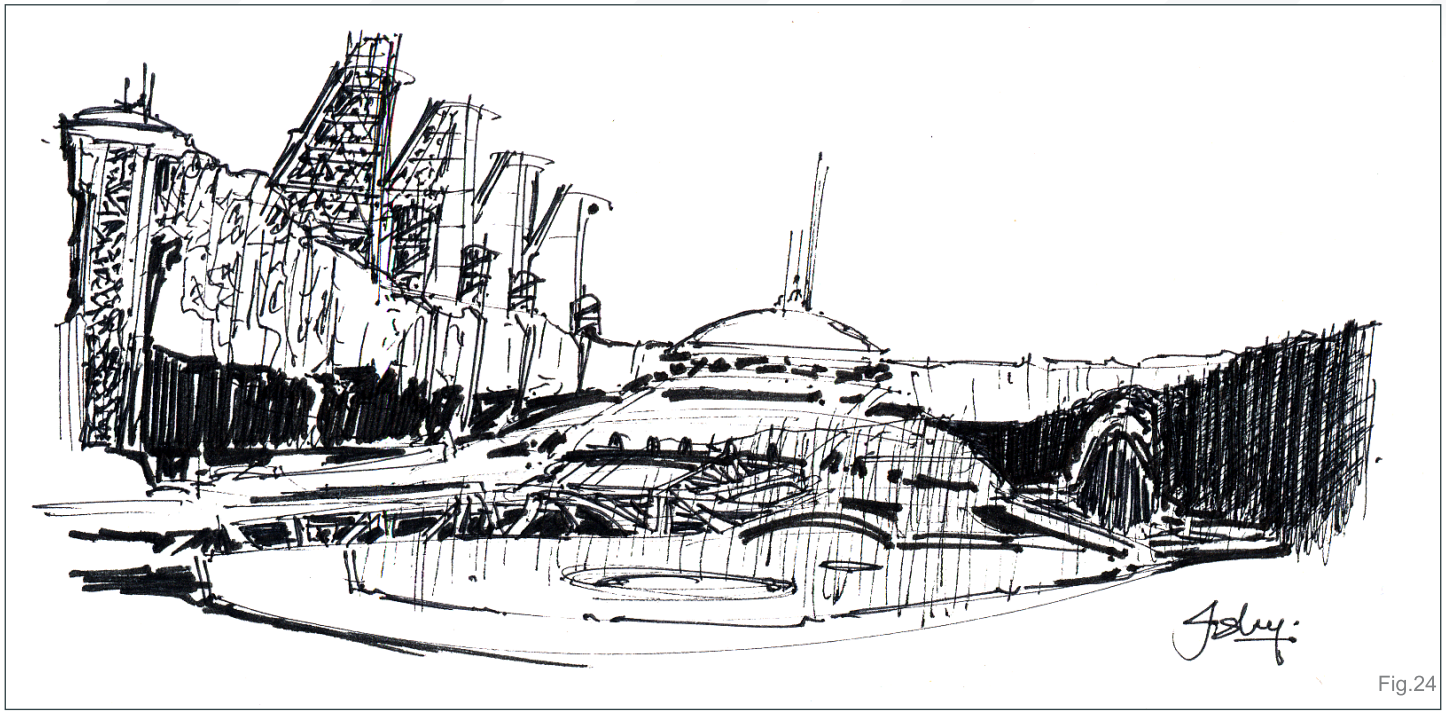


Fig.24

Moon Base: Version 2

Having refined the moon base design further, let us consider a more useful composition (**Fig.24**). This could be used either in an exotic location or on the moon.

1. This rough thumbnail (**Fig.24**) aims to simplify and tackle composition, form and lighting all in one go; this is a closer shot of the moon base within a two-point perspective, focusing on the main dome which is protruding from the crater floor.

2. In the mind's eye, try to imagine that there is a stark contrast between dark and light as the sun casts a solid shadow across the crater rim, and nestled within is a well-built habitation that looks familiarly human, yet advanced and elegant. For this instance, a new composition featuring a close-up shot will be helpful to engage the viewer more and get them enthused about the building and an elegant moon base.

3. In the redesign, I wanted to bring back some of the best elements of retro space and futuristic designs, namely the white featureless planes and curves accentuated with angular tones; these few things bring a certain familiarity whilst still providing an evocative composition.

4. Using a simple one-point perspective, I aligned the main horizon and various objects with the main vanishing point which I located slightly off centre, to the left (**Fig.25**). I

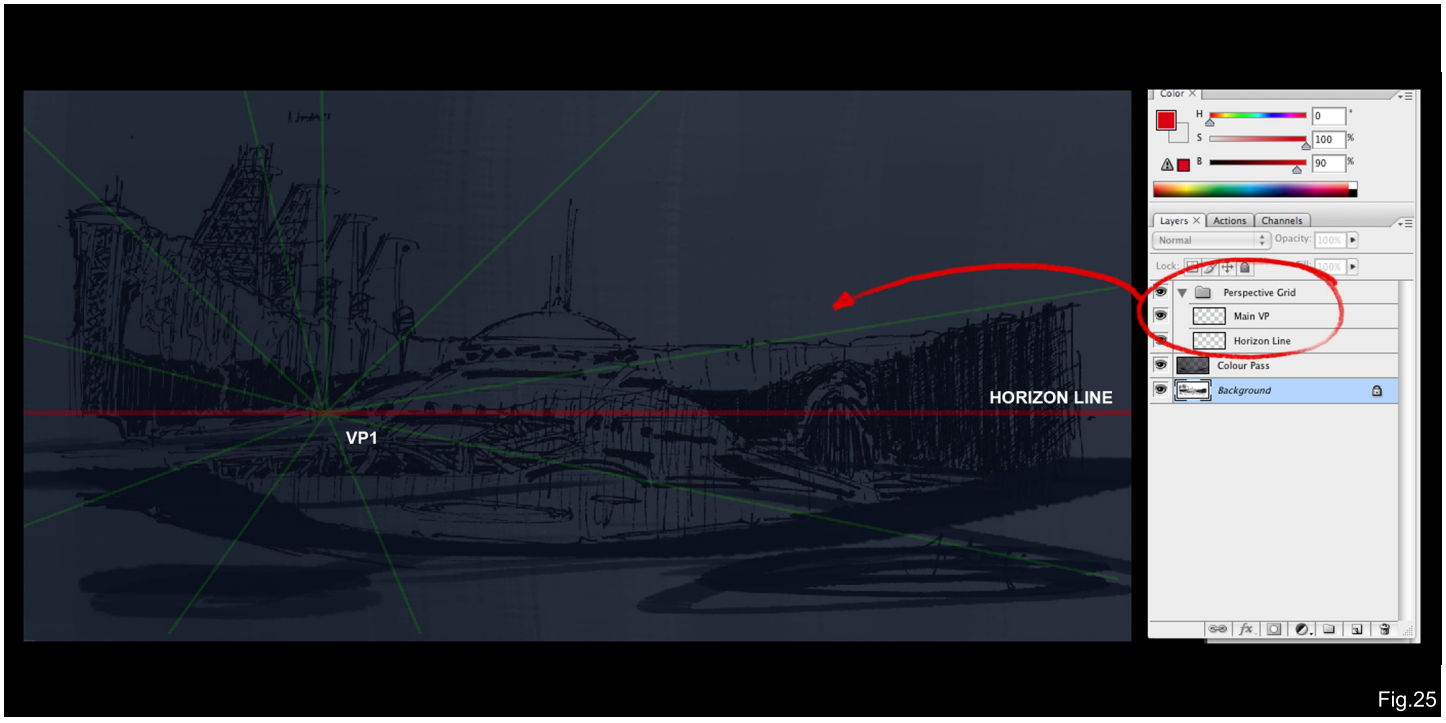


Fig.25

Fig.26

suggest putting the perspective lines onto one transparent layer and lowering the opacity to around 20%. This allows you to toggle it on/off at will. Don't forget to apply the lock function on the layer to prevent painting on it!

5. For a basic colour pass, I separated the image into four basic values, showing a hierarchy of values to project depth and distance (**Fig.26**). The initial composition should resemble a simplified graphic shot that the eye can interpret easily. This will allow you to now work on various areas, according to tone.

6. In this instance, we know that the lunar surface is not entirely a bleak grey, but is variants of grey with streaks of maroon, copper green, gold, and dark orange. In this respect, it might perhaps be advisable to take a more artistic license and use a deep saturated blue to suggest areas of shadow.

7. The far rim of the crater, stretching from the far left to the middle, suggests light through the use of a warm tone, complementary to the blue (**Fig.27**). This unfortunately breaks up the lovely values which we established early on, but if you keep in mind the value structure established then you can try to work back to the original as much as possible.

8. Local lighting can now be considered, and the solar arrays and local lighting from the moon base will eventually push our set of original values further beyond its initial plan.

9. A good and simple way to apply ground texture is to initially paint your desired surface in a rectangular shape. In this instance, we simple scatter a few dots with a dirt brush. Apply the Transformation tool (Ctrl + T) and manipulate it into the correct perspective (**Fig.28**).

10. Having gone through the ugly stage of painting, where everything looks like a mess and it feels as if nothing will come out right, here is the last chance to correct any major composition issues. From here on, we'll consider two final outcomes: a lunar realistic-type rendition and an impressionistic space art style rendition.

11. It's always useful to keep a greyscale version of your current painting to check on the established values and tones (**Fig.29**). If you squint your eyes then you will see that the separation of values (that we initially established) has been lost, and the scene has now been separated into two to three zones, rather than four distinct zones.

12. Well, this part can get a bit tedious; however, now that the values, composition,

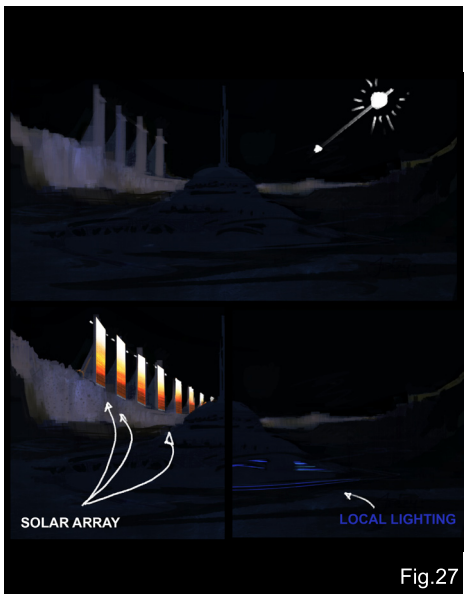


Fig.27

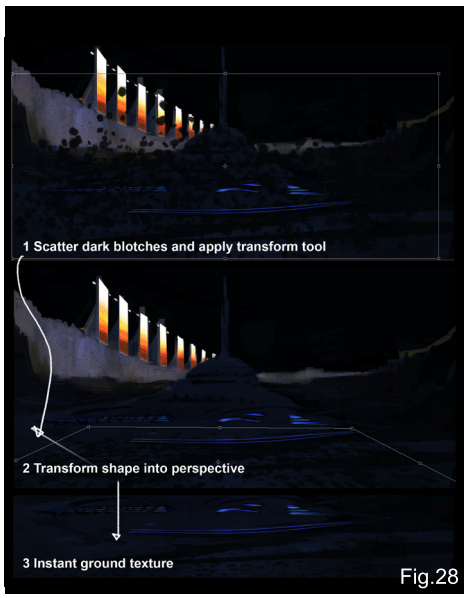


Fig.28

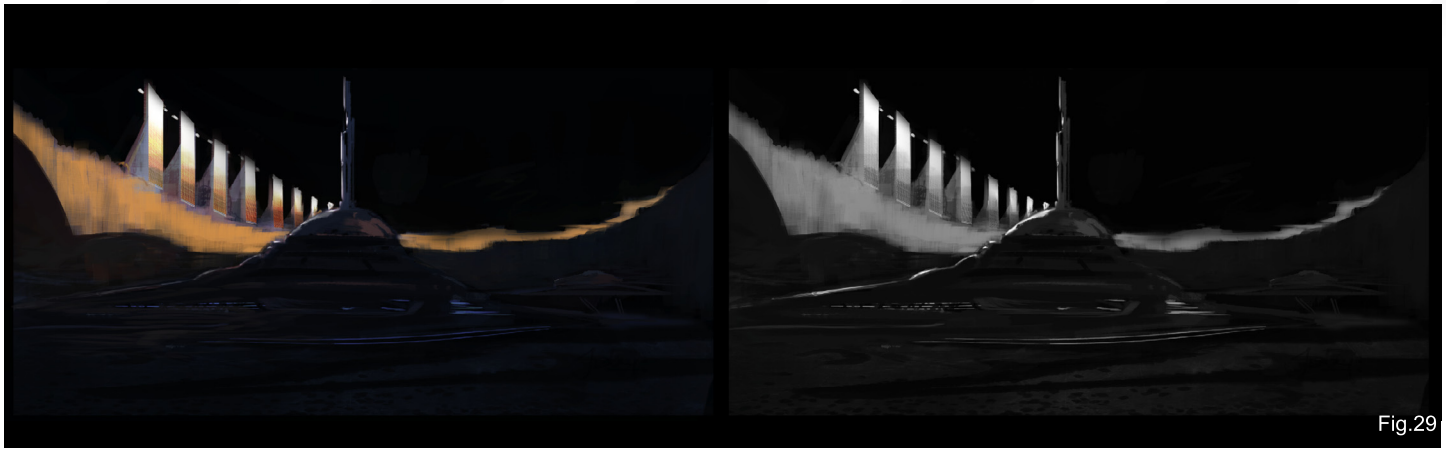


Fig.29

layout and lighting have all been established, you can really take the image to town by rendering every nut, rivet and bolt according to your needs! Here is a simplified checklist that I try to tend to adhere to (hopefully it can simplify and make your life easier during this stage) (**Fig.30**):

- **Panels**: neon lighting and subtle mixtures of angular and sweeping forms make for simple and retro sci-fi image;
- **Lights**: to ensure the glows are soft and project through mist, dust or clouds accordingly;
- **Bounced Light**: gives that extra special magic from local light sources and is a good way to describe a form moving within a shadowed/ darkened area if you have no focal light source;
- **Object Interests**: the main challenge of adding detail, I find, is that you can add too much hyper-detail throughout the canvas. More often than not if you add detail in the key areas, the mid-ground and background can have large simplified forms that can be left loose and the mind's eye will automatically fill in further details;
- **Forms**: ensure the large forms read and don't conflict with one another; a good method to check this is by squinting at your image frequently, or having a second monitor set up

Fig.30

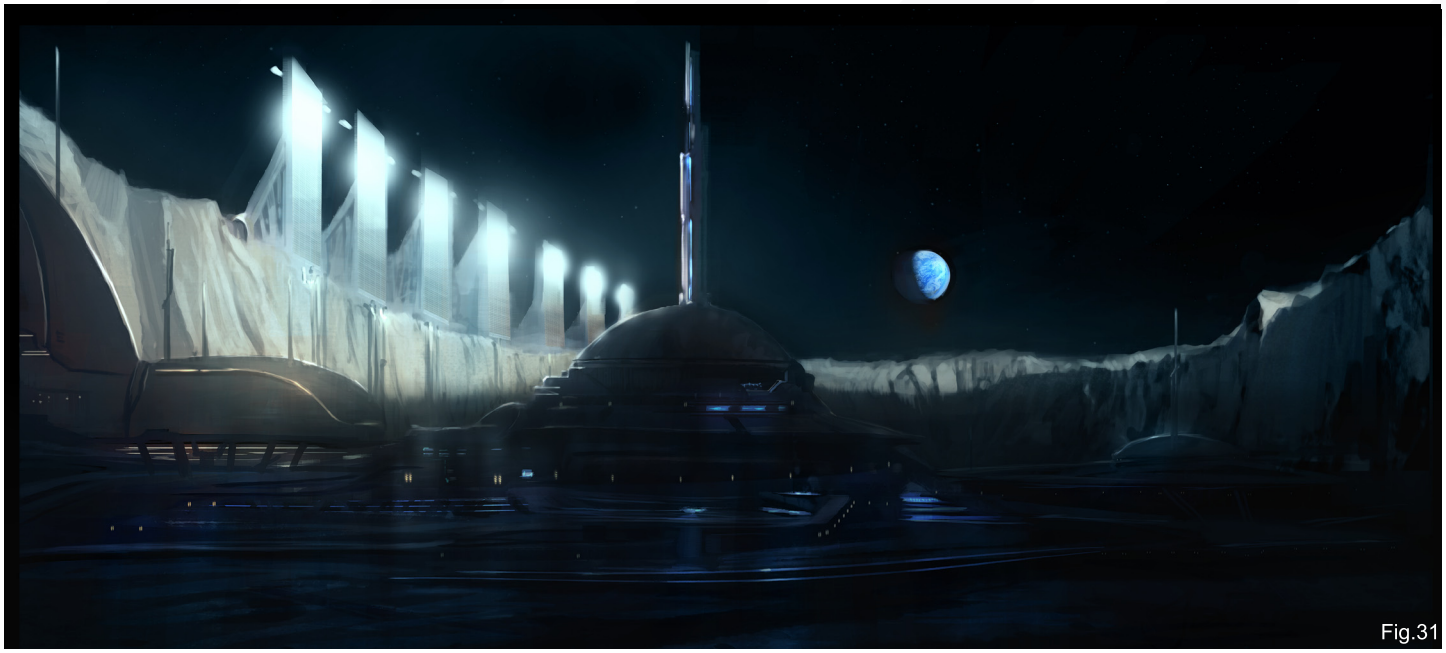


Fig.31

with the image size set to 50% or less.
And there you have it!

I have also taken the liberty of adding a few more details, such as piping from the solar arrays and additional antennae. It is these small details that help to make your image look that much more convincingly.

Finally, I will end here with two images:
Fig.31: A final monochromic illustration which is more suited towards a lunar-styled environment and projects a more brooding, cold feeling.
Fig.32: Ultimately, I love colour and have produced a more impressionistic space art version here, blending in the main primaries of gold and deep blue/violet.

Conclusion

In producing this second part of the series, there were many images and illustrations produced, ranging from a moon buggy, ice formations, ice craters and imagery of exotic locations. However, due to the existing length of this second part already, I have decided to intersperse these with each chapterly section, so that content is both informative yet relatively concise.

All the information provided here in this article has been researched as best as possible and any factual errors rest solely on my shoulders. I hope you have enjoyed this workshop; in the

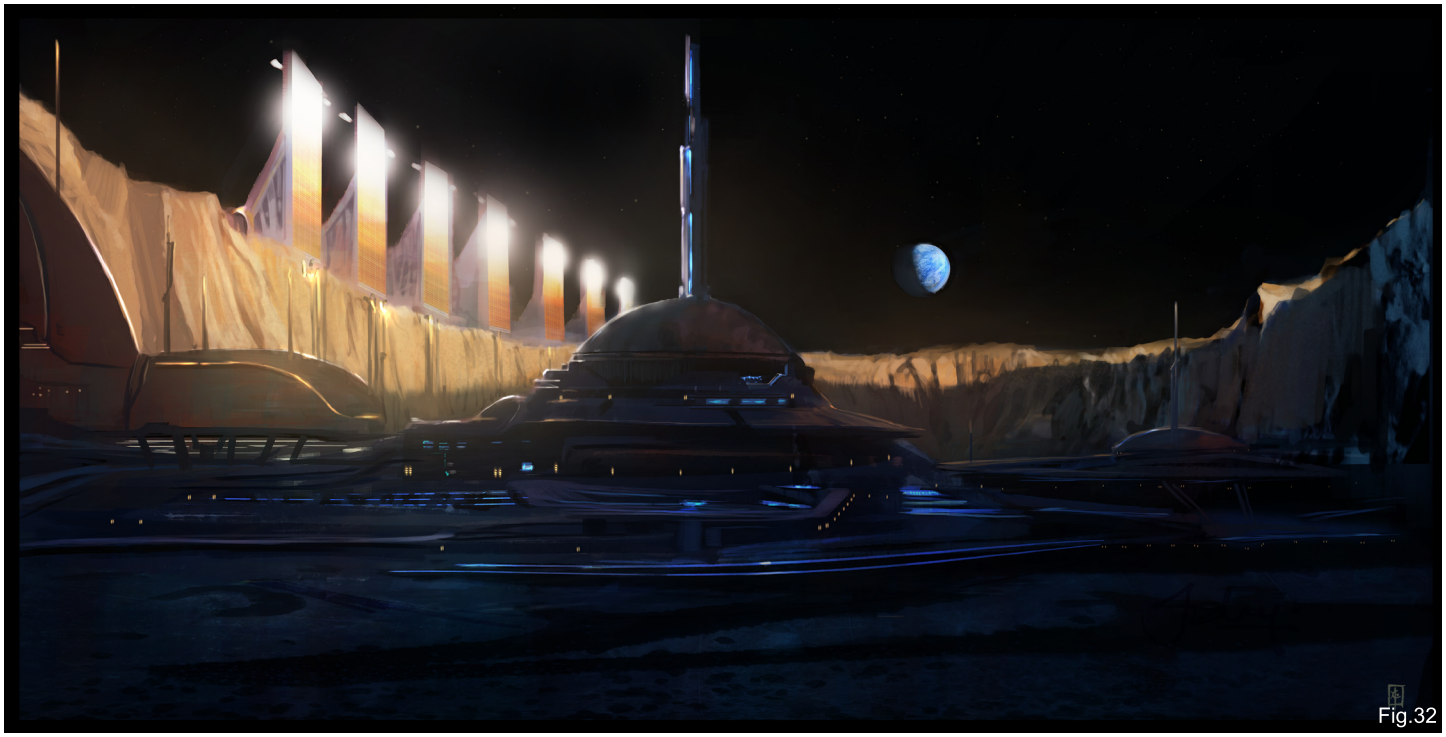
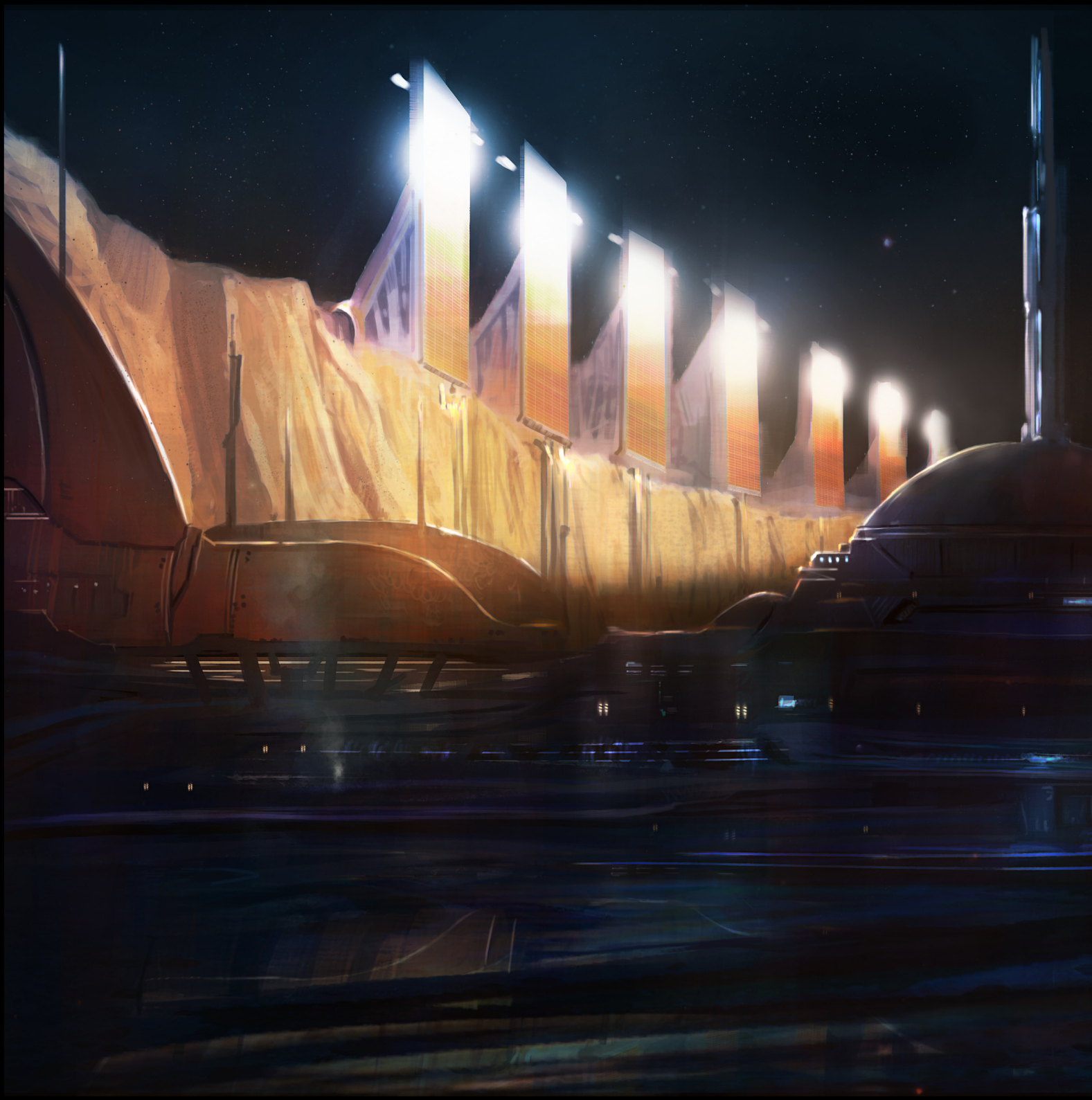


Fig.32



next section we will aim to look at external barren planets and tackle painting gas giants, external moons and ice rings, as well as design transport to accommodate our travel to these locations!

As a parting gift, for all you chair-bound earth dwellers, you can now use Google maps to see the moon (based on the Clementine atlas):
http://www.google.com/moon/

With Google Moon, please note that the imagery contained is limited to details of the Apollo mission and is not a true atlas of all the existing moon imagery! In any event, happy lunar landscaping!

Final Image (**Fig.33**)

Dr. CM Wong

For more from this artist visit:
http://www.opusartz.com
Or contact:
info@opusartz.com

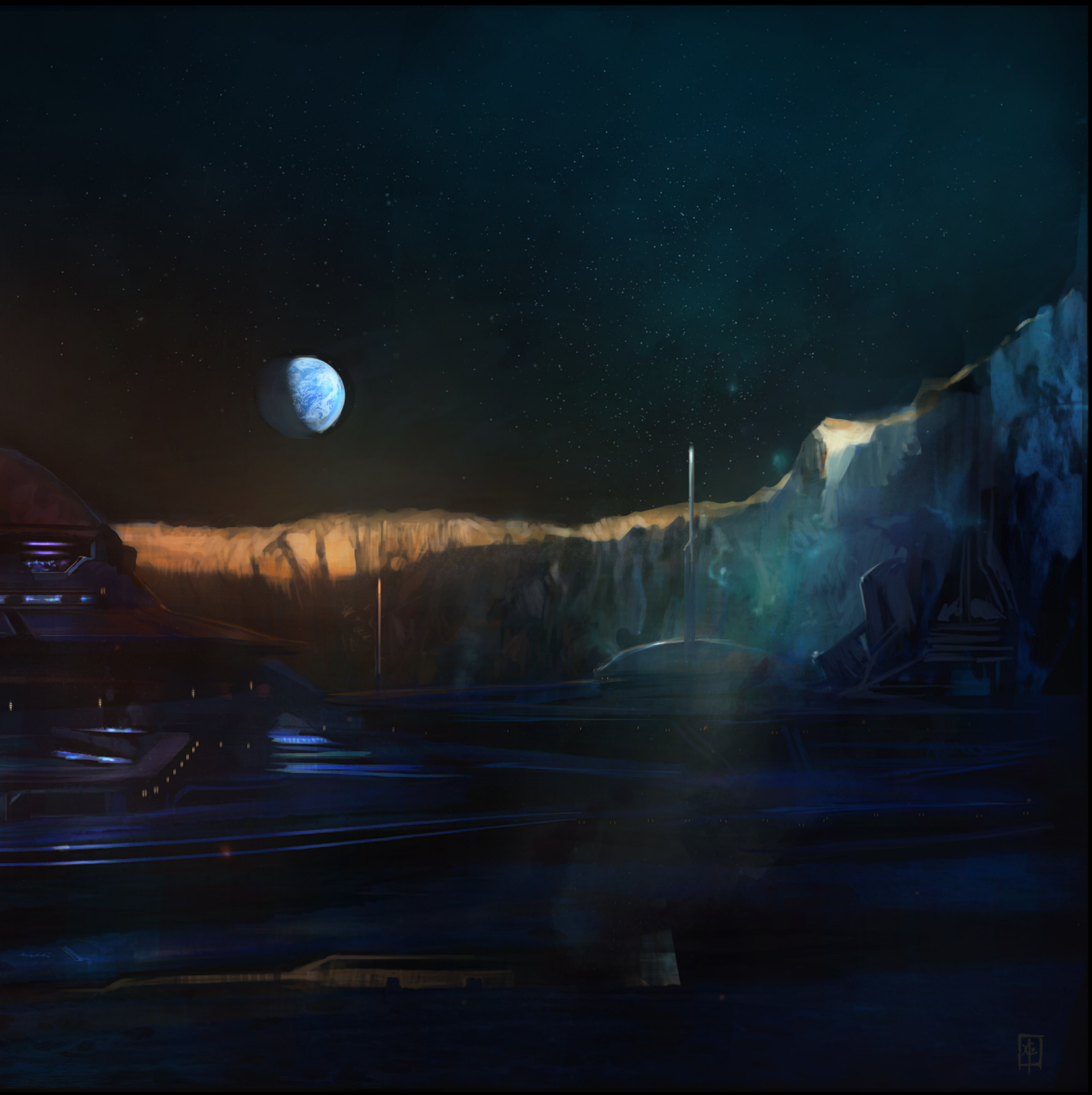


Fig.33

Chapter 03

BARREN PLANETS

SPACE PAINTING

CHAPTER 03: BARREN PLANETS


Fig.01

Created In:

Photoshop

Overview

Drifting into the third aspect of our 12-part space and sci-fi art series, we take a planetary wide approach at how planets are formed, depict the destruction and death of planets, and explore the farthest regions of our known solar system! But first of all, let's take you back to the beginning... to the birth of the solar system.

The Solar System - a Fiery Birth and its Destruction

(**Fig.01**) Space is a wondrous thing, and current cosmology models suggest that the Universe is approximately 13.7 billion years old! The constant search for how life began and the origin of the species comes to mind first and foremost. For space enthusiasts, scientists and armchair explorers alike, the current consensus leads to the Big Bang model, as originally proposed by Georges Lemaître, and its modified framework based on Einstein's Theory of General Relativity by A.Friedmann.

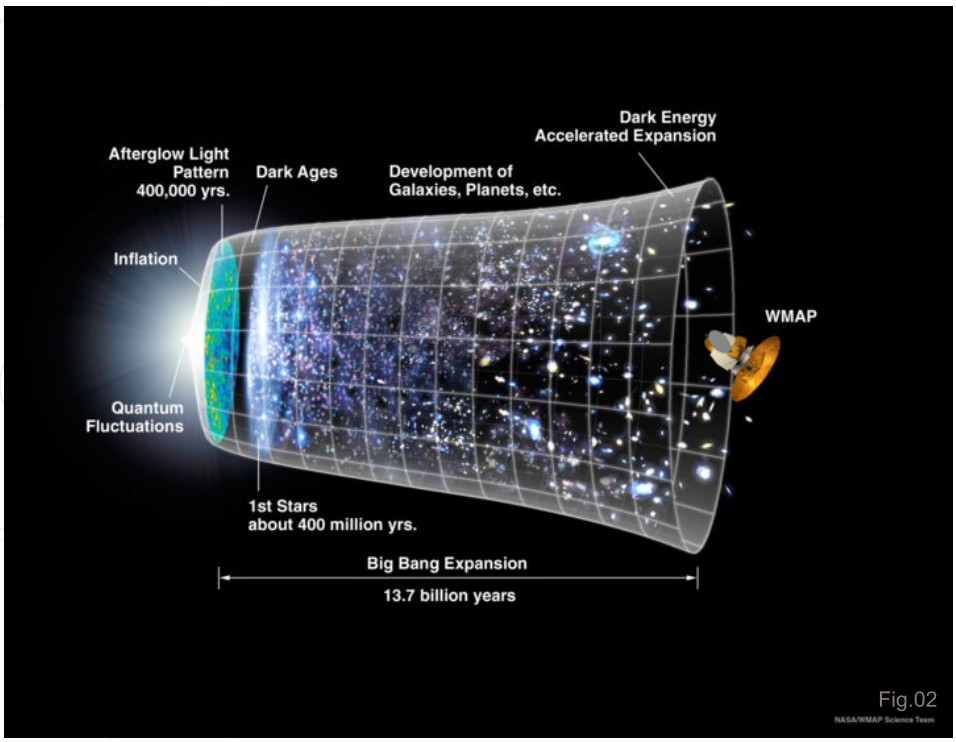


Fig.02

Note: Fig.02 describes a suggested timeline of the Universe based on a 1996 WMAP (Wilkinson Microwave Anisotropy Probe) Satellite that measured the remnant temperature of the Big Bang (by measuring the temperature differences in the Cosmic Microwave Background (CMB) radiation), and thus extrapolated the age of the Universe to be 13.73 ± 0.12 billion years old.

So how do we best depict the rise of the solar system in a painting?

Fig.03

Our Solar System - In A Nutshell

Note: Fig.03 depicts our Milky Way galaxy (centre), with our closest neighbouring galaxy, the Canis Major Dwarf galaxy (left: red stream – the Milky Way is depicted as a blue stream), and our other neighbour the Andromeda galaxy (right).

Solar System

From inside looking outwards, let us look at the Solar System as it exists. Our solar system resides within one of the outer spiral arms of the Milky Way (small spiral arm – known as the Orion Arm).

Our solar system comprises of a main sequence G2 star, an inner circle of four terrestrial planets, a main asteroid belt and outer four-gas giant planets.

An outer Kuiper belt of ice, debris, Pluto (and its moon, Charon) and Makemake (initially known as 2005 FY) encircle the outermost region, also known as the Trans-Neptunian region (i.e. the area beyond Neptune).

Overlapping this is a wider belt called the Scattered Disc – thought to be an extended version of the Kuiper belt containing scattered objects, although it exists in a wider elliptical belt on a perpendicular axis to the Kuiper belt. Interestingly, there is also a large brown dwarf planet, Eris, within this region (which led strongly to the redefinition of what constitutes a planet, resulting in the current loss of Pluto from the list of our own planets).


Credit: Orion Nebula. M42. Hubble Space Telescope - ACF/WFC
Fig.04

Going even further outwards lies the hypothetical Oort cloud – comprising of billions of comets or a trillion icy objects, all believed to be comets having been ejected from the inner solar system and gravitational effects of the outer planets.

And beyond that, who knows...?

The Birth of the Solar System

Solar System 101 aside, let us proceed with actually depicting the birth of the solar system, with the death of a star...

Imagine going back roughly 10 billion years after the Big Bang. A large star is about to die, having expended all its fuel, and from this its core eventually collapses inwards until it explodes as a supernovae – sending a shock wave through the galaxy (**Fig.04**). It is from the remnants of this long distant star, and many others, that eventually form a new star – our Sun – via the fusion of hydrogen atoms in a process called "nucleosynthesis".

Illustrating A Dying Star

For our first painting we will look at illustrating the last moments of a dying star, transitioning before it explodes in a spectacular nova (which in the case of a large star is a super novae). In this instance it is probably more interesting to take a more impressionistic approach to space

art, whilst working from a position of informed knowledge (**Fig.05**).

1. Coloured Approach: We start by depicting a loose bluish-green background with flat washes over the canvas.

2. Basic Planning: Incorporating a circular styled composition, the illustration is planned to spiral outwards from its point of origin – the dying sun.

3. Edge Control: To illustrate a mixture of expanding gasses, a dash of orange and burnt yellow is applied liberally, towards the outer segments of the illustration (far left) at almost 100% opacity and with 100% flow. At the same time a softer wash of looser shapes and forms suggests clouds of gas in the mid-ground. The purpose of this is to establish early on the feeling of hard and soft edges (the analysis of clouds reveals that they often have a hard outer edge).

4. Establishing the Mood: In the initial stages the overall look is less important than the general feel and ambience. And preceding all of this, composition more so (I would normally add perspective is King, but in this instance it takes a lesser role).

5. Level 1 Details: You can start to consider various aspects like stars and local objects at this juncture (as they are easy to forget later on in the process). Remember that the background stars will probably be very faint and only the brightest will shine through.

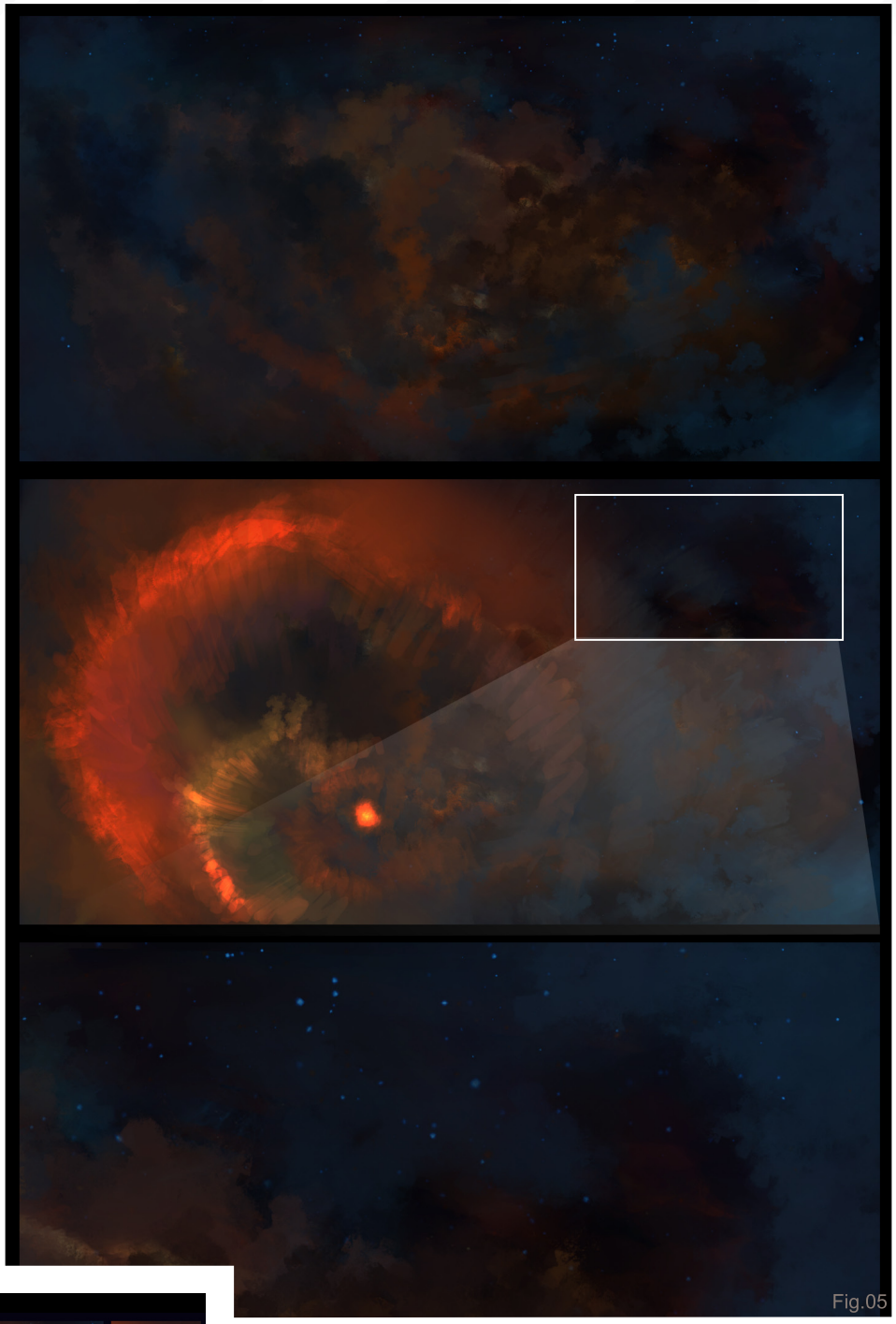


Fig.05

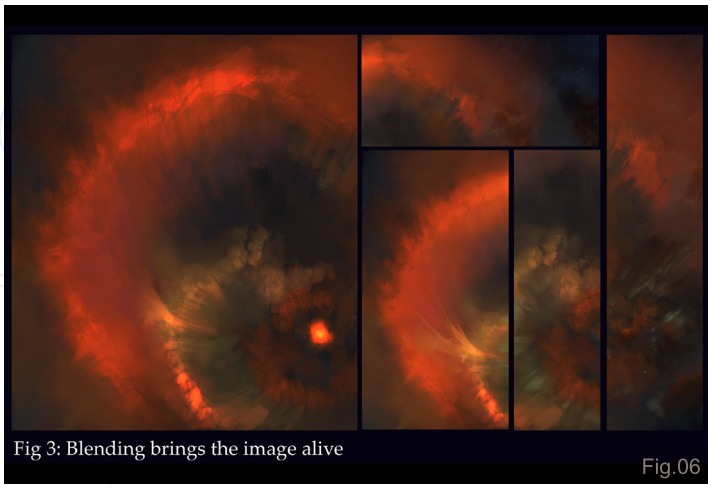


Fig 3: Blending brings the image alive
Fig.06

6. Blending: (**Fig.06**) The next part brings the illustration to life, as it allows the establishment of mid-tone values, allowing various colours to bleed into one another and providing a softer, more realistic feel of an expanding cloud of gases.

7. Level 2 Details: Once the general disparate colours are blended in general (remember not to blend in just one area of the illustration, but to work and put effort into the whole image), the next step to consider

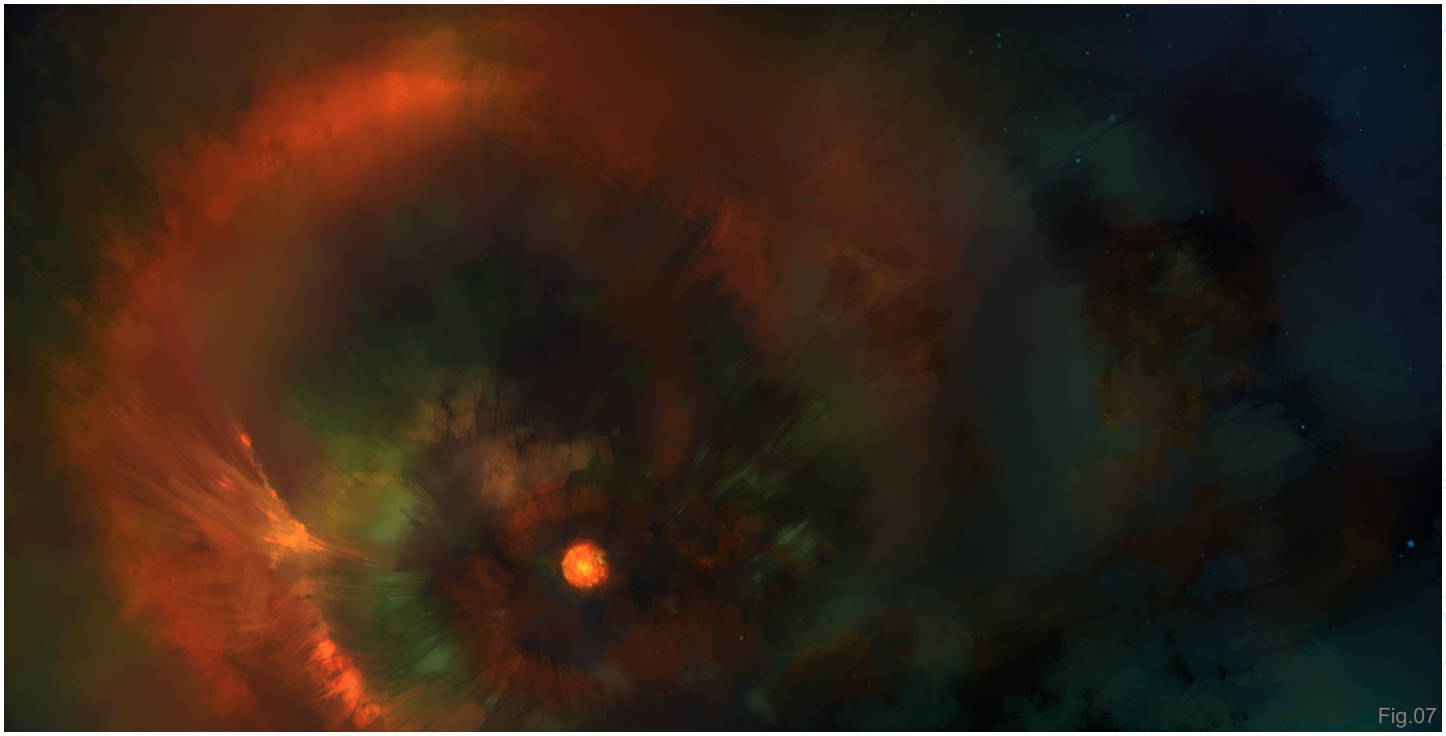


Fig.07

is the level 2 details. This means taking that extra care and making additional attention to ensure that the key areas of the illustration harmonise and 'sing' together. In this image, it means adding a subtle blend of golds, jade, and turquoise with faint highlights and glows to make it all work together (**Fig.07**).

Illustrating The Birth of a Solar System

Following the death of a star, a vast and widespread cloud of raw material is scattered across a region. When sufficient interstellar clouds (giant molecular clouds) of raw elements collapse under gravity, it is theorised that, in the centre of these clouds, some minor rotation already exists. As the mass of the centre gets heavier and heavier, the rotation also gets faster and faster. Eventually, clouds of hydrogen become fused together until sufficient mass is reached to form a proto Sun disc under a process called Stellar Accretion.

It is this process, through which a star is born, that a stable solar system is formed. And it is this transition between the formation of a stable Stellar Accretion and a proto Sun that we will try to illustrate in this tutorial, at this point. In some ways, it is similar to the shape of how some spiral galaxies may appear from a long distance, however not quite the same (**Fig.08**).

Initial Composition

In the initial stage we start with a rough layout of the proto stellar disc, using just pure deliberate colour choices on the main canvas. Using the similar principles as before we can continue as follows:

1. Flat Washes: Paint in a background of deep saturated blues and greens initially, and then sprinkle a scattering of faint stars.

2. Work Briskly: Then, very quickly and loosely, just paint in the basic layout of a central red and orange clump of clouds that spiral outwards in a ring.

3. Technical Data: Different artists depict this – the proto sun – as a geometric ring, and others as faint arms within a red disc. For the clarity of purpose here, we will first depict the thin edges of the arms, and subsequently lay in the red proto disc.

4. The Problem of Establishing Highlights Early On: Other chapters to consider are the use of Colour Dodge and brighter glows. I would like to stress that, in the initial stages, it is often

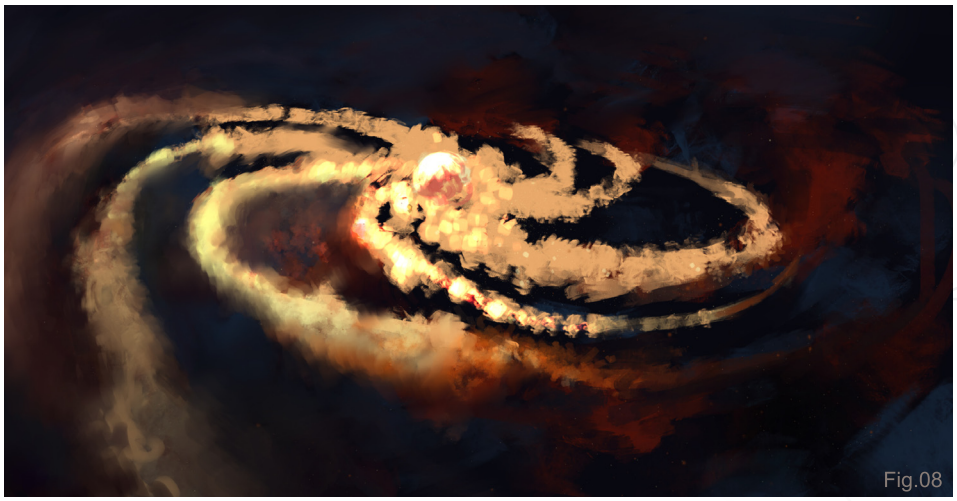


Fig.08

too easy to Colour Dodge or add highlights straight away. If you do wish to do this here, try to limit these actions purely to the central portion!

5. Contrast to Make Things 'Hotter': This is due to the fact it is very hard to add further information/pixel data onto a white value. This illustration has almost pure white in the centre, but due to the contrasting red surrounding it, it appears even hotter (in fact, it is merely a light desaturated yellow).

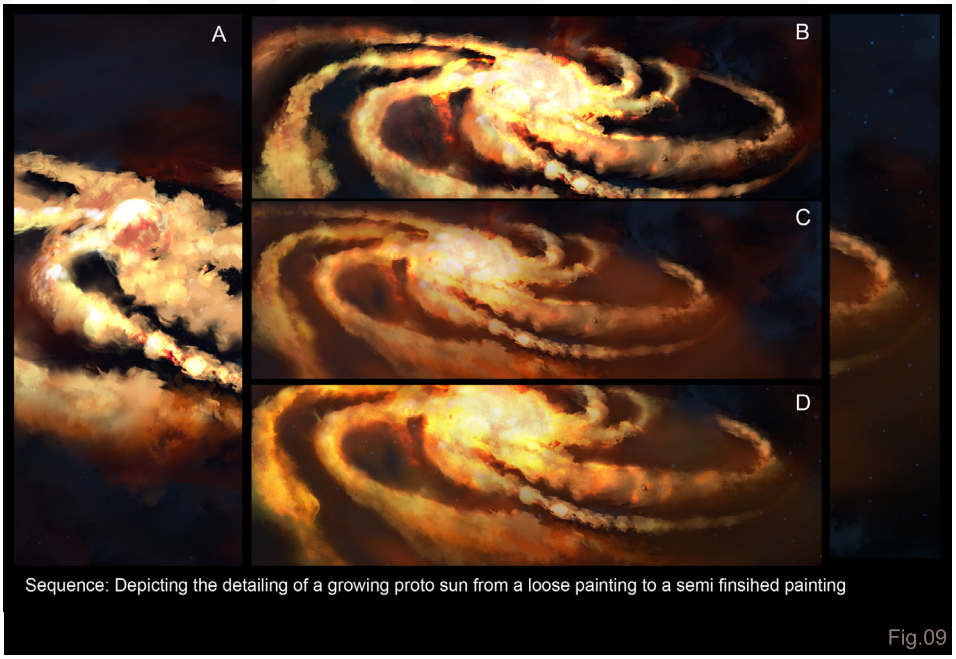
6. Minor Details: The ends of the disc should be depicted as wispier clouds (of raw elements). Using the method of blending as shown previously, establish your mid-tones early on.

7. If all of these points have been considered, the early draft of your image should look pretty decent (**Fig.09**).

Maturing The Illustration

The next stage to consider is to 'work up' the initial composition into something respectable. Thereafter, one can spend a good indeterminate amount of time perfecting every tiny detail or star, perhaps even adding a foreground element like an asteroid or some space transport of sorts – basically working till your heart's content!

The following stages refer to the **Fig.09** sequence:



Sequence: Depicting the detailing of a growing proto sun from a loose painting to a semi finsihed painting

Fig.09

A. The foreground elements of the edge of the stellar clouds have more colour and mid-tones applied. Moving inwards, brighter glows – with judicious use of Colour Dodge – can be applied closer to the centre.

B. The central disc is thickened, with a more nebulous ring of circular globes that cumulatively form a rough spherical aspect.

C. The mid-range of the disc has more orange blended within. This lends a bit of an aspect of atmospheric perspective, however it does detract from the brightness of the original draft.

D. Additional details and blending are added to harmonise the overall feel. A faint wisp of red is eventually seen to emanate from the central aspect.

To finalise, the edges of the illustration are Colour Balanced and lightened to provide relief and contrast to the final illustration (**Fig.10**).


Fig.10

What Defines A Planet?

Or, what differentiates a planet verses a lump of rock...?

In August 2006, the **IAU** (International Astronomical Union) were forced to redefine the definition of what constitutes a planet, following the discovery of Eris (a trans-Neptunian object confirmed to be larger than Pluto, discovered on July 29th, 2005 by Mike Brown of California Institute of Technology). The acceptance of Eris as a tenth planet meant that Pluto would now be the arbitrary minimum size.

However, other recently discovered trans-Neptunian objects (TNOs) such as Quanar and Sedna also exist. Does this mean they will be included within the current catalogue of planets? For a brief moment, it seemed as if our current solar system would be welcoming these into the fold (**Fig.11**)!

This created a small problem; a problem that essentially did not change how we saw the universe, but from the official stance it meant updating a clearer and more robust definition of what constitutes a planet – a definition that will still require "tweaking" in 2009!

In any event, a long story cut short, this culminated in a decision. As such, the final vote of the IAU General Assembly defined a planet as such:

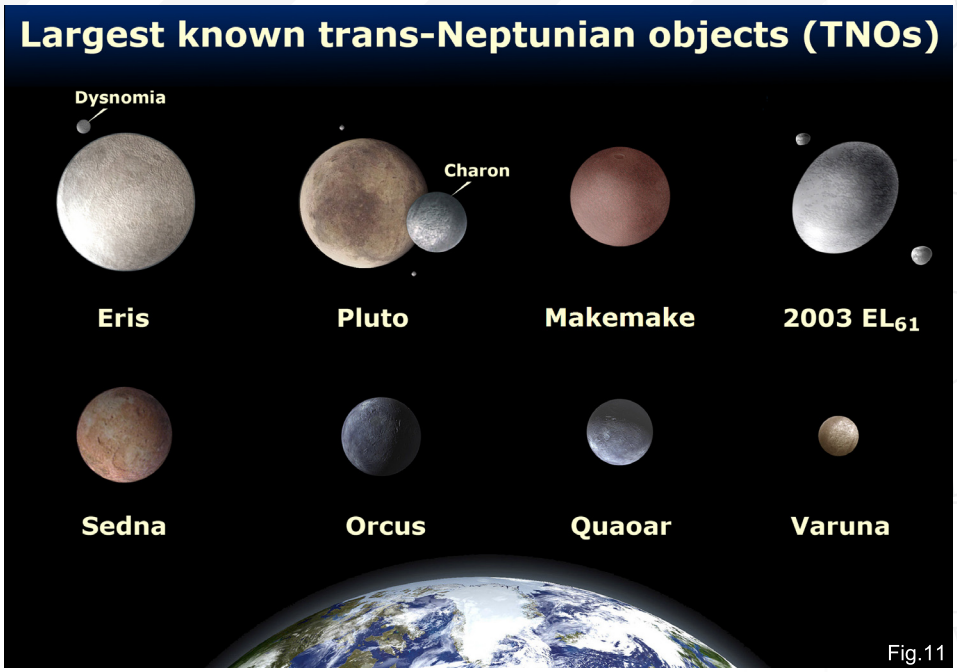


Fig.11

1. A "planet" is a celestial body that (a) is in orbit around the Sun, (b) has sufficient mass for its self-gravity to overcome rigid body forces so that it assumes a hydrostatic equilibrium (nearly round) shape, and (c) has cleared the neighbourhood around its orbit.

Fig.12

2. A "dwarf planet" is a celestial body that (a) is in orbit around the Sun, (b) has sufficient mass for its self-gravity to overcome rigid body forces so that it assumes a hydrostatic equilibrium (nearly round) shape, (c) has *not* cleared the neighbourhood around its orbit, and (d) is not a satellite.

3. All other objects, except satellites, orbiting the Sun shall be referred to collectively as Small Solar System Bodies.

This means there are now only 8 planets: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune. All other celestial bodies had to be designated into the 'minor planet catalogue', namely Pluto, Eris (and its moon Dysnomia), 2003 El, Makemake (2005 FY), Sedna and Quaoar.

Pluto Now A Plutoid...?

In addition, the IAU decided to further distinguish planets from dwarf planets, whereby a dwarf planet is *not* considered to be a planet (and therefore Pluto could no longer be considered a planet).

Furthermore, on June 11th 2008, the IAU decided to establish even further a subclass of dwarf planets into the term 'Plutoid' (defined as any TNO having an absolute brightness magnitude of higher than H= +1).

To summarise, in a final conclusion:

Planets: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune

Plutoids: Pluto, Eris, 2003 EL, Makemake

TNOs: Sedna, Quaoar, etc.

For the purposes of further self-directed learning, check out the NASA: JPL Solar System Simulator (**http://space.jpl.nasa.gov/**) which produces accurate depictions of planets and satellites as seen from elsewhere in the Solar System.

A Space Probe

For the purposes of object interest, let us now design a space probe that can look to the stars (**Fig.12**). And perhaps, to project it even further, one that could look at past events or travel back in time?! Often, the challenge of producing space imagery is the lack of providing relative scale between the viewer and the main object of interest. This will often be a large astronomical object, such as a planet, star and asteroid field, or the heavens above.

Providing An Object Interest

There are two popular ways to achieve this:

1. Depict the object of interest from the view of a Moon/Surface of an asteroid.

2. Depict the object of interest from a space transport of some description.

In this instance, let's opt for the latter option.

Key Features of a Space Probe:

In the design of the space probe, the key features that come to mind are:

1. The ability to launch deep space to surface probes;
2. The ability to feature a large protective and heat resistant shield (anti solar flare/anti debris);
3. The ability to have alternative means of propulsion, e.g. a deployable solar sail or ionic propulsion;
4. The ability for secondary propulsion;
5. The ability of vector thrusters;
6. The ability and feasibility of long-term main propulsion

With regards to feasible propulsion solutions, possible viable and future technological solutions suggest:

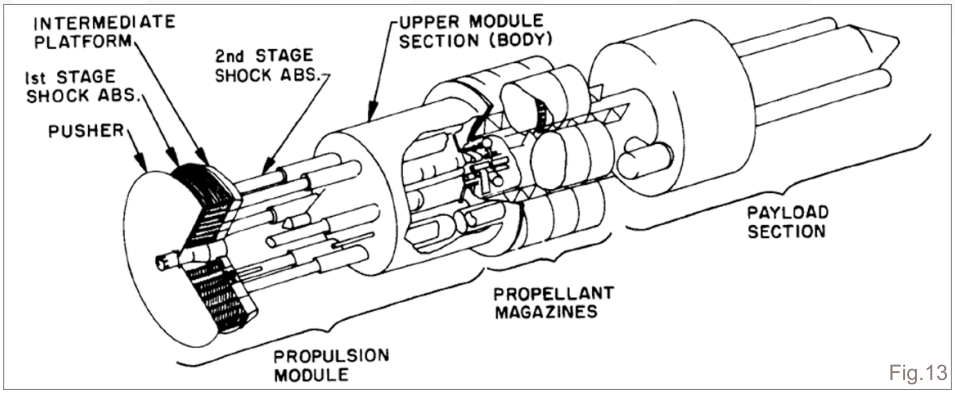


Fig.13

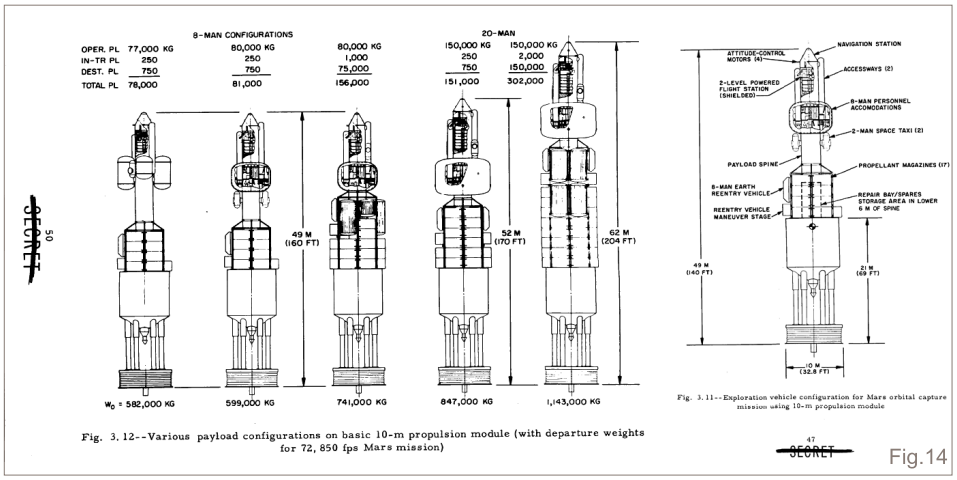


Fig.14

1. A compact He3 fission reactor (e.g. The British Inteplanatery Society – Daedelus Project, 1973-1978);
2. A ZPE (Zero Point Energy) alternative;
3. A trusty – fully feasible – nuclear powered fission alternative which features beautiful and impressive pulses of nuclear fireballs in its wake The latter is best exemplified by the 1960 General Atomics and USAF-backed seven-year feasibility study, Project Orion (not to be confused with the new CEV NASA space vessel also named ORION-CEV).

History contains many forgotten discoveries and advancements, and in this respect I recommend the following read: Dyson, F. *Death of a Project*, Science, 149, 141-44 (1965).

Project ORION

The initial idea is accredited to Stanislaw Ulam and Cornelius Everett in a classified 1955 paper describing the use of solid propellant discs and the release of atomic bombs, that, when vaporised, converts the propellant into hot plasma, subsequently impinging on a pusher plate and thus driving the vehicle forwards (**Fig.13**).

In terms of durability of the pusher plates, extensive testing of the plate erosion showed that exposure to such extreme temperatures were only for 1/1000th per second of each explosion, and that very little heat flowed into the plate. As such, active cooling was not required even. Technically, and economically, there was *no flaw* in the overall scheme, save for the use of nuclear powered explosions that would potentially release harmful radiation into the environment.

The project was subsequently upgraded to involve NASA involvement, whereby the design involved the Orion vehicle to be carried – initially – into orbit as a Saturn V upper stage (thus reducing the radiation hazard to Earth's atmosphere). Ultimately, however, Orion fell quietly into the wayside for the following reasons:

1. Politics: In 1963, a nuclear test-ban treaty by the US, Britain and Soviet Union made the use nuclear explosion illegal by international law.
2. Classified: As a classified project, few in the scientific and engineering community knew it existed. For the project to survive, Orion needed to be reclassified as a peaceful scientific endeavour, and had to be partially declassified.
3. Funding: And lastly, the final nail in the coffin: funding. In 1964, the USAF indicated it was unwilling to continue support unless NASA also coughed up from its own coffers. In addition, the moon race from the Apollo missions meant that further funding was not easily forthcoming.

Thus, in some senses, mankind could have been travelling to the stars from as early as the late 1960s (**Fig.14**).

For the full declassified document containing the conceptual vehicle design can be read here: **http://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/19770085619_1977085619.pdf**

Numerous other video material and articles show its working test models and reincarnations, which still capture the popular imagination of future space explorers to this age.

Designing a Space Probe

There is not much to add here, except to say that, using the various existing reference material and research, we end up with a simple robust space probe that has a few additional features (**Fig.15**):

1. The ability to deploy solar sails;
2. Multiple probe modules – allowing easy deployment to explore different planets for various scientific endeavours

Dead Moon

Moving on towards our last segment of this workshop: **How to depict a dead barren planet.**

Technically, Mars and Venus count as terrestrial planets that can sustain life, but not classically Gaian, and thus will be covered in our next segment instead (when we look at possible colonisable planets and the concept of terraforming).

In this instance, we shall use our own natural satellite: the Moon – in full colour, that is (**Fig.16**).

Often, the lunar surface is depicted in a bland grey, or a false desaturated blue colour. However, the advent of webcams and improved technology now show that the moon is indeed more colourful that previously known (colour photography provided from the 1994 DSPE (Deep Space Program Science Experiment) Clementine satellite).

Craters on the Moon

The key chapter to consider when drawing any large circular object on a curved body, such as a planet, moon or asteroid, is the perspective. In contrast to the other aspects throughout the workshop, perspective is the key primary

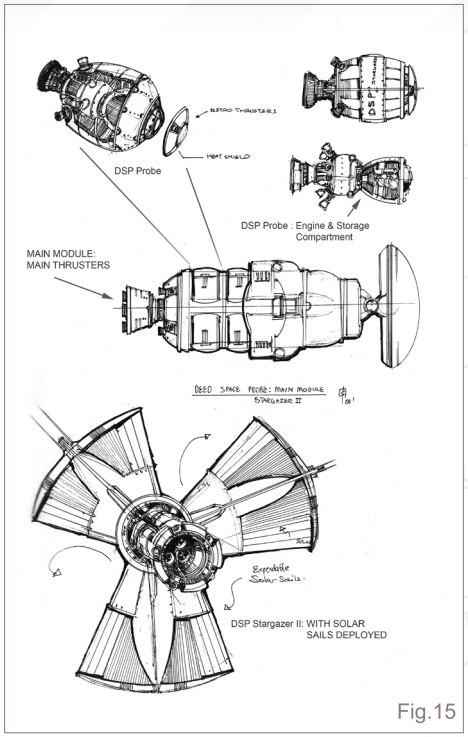


Fig.15

determinant when drawing craters (**Fig.17**). In general:
1. The closer (or more perpendicular) a crater is towards the viewer, the more circular it appears;
2. The further away a crater is, the more elliptical it appears;

Lastly, nature is random, and thus, to achieve both aesthetic and an accurate rendition of the moon, try to vary the size, depth and discolouration of the craters!

Illustrating The Moon

Some things to consider when illustrating the moon are that there is a nearside and a far side. Because our moon is “tidally-locked” to the Earth’s gravitational pull, the view of the moon is

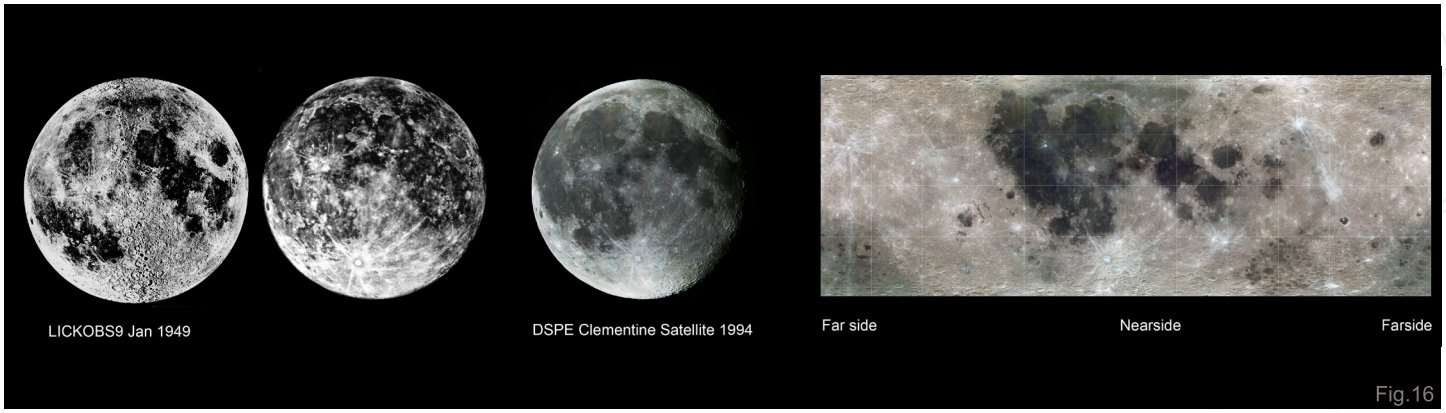


Fig.16

Fig.17

always fixed relatively to Earth. In the example of the Moon, it is said to be tidally locked to a larger body of the Earth. The dark patches seen on the moon by eye are said to be called the Lunar Mare/Maria (**Fig.18**).
The dark patches seen on the moon by eye are said to be called the Lunar Mare/Maria (dark regions made of basalt which give a dark green-blue colour cast).

Initial Layout and Composition

1. Initial Layout: Using the circular Marquee, paint a base of light yellow/grey in large flat washes to represent the base of the moon.

2. Palette: A colour palette of dark, mid and light tones will help in the overall production of the image using only colour. Optionally, one can choose to start out in greyscale and work out the base values based on the reference of the near and far side; however, it will take some work to make it appear painterly and naturalistic in the final outcome (**Fig.19**).

3. Save A Selection: In the Channels option, add a new alpha layer of the circular marquee. This will be frequently used from time to time; however, note that this will result in a sharp circular edge, whereas a softer edge is a more desirable outcome.

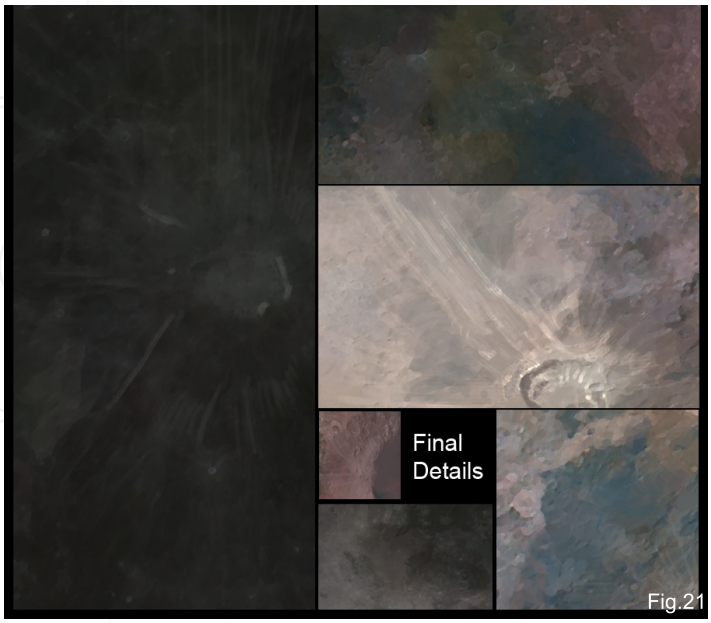


Fig.21

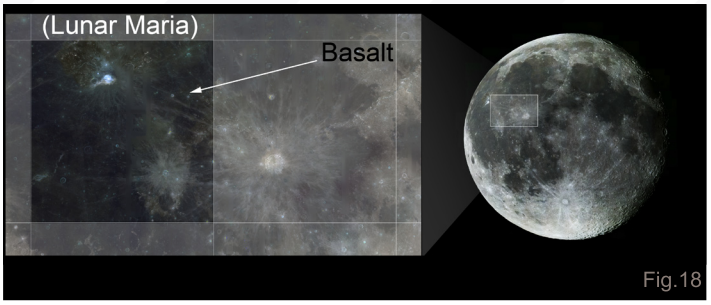


Fig.18

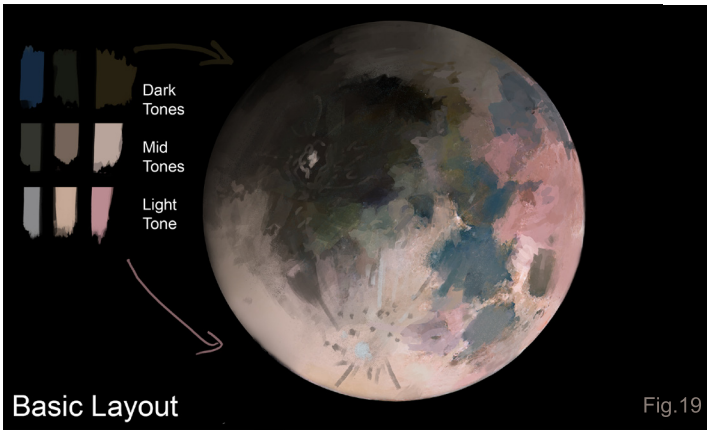


Fig.19

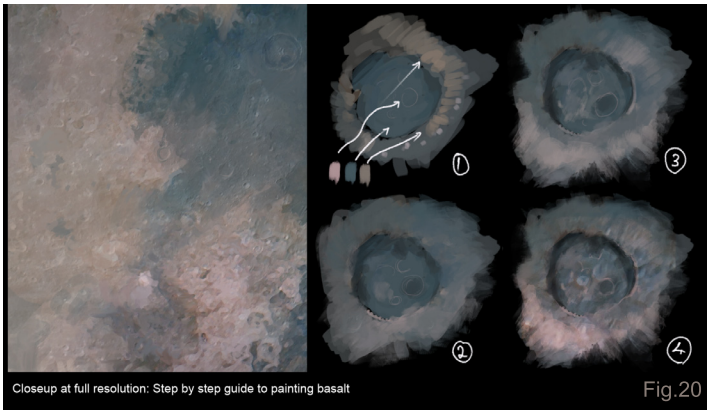


Fig.20

4. Base Shapes: Using the dark tones, lay down the dark basaltic mares, tempered with the mid-tones of pink and yellow. Finally, the lighter tones can be used to inscribe the edges of large and small craters. For a naturalistic feel, do not describe the whole shape of the crater, but rather just the edges that may catch light (**Fig.20**).

Adding Details

1. Work Big: For this piece, the overall image is at 6,000 pixels wide. This allows many tiny details to be “faked” by using purely colour complementaries.

2. Painting Basalt: Using a base of sea green, mix in a desaturated pink to suggest crater edges and highlands, and mix it in with the base green and yellow to get a good blend.

3. Craters: Try adding long light streaks emanating from some large craters. These can be thought to be left over trails from micro meteorite impacts or smaller showers.

For that final finish, try adding various foreground elements, such as the space probe previously designed, or the whole illustration can be colour-graded to a more traditional monochromic look (Fig.21).

Well, this has been a quick ‘whistle stop tour’ of the start of the galaxy and depicting a barren planet. In the next chapter we will look at how to terraform and paint Gaian planets!

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Chapter 04

GALAN PLANETS

SPACE PAINTING
CHAPTER 04: GAIAN PLANETS

Created In:

Photoshop

Tutorial Overview

Settling into a longer term view, the fourth aspect of this 12-part tutorial series on space and sci-fi art looks at the search for new Earth-like worlds, the colonisation of planetary surfaces and settlements within space.

Space exploration has had a few jump starts and periods of slow growth. Ultimately, the aim would be to travel beyond the stars and establish permanent self sustaining outposts within the regions of known space.

The strategies for these are initially twofold:
1. Settlement within contained man-made biospheres, necessitating reliance of life support systems and existing resources;
2. Inhabitation of planetary surfaces by engineering sterile planets into life via a process known as “terraforming”

In this chapter, we will focus primarily on the search for Earth-like worlds, known in some fields as “Gaian planets”, and the alternative of terraforming, as the two main viable tenets of space colonisation.

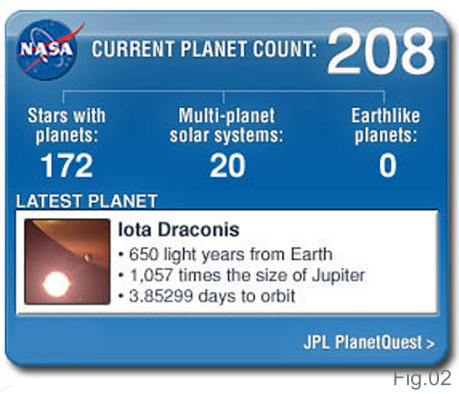


Fig.02

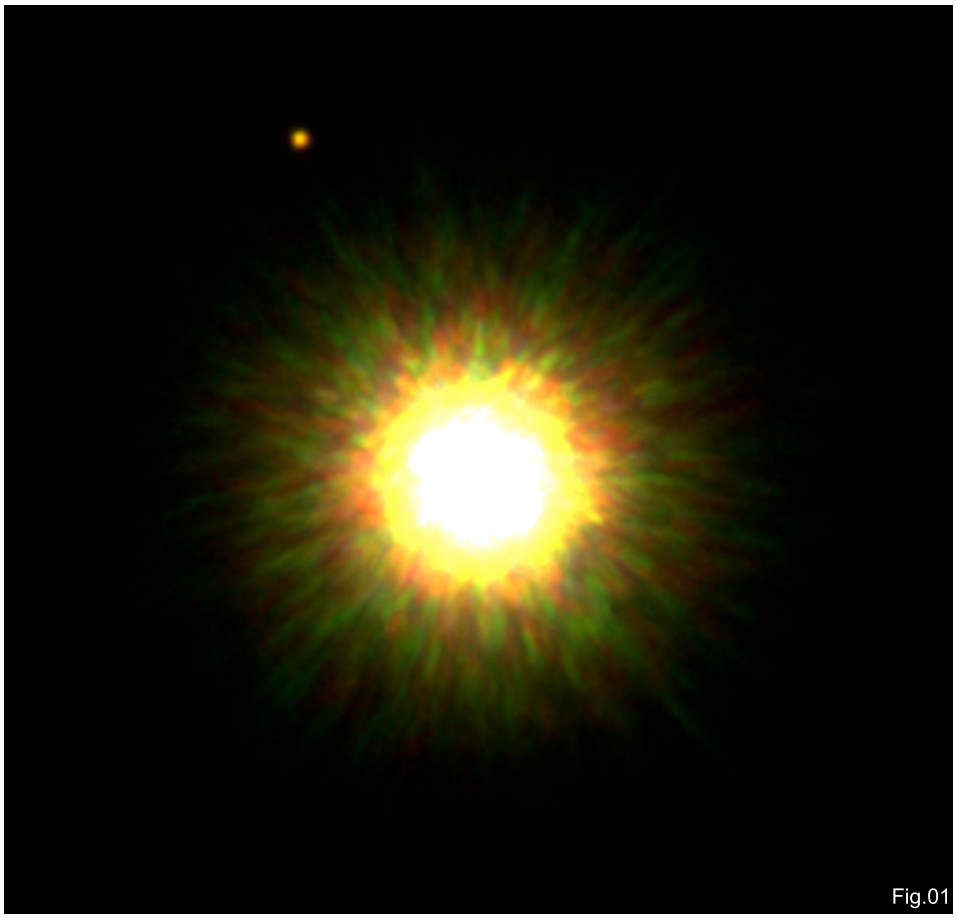


Fig.01

I: The Search for a New Home

On September 15th 2008, astronomers of the University of Toronto found the first extra solar planet to orbit a parent star similar to our Sun (**Fig.01**). This candidate planet has eight times the mass of Jupiter and lies 330 times the distance of the Earth-Sun from the young star: 1RXS J160929.1-210524 (which lies about 500 light-years from Earth!).

The challenge of finding Earth-like (gaian) planets is challenging, because many new planets are either too hot or cold due to their relative proximity to their prime star. In addition, the planets found so far have masses the size of Jupiter or more. Gaian planets tend to be much smaller and are thus rarer as they have all the right ingredients for life and are an appropriate distance from the star.

The key ingredients when identifying if a planet can support life are evidence of the following:

- oxygen
- liquid water
- carbon Dioxide
- signs of biological activity (e.g. methane)
- light analysis (to determine if a planet has atmosphere)

To date, the current search for habitable planets continues, spearheaded by NASA’s JPL Planet Quest Mission (http://planetquest.jpl.nasa.gov) involving exoplanet exploration; i.e. exploring the local galactic neighbourhood for future signs of habitable Earth-like planets (**Fig.02**).

The prime candidates to lead a search would be the:

1. Keck Interferometer – combines the lights from the world's largest optical telescopes to study dust clouds around stars, where Gaian planets may be forming

2. NASA Kepler Mission (to be launched in 2009) – aims to survey and chart our Milky Way galaxy, and thus detect and characterise multiple Earth-sized and smaller planets

3. SIM Planet Quest – the mission is to accurately measure the distance and relative position of stars via astrometry. This will help pin-point any Earth-sized planet more accurately. In addition, with an accurate star map, this will allow us to better navigate, locate and travel to these stars one day

4.Terrestrial Planet Finder – a hundred times the power of the stalwart Hubble Space Tele scope, the TPF will provide the first photographs of nearby planetary systems

Currently, the current planet count is as follows:

- Total exoplanets: 313
- Stars with planets: 268
- Multi planet solar systems: 20
- Earth-like (gaian) planets: 0

Illustrating an Earth-Like Home

The illustration of an Earth-like planet can be simplified in two steps:

1. Blocking-In a Gain Planet
2. Fine Detail Phase

Using this process, we can paint any planetoid mass with a bit of pre planning (**Fig.03**).

Blocking-In a Gaian Planet

1. Apply a Basic Star Field: Using either a custom scatter brush or manual placement, apply a liberal scattering of fine stars against an 80-90% grey background. These will serve as background stars.

2. Bright Stars: For application of various fixed objects, these will tend to be the brightest points of light on the canvas.

Blocking in a Gaian planet Fig.03

3. Coloured Stars: Ensure a fine gradation of blues, greens and reds are applied onto the stars via a subtle shift of colour balance/hue/saturation layer options. These can be set to around 5-10% and barely perceptible.

4. Finely Rough-Out Planetary Masses: Gaian planets may take on various appearances, from a large land mass to a watery planet, from a singular land-locked mass to a multi-continental planet. In this instance, we have gone primarily

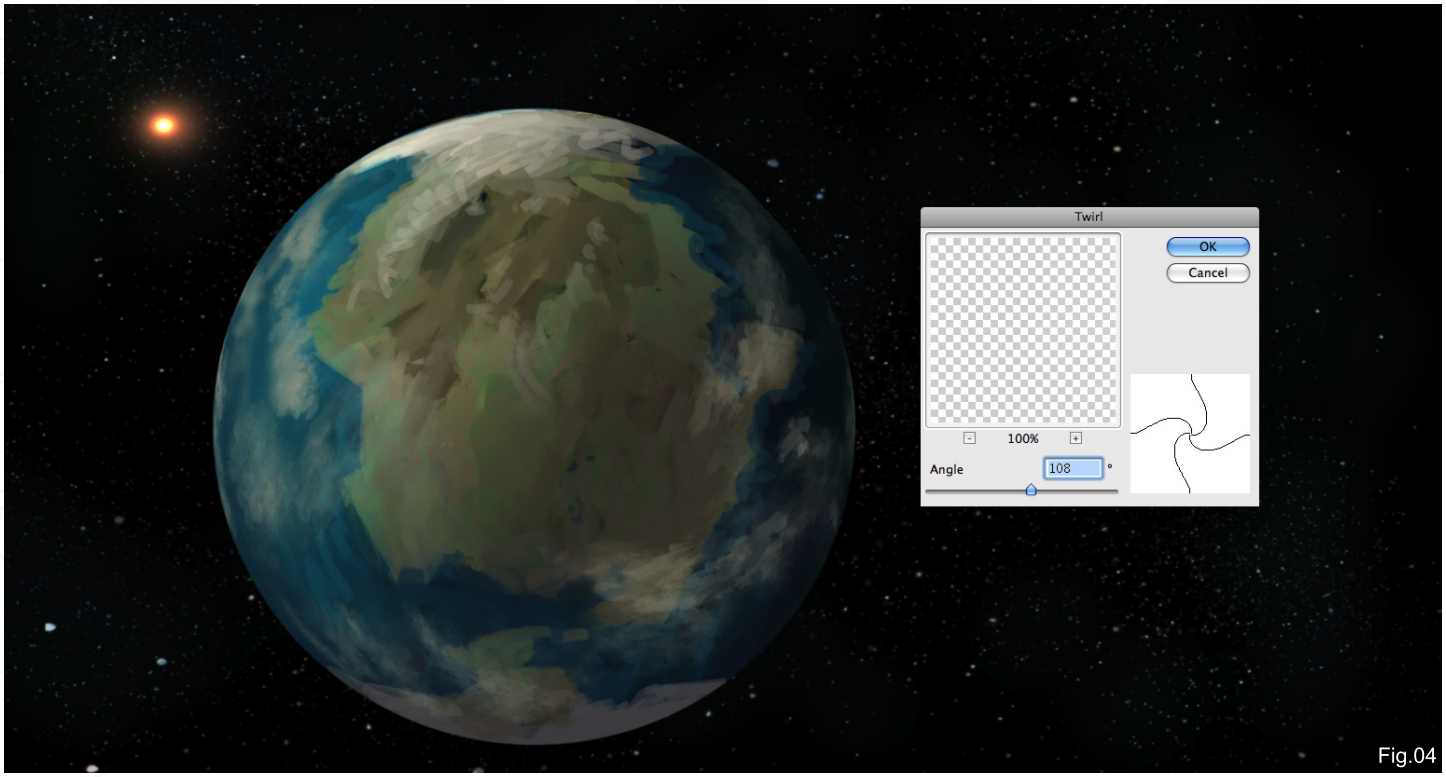


Fig.04

with a singular land mass. Rough this in – in any manner or form – using a selection of neutral-based colours.

5. Reference: Analysis of various reference photos shows us that land masses are primarily an ochre/red to tawny colour, while ice tends to be depicted as blue-white to white-yellow. Occasionally verdant planes take on a traditional green appearance (dependant on the cloud cover); deeper patches of water take on a dark green to deep blue colour, and relatively shallow water a lighter crystal green/blue appearance.

6. Apply Focal Lighting & Detail: A planetoid is roughly spherical and as such can be lit similarly using a focal light source, similar to observing light on a snooker ball from various angles and directions (except ambient lighting is minimal in space).

7. Scale Distances: This would be a good opportunity to apply the Gaussian blur filter (or atmospheric perspective/fog), thus allowing the composition to read: background, faint stars and the star as the brightest object, leaving the main planet in focus.

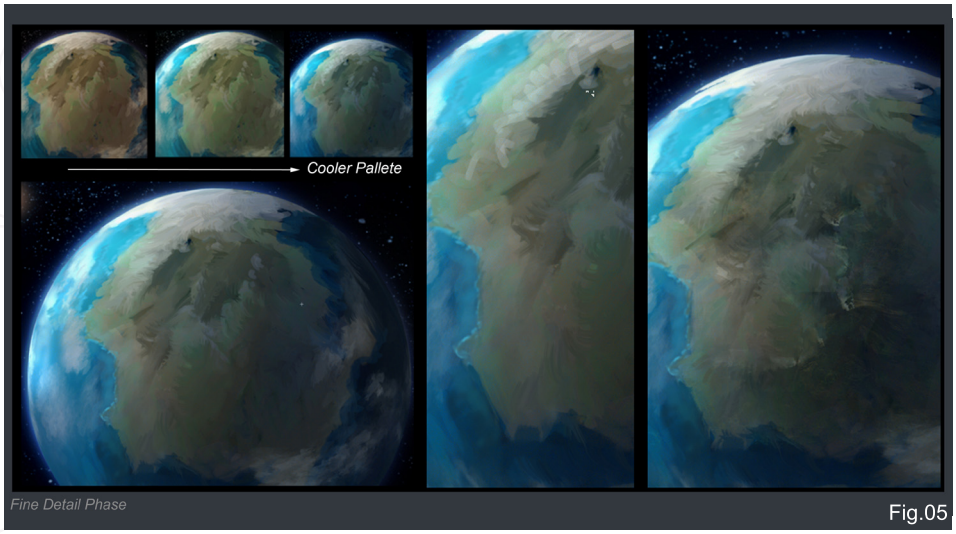


Fig.05

8. Add Atmosphere: In this instance, the addition of clouds on both the light and dark side of the planet helps to add that layer of 3-dimensionality and depth.

Fine Detail Phase

For the finer aspects of rendering an Earth-like planet (or any planet with an atmosphere), the realistic rendition of clouds of vapour is the key.

1. Twirling: Applying a circular selection to the planet, you can apply the twirl function moderately to suggest moving currents (**Fig.04**).

2. Colour Palette: The next objective is to bring the colour palette into a cooler blue green feel (**Fig.05**).

3. Colour Palette: Using the Colour Balance option, one can gradually shift the warmer hues to the periphery and all other areas into a cooler saturated shadow.

4. Atmospheric Glow: Most artists tend to exaggerate the atmosphere by providing a soft glow around a planet. Whilst this is not strictly a highlighting exercise, the upper atmosphere for Gaian planets tends to be thin, not as thick as

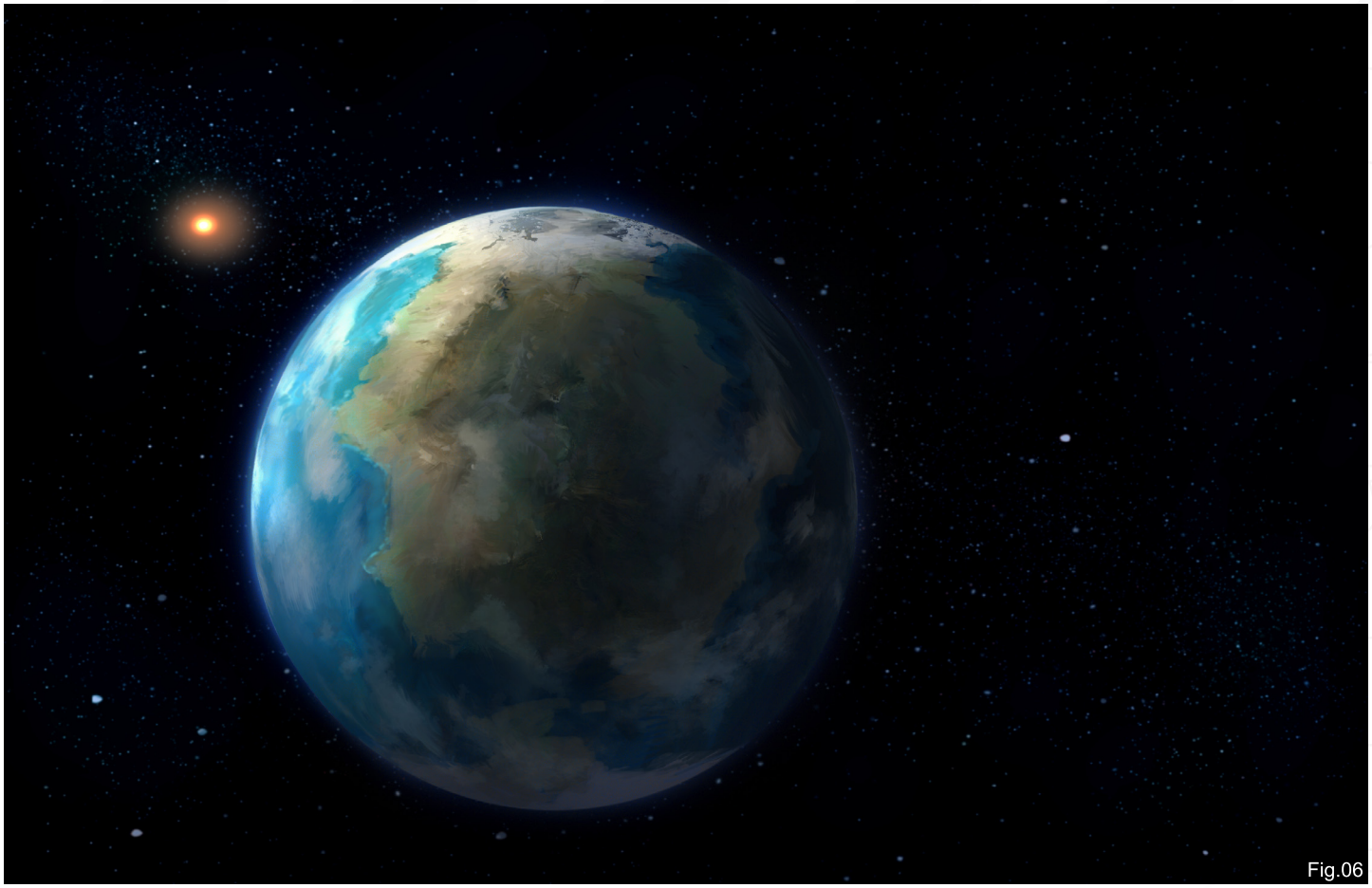


Fig.06

gas giants such as Jupiter/Saturn. So the main task is to ensure a very subtle approach is used.

5. Oceans & Shores: To suggest subtle depth, darker parts of liquid surfaces will take on a saturated darker blue (for oceans) and a lighter blue/green for shallower bodies of water.

6. Land Masses: The final defining moment is to suggest mountain ranges, planes and tundras. In our fictional image we can depict giant mountain ranges which are partially snow-capped; from an external view, such sharp details are rarely seen until within closer range.

Hopefully, with all the details roped in, the final image should look similar to **Fig.06**.

II: Terraforming for a New Home

The terraforming (Earth-shaping) of sterile planets requires the amazing feats of planetary-wide engineering. The term itself is widely attributed to a sci-fi writer, Jack Williamson in his book titled “Collision Orbit”, dated 1942, which has since come into popular and mainstream use. For the subject matter itself, Martyn J Fogg has since published numerous articles about terraforming and has devised various levels, classifications and ease of terraforming.

Types of Terraforming:

1. Planetary Engineering – the application of technology for the purpose of influencing the global properties of a planet
2. Geoengineering – planetary engineering applied specifically to Earth. It includes only those macro engineering concepts that deal with the alteration of some global parameters, such as the Greenhouse Effect, atmospheric composition, insulation or impact flux
3. Terraforming – a process of planetary engineering, specifically directed at enhancing the capacity of an extraterrestrial planetary environment to support life as we know it. The ultimate in terraforming would be to create an open planetary biosphere emulating all the functions of the biosphere of the Earth – one that would be fully habitable for human beings
4. Astrophysical Engineering – taken to represent proposed activities relating to future habitation that are envisaged to occur on a scale greater than that of “conventional” planetary engineering

Ease of Terraforming (of candidate planets):

1. Habitable Planet (HP) – a world with an environment sufficiently similar to the Earth so as to allow comfortable and free human habitation
2. Biocompatible Planet (BP) – a planet possessing the necessary physical parameters for life to flourish on its surface. If initially lifeless then such a world could host a biosphere of considerable complexity, without the need for terraforming
3. Easily Terraformable Planet (ETP) – a planet that might be rendered biocompatible,

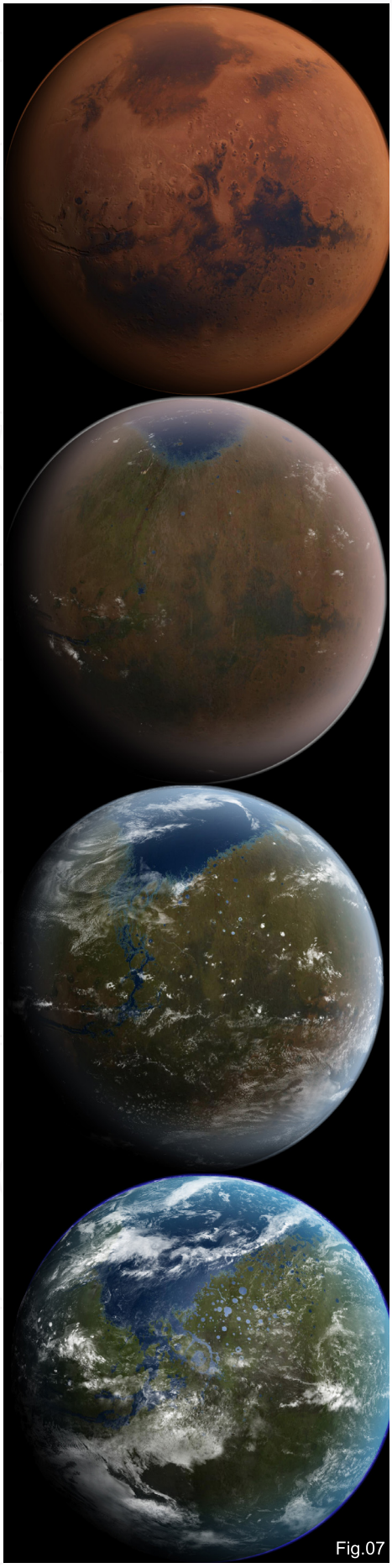


Fig.07

or possibly habitable, and maintained so by modest planetary engineering techniques and with the limited resources of a star ship or robot precursor mission

To a Future Blue-Green Mars!

Here is an artist depiction of the possible transformation from a red Mars to a green Mars, by Daein Ballard, 2006 (**Fig.07**).

Of all the possible planets within our Solar system, we have four terrestrial planets, and of those four only Mars proves to be a suitable biologically compatible planet for future human colonisation – but not without great effort and challenge, notwithstanding issues involving ethics, logistics, economics, politics, methodology and possible xenobiology of altering the environment of Mars.

Nevertheless, a generally accepted view would be to firstly establish a permanent human settlement on Mars, followed by a gradual, phased terraforming process, as our technology and understanding hopefully improves.

The remainder of this tutorial deals with the aspect of envisioning this futurist view of humankind, and looks at possible methods we have to undertake to achieve this aspect.
To terraform Mars, there are a couple of options – once the logistics of getting to Mars in a regular Mars-Earth transit becomes the norm! So firstly, let's analyse the similarities and differences between Mars and Earth, and the obstacles that stand in the way of producing a new planet sustainable of supporting human and organic life.

Facts about Mars

In a nutshell, Mars has conditions similar to a proto Earth (**Fig.08**), with 1% of Earth's atmosphere. Terraforming would be to accelerate this process to a level able to sustain organic and human life.
Here is a current up-to-date factual rundown of data pertaining to Mars:
Similarities – Mars has a solar day (sol) of 24.6 Earth hours (24 hours, 39 minutes and 35.244 seconds). Overall, Mars is less dense and smaller in volume compared to Earth, but has a similar land mass of 28.4% (compared to 29.2% of Earth's). The Martian atmosphere contains 95% carbon dioxide, 3% nitrogen, 1.5% argon, trace amounts of water, and no oxygen – verses Earth's 78% nitrogen, 21% oxygen, 1% argon, and 0.03% carbon dioxide.
Differences – the surface gravity is a third of Earth's, and in its current state much colder (average surface temperature of -63°C and as low as -140°C). The amount of solar energy is half of that reaching Earth, but without the thick atmosphere of Earth it has roughly the same amount of solar energy. Lastly, the Martian atmosphere primarily consists of CO_2, allowing

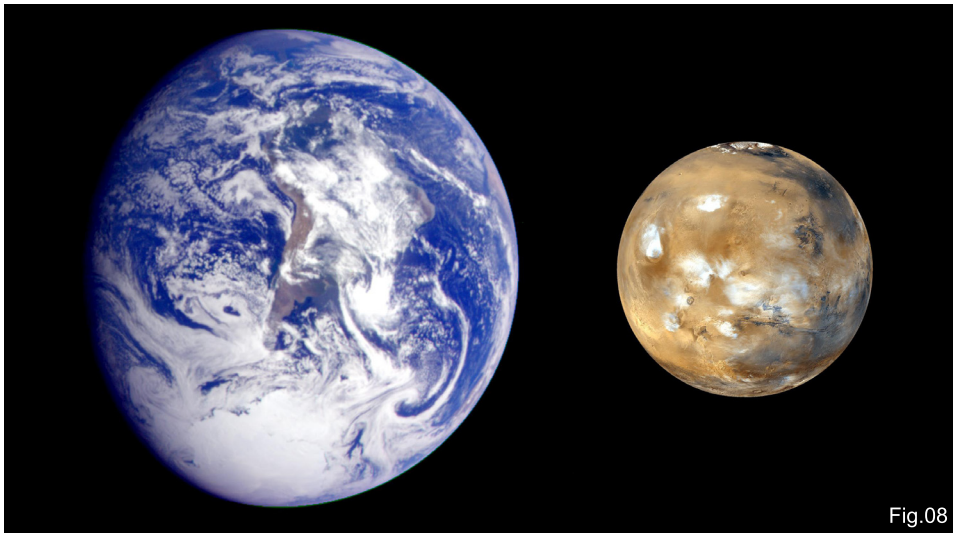


Fig.08

the possibility of supporting plant life and, during the short term, requires pressurised habitable structures.

Ethics – the question of any pre-existing life on Mars is still indeterminate, and any future terraforming measures will possibly run into hostile pro-Mars activists, once permanent human settlement exists on Mars.

Economy – the immediate costs of colonisation, habitation and terraforming of Mars will be immense, with a long term economic export still to be indeterminate (in terms of raw materials) in recompense. It is speculated that perhaps some new advancement in space materials, engineering and technology could be the trade off.

Communication – Mars currently has three functional spacecraft: Mars Odyssey, Mars Express, and Mars Reconnaissance Orbiter, plus two robotic Mars exploration Rovers: Spirit and Opportunity. Communication with Earth ranges from 6.5 minutes to 44 minutes, with a cut off of two weeks every synodic period (i.e. when the sun is between Mars and Earth). With additional communication relay satellites at L4/ L5 Earth-Sun Lagrange points, these could be improved in the near future.

Highlights about Mars

- Water & Ice – the largest concentrations are within the North to South polar ice caps. Additional sources of water are hinted within various caves, buried oceans, gullies and craters
- Mount Olympus – the highest mountain in the solar system rising 26km in height
- Valles Marineris – the longest and deepest canyon in the solar system ranging 4500km long, 200km wide and up to 2-8km deep

Fig.09 shows various angles and positions of Mars from the Mars global surveyor, with close-up views over the northern hemisphere.

The Mars Data Sheet

Martian Day (or Sol): 24.6 Earth hours

Martian Year: 1.88 Earth years = 687 Earth days = 669 Mars days

Distance from the Sun: Minimum 206,000,000km to Maximum 249,000,000km

Distance from Earth: Minimum 56,000,000km to Maximum 399,000,000km

Size: Diameter = 6792km vs. 12,756km for Earth

Surface Gravity: 0.38 (about 1/3) times Earth's gravity

Temperature: -125°C (-193°F) to 25°C (77°F)

Moons: Phobos and Deimos

Mars missions: 37 (to date)

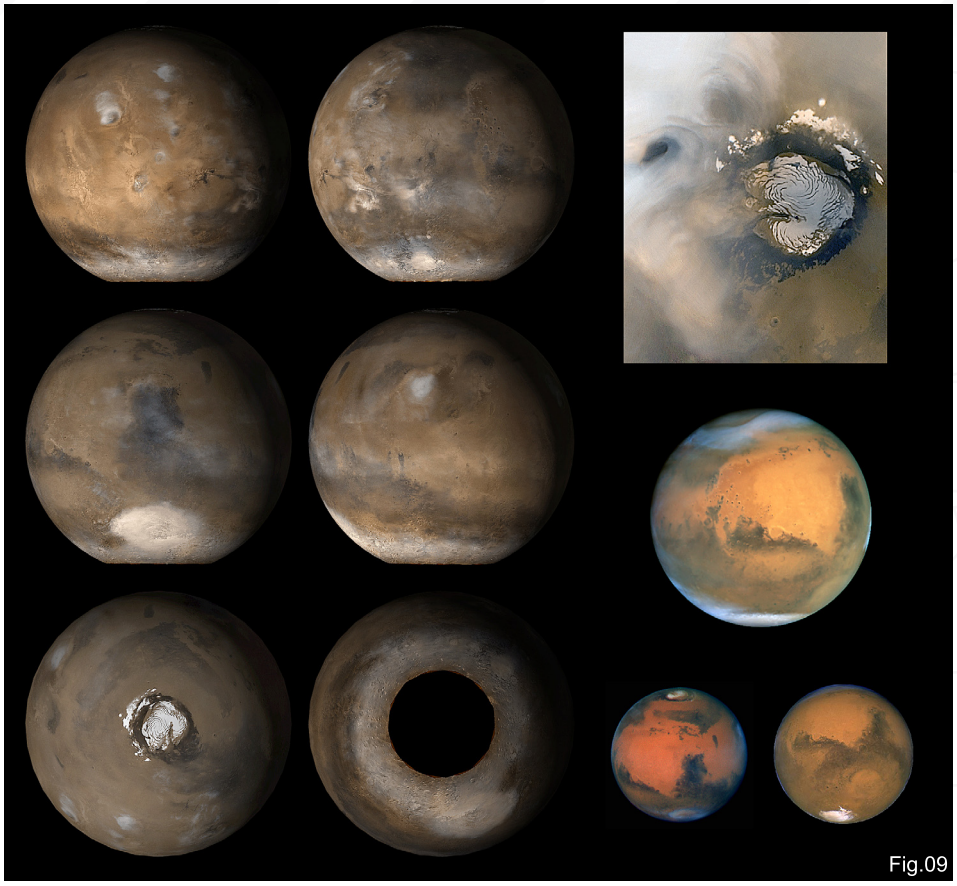


Fig.09

Terraforming Mars

Having pre-used the existing Mars data, the main challenges of producing a sustainable Mars biosphere would be to:

1. Increase surface temperature
2. Increase the atmosphere
3. Extend regions of liquid water
4. Achieve favourable conditions for assembly of complex organic molecules
5. Achieve sufficient energy sources to sustain metabolism

Once these basic criteria have been met, the advancement of terraforming by seeding the planet with plant life and microbiological life forms can exist, and thus help accelerate the production of breathable oxygen.

Red-to-Blue Mars

To fulfil the criteria of a warmer surface temperature to above freezing, it has been calculated that a minimum of 4°C is required to snowball the re-warming process. Ultimately, this will allow water to become liquid and generate sufficient atmosphere for habitation. To achieve this process, there are a few additional options, ranging from relatively moderate impact to drastic.

To tackle all three in one swoop, we have to – ironically – find methods of achieving a Greenhouse Effect on Mars! Here are the various ideas proposed:

1. Placement of Orbital Solar Reflective Mirrors – Solar Power Satellites (SPS) encircled around the poles could generate sufficient heat

to gradually melt polar ice caps in controlled amounts. These would help thicken the atmosphere, and with a further temperature rise of 10°C this could release further significant CO2 from the Martian regolith (surface soils).

2. Drilling – it is suspected that the surface permafrost layer of Mars might contain pockets of water, hot water vapour or other gasses, at a drilling depth of 800 metres. Water vapour itself is an effective greenhouse gas and in its vaporous state has an important heat-trapping "Greenhouse Effect" .

3. Factories – the installation of manufacturing plants and factories that tend to produce CFC gasses as a by-product, and thus contribute in due course to the Greenhouse Effect.

4. Robotics – nanobots and large scale autonomous terraforming robots could be manufactured to process the abundant CO2 and water to generate sufficient oxygen and nitrogen, once a sufficiently thick atmosphere has been produced.

5. Impactors – alternatively, one could radically harness asteroids near Mars, drill sufficient propellant onto the surface and redirect these asteroids to impact the desolate areas of Mars. The impact of such asteroids would be sufficient to generate a modest amount of heat, gas and dust, if near the polar ice caps, to help kick start the terraforming process. Such candidates could be similar to the recent asteroid 2007 TU24, which modestly measured 150-160m metres. (The next asteroid of a similar significant size is projected to enter near Earth/Mars in 2027.) It would simplistically be a matter of tracking around 7,000 of these near Earth/near Mars objects and redirecting their course to the intended target.

6. Seismic Events – another radical alternative would be to cause the eruption of local volcanoes in sufficient regularity and quantity to contribute towards the greenhouse process

Mars Impact

Actually, the aspect of impacting onto Mars is not new! For quite a while now, scientists have pondered at a major difference of Mars's

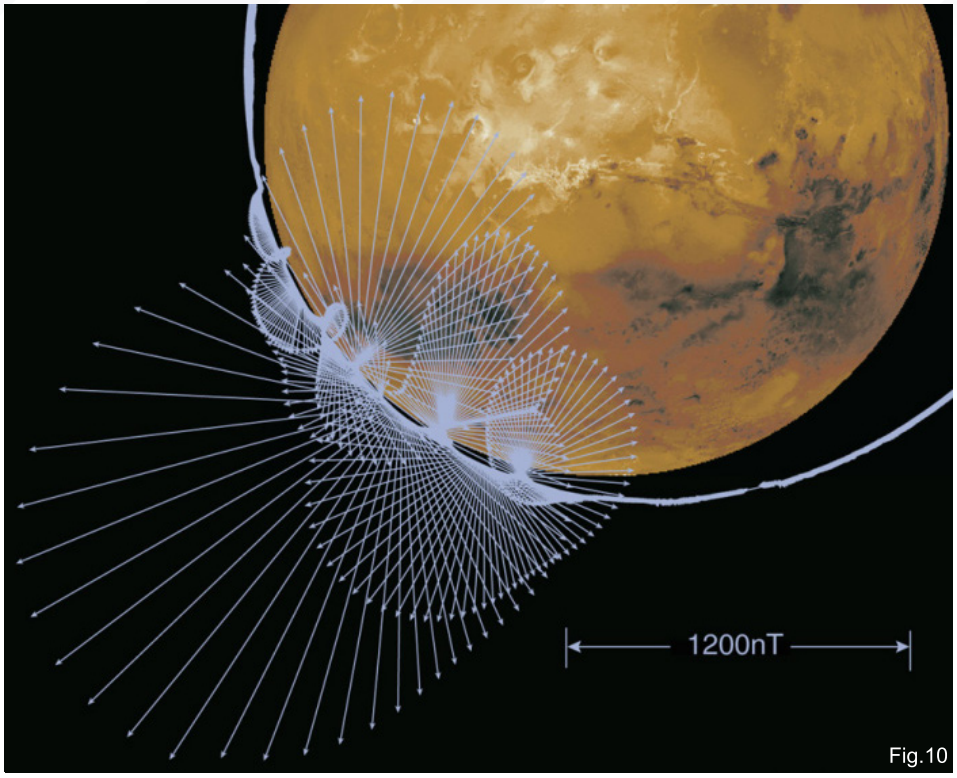


Fig.10

sudden loss of atmosphere, and an asymmetric magnetic field localised in the southern hemisphere (first observed by the Mars Global Surveyor in 1985).

This dichotomy of a smoother, thinner northern hemisphere crust, versus a magnetised southern hemisphere, has been a longstanding mystery until now. In a recent study published in the Science Journal 2008 (DOI: 10.1126/science.1161119), the implication of this suggests an oblique long angle impact by a giant mass/asteroid, said to be as large as the size of Earth's moon, striking the upper hemisphere of Mars.

Fig.10 shows Mars's magnetic field, as observed by Mars Global Surveyor in 1985.

Sabine Stanley from the University of Toronto in Canada, and her team, have provided for an intriguing and compelling study using computer-generated studies of heat flows that tie these various congruities together. Within the study, the large scale impact would explain why the northern hemisphere is so much thinner and virtually flat, as a result of the warming of the mantle there. This results in less flow of heat between the mantle and core boundary, and thus leads to non-existent magnetism. In contrast, the surviving southern hemisphere would have a greater heat gradient and flow exchange, explaining why the resultant rocks have a strong localised magnetic field.

III: Seeding a Possible Home

Advancing the future timeline, we can extrapolate that to expand beyond the current solar system we could look for habitable planets with similar Sol-like stars.

The barrier between technological inventions and advancements, described in science-fiction, is often reduced, and inventions such as the mobile phone (inspired by portable gadgets such as the communicators featured in Star Trek) and nanotechnology (a famous Japanese manga, such as Dragonball, regularly described pill-sized devices that could encapsulate any medium, device or requirement) are different ends of the spectrum of what inspiration can help achieve with mankind's ingenuity.

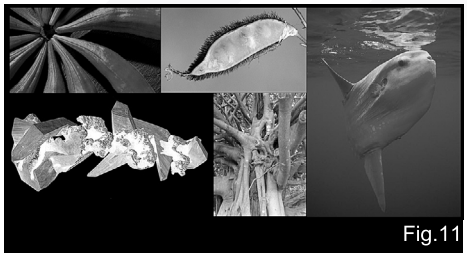


Fig.11

With regards to the purpose of finding new planets for habitation and terraforming, let's look at future star ships to seed the stars, after the fashion of replicators or von Neumann devices. The theory would be that large, self-replicating devices could traverse the stars in groups and help identify and seed planets ready to be terraformed, priming them for future habitation. On board each ship could be a whole host of mini ark-like ships carrying compact DNA banks, raw materials and technology, to help in this vast transformation process. Naturally, only sterile worlds would be selected for this purpose, and as such a vast bank of space to planet-side probes would be produced to scout and scan various planets within each solar system.

Building a Seed Ship

Whilst designing a futuristic spaceship allows one to be creative and apply a liberal amount of creative license, being able to both inspire and convey the purpose of these large replicating transports from a purely visual aspect is both a worthy industrial design and aesthetic challenge in itself!

Features that one could take inspiration from are as follows (**Fig.11**):

- Seed/pod shape
- Giant sunfish
- Giant floating tree ships
- Organic and minimalist sculpture and forms

To complete our tutorial, here is an alternative and rapid method of designing a transport within an illustration (**Fig.12**). Utilising the illustration of the gaian planet developer earlier, we will crop into the image (as the main concentration is on the space seed ship rather than the planet).

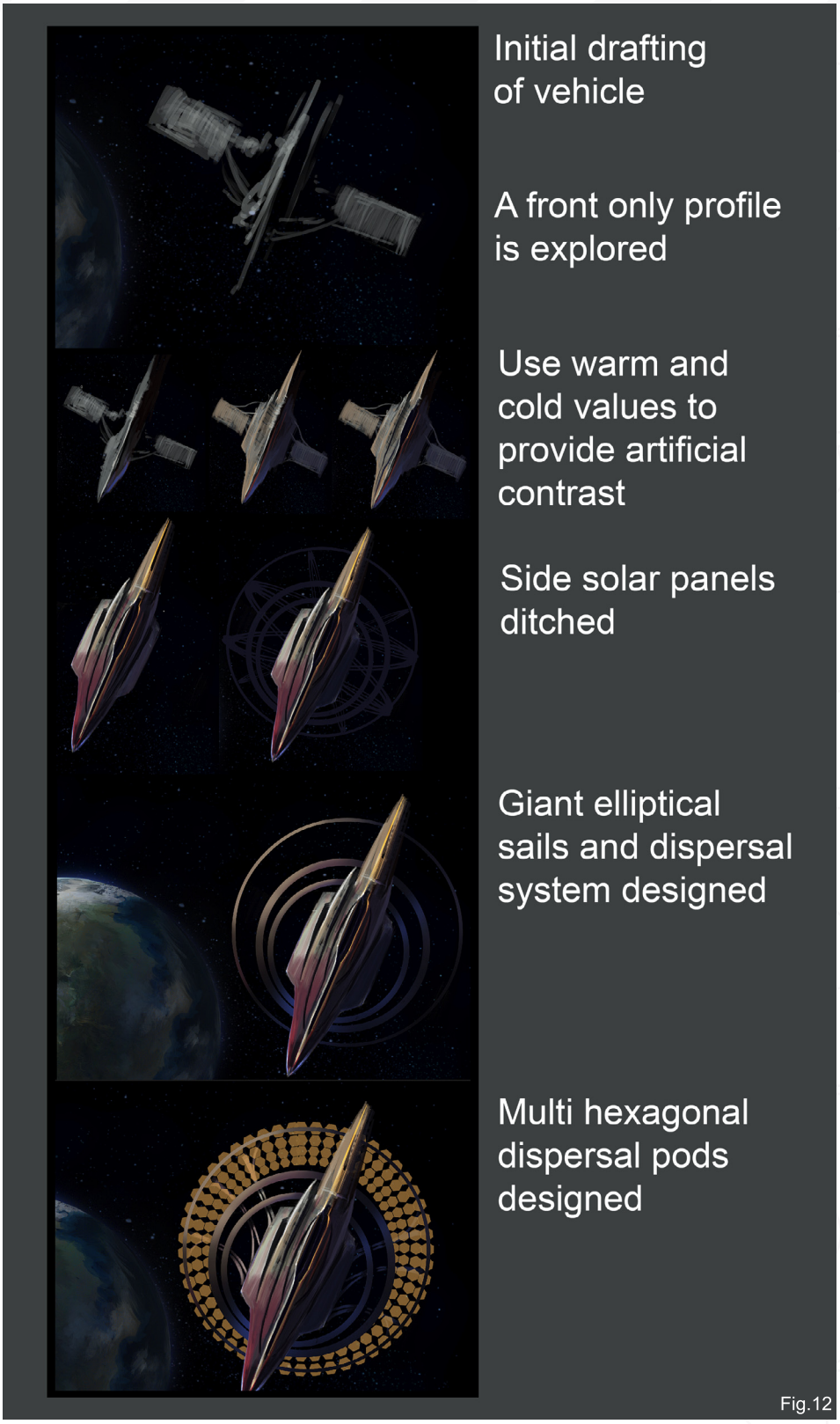


Fig.12

1. Initial Draft: The initial draft is loose and produced in greyscale.

2. Colour Scheme: Mindful of the surrounding environmental values, we opt for a yellow/blue colour scheme.

3. View: In this instance, a front profile is used for dramatic effect.

4. Design Shape: Using the various inspirations of naturalistic features (as previously discussed), and the design language developed

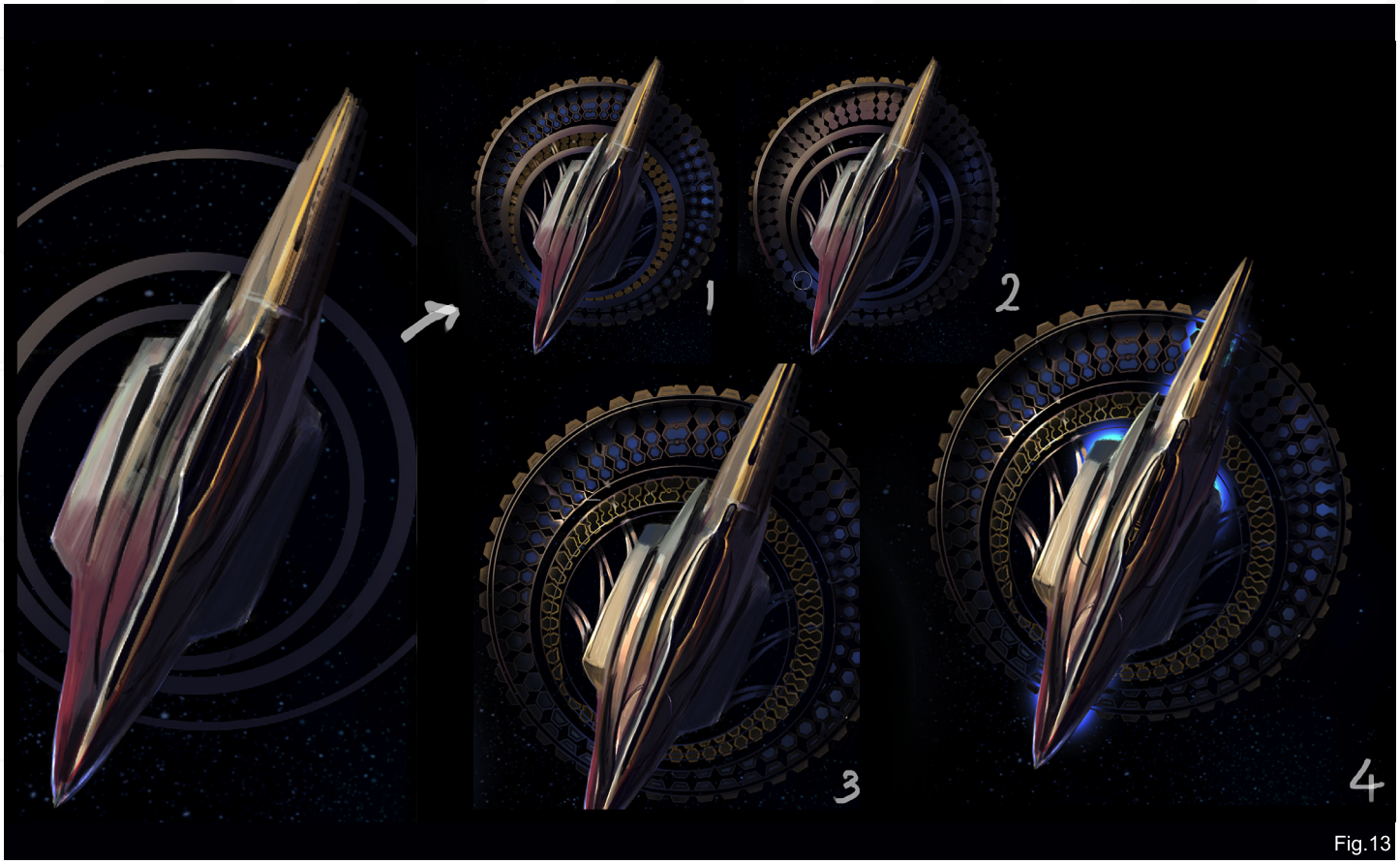


Fig.13

by Luigi Calloni, the idea is to develop a Gigantic propeller-shaped seed star ship (however, after a brief iteration, the side panels protruded horribly and were deleted).

5. Refined Design Shape: A warmer red-purple value is used to demonstrate the reflective ability of this giant ship, and values are ghosted in more solidly to give further definition. An idea to use elliptical giant constructs are implemented to provide space sails and space seed pods.

6. Seed Pods: The use of a hexagonal pod, arranged in a circular fashion, is experimented with. The idea is that as new seed batches are used, these can be replaced and released, like a revolving canister.

Following the initial conceptualisation, we now have both a back story and a purpose for this vehicle (**Fig.13**). We know that these large seed vessels can travel the various solar systems within different galaxies, and as they gather more raw material from flying space debris and asteroids, their ability to self-replicate via the von Neumann methodology allows for these large ships to send home identified planets ready for habitation.

The next stage is to take the star ship into a full render (**Fig.14**):

1. Selections: Provided you have various objects and shapes on different layers, you can select the various parts, e.g. the seed pod area, using the circular area via your saved selections. Selections can be made by selecting a specific shape you desire and clicking on a new alpha mask. These selections get saved into the alpha channels and can be accessed easily thereafter. Good selection habits are vital for successful transport design!

2. Depth and Colour: Using a tonal contrast of warm and cool values, remember to apply a shadow layer onto the circular selections to project a feeling of 3-dimensionality. To provide that extra dimension of believability, you can contract your selection by 1-2 pixels, add separate colour uniformity, and contract the selection even further to apply your final, overall colour.

3. Border: Using this method, you can emulate a distinct border between different parts, as seen in industrial design products, e.g. cars, fridges, drawers, phones, etc.

Final steps: To finish off, the addition of highlights and subtle engine glows/wash are vital. The important caution here is to add a fine wedge of light as your highlight. Large highlights suggest the viewer is very close to an object, and that the object is either greatly curved or very small in relative scale. For larger scaled objects, sharp highlights are smaller and fainter.

And there you have it – a good selection of mankind's current pursuit into reaching the stars, and real problems and solutions towards reaching the moon, Mars and then the stars. To infinity and beyond!

Addendum

Permanent Settlement on Mars

For further information and involvement about Mars, you can seek out the following:

1. Mars Society (http://www.marssociety.org) – founded by Robert Zubrin, including members such as sci-fi writer Kim Stanley Robinson and filmmaker James Cameron as an international space advocacy non-profit organisation dedicated towards encouraging the exploration and settlement of Mars.

2. Mars Drive (http://www.marsdrive.com) – founded in 2005, is a similar international non-profit space organisation with the goal of involving the public, directly and actively, in the settlement and exploration of space. Its intent is to enable the rapid expansion of humanity into space and Mars by gathering public support and helping build up funds for the growth of a viable space economy.

Dr Chee Ming Wong

For more from this artist visit:
http://www.opusartz.com
Or contact:
info@opusartz.com

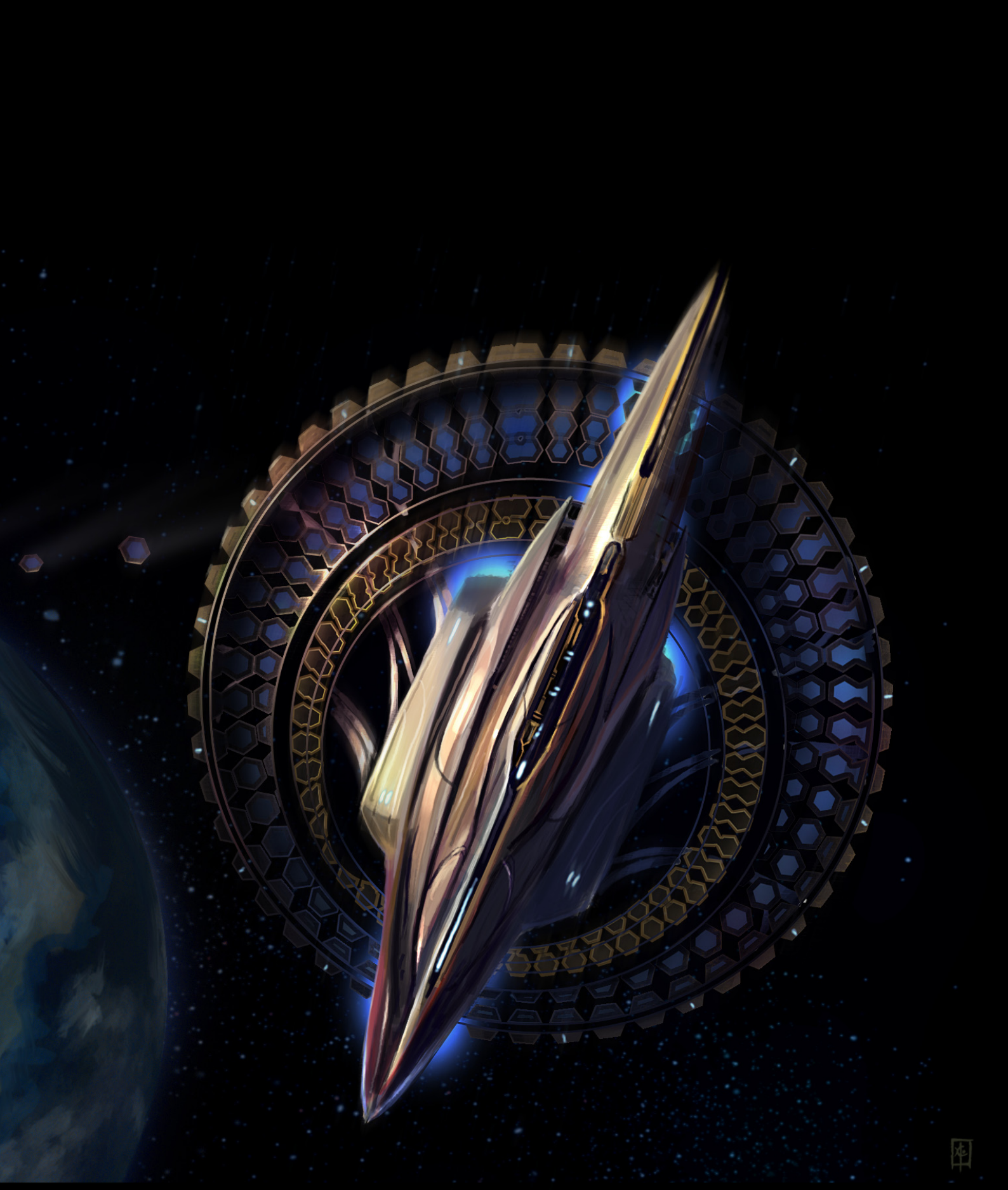
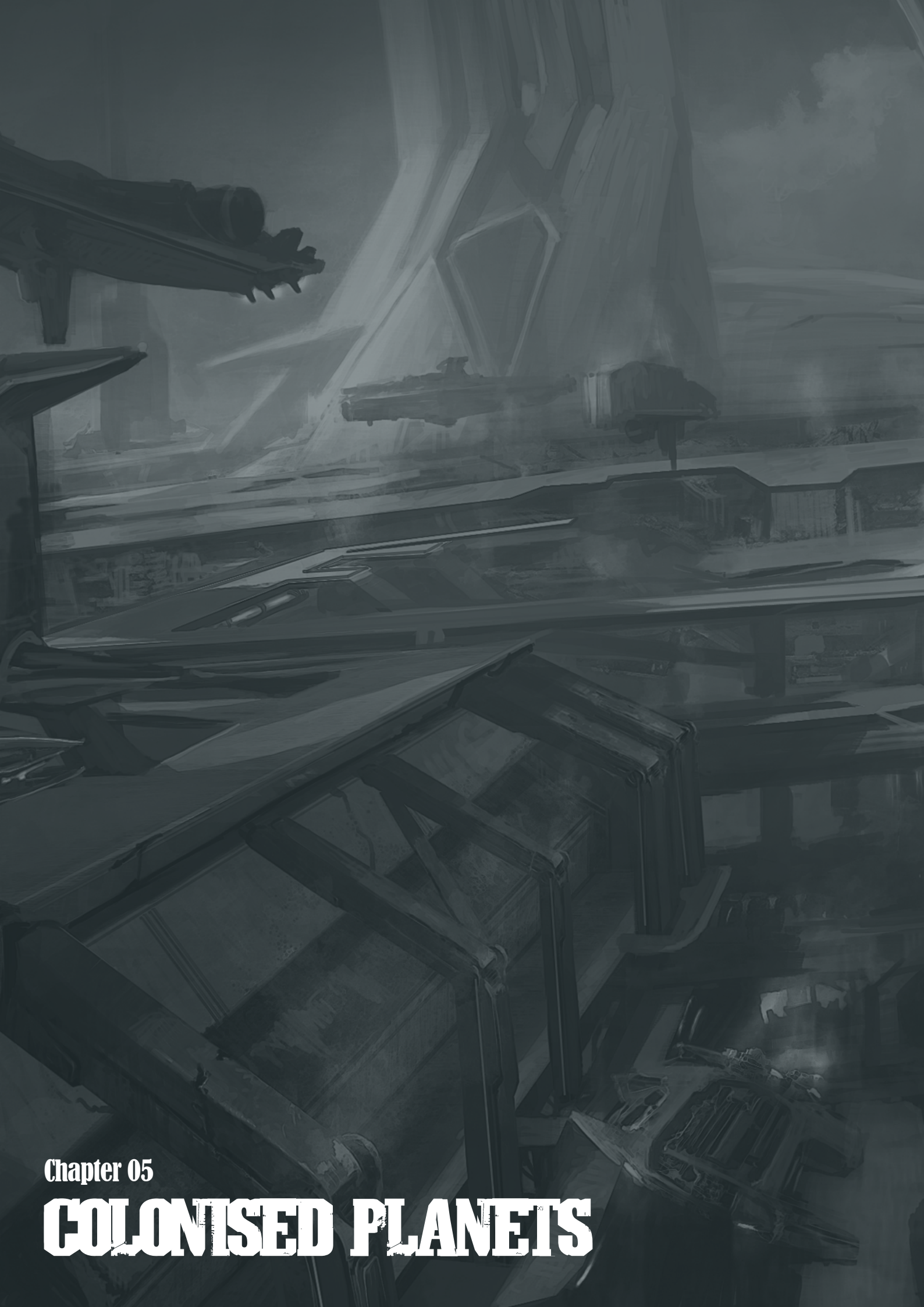


Fig.14



Chapter 05

COLONISED PLANETS

SPACE PAINTING

CHAPTER 05: COLONISED PLANETS

Created In:

Photoshop

Welcome to the fifth instalment of this space painting series. In this chapter, we have finally relinquished the heavy theory aspects of composition, painting and rendering, and now take the opportunity to tackle one of our more sci-fi based topics: Colonised Worlds. In imagining the aspect of colonised worlds, there are many renders of futuristic cities that are both beautiful and inspirational, and images that seem to influence a generation of artists. So let's imagine a large-scale, multi-asset environment, featuring such futuristic worlds…

Overview

During this workshop we will also discuss, in finer detail, the challenges of illustrating an image through to its finality, and the various choices that one has to make when depicting a theme. Inevitably, there comes a point where even an image cannot be saved, and you have to make a key decision as to whether to persevere or adapt it into something more fitting. And it is these decisions and troubleshooting elements that make illustration even more worthwhile.

One of the key advantages of painting for leisure is that you are your own art director; however, the offshoot of this is that you are also your harshest critic. So it is also a matter of good time management (i.e. are you spending too long on the image?), finishing (an image is said to never be finished until you run out of time!), avoiding over-rendering (knowing when

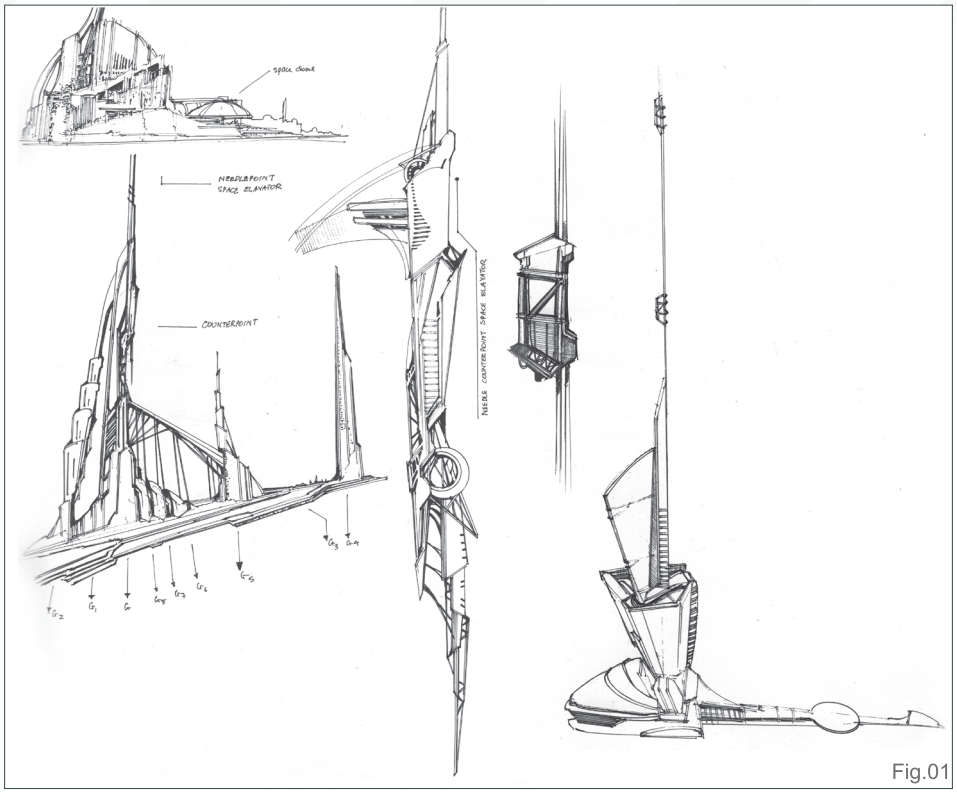


Fig.01

Fig.01 – 02: Various sketches exploring different architectural styles to house a space elevator. These include hypothetical designs of the elevator tower itself and potential portable man-sized containers to lift travellers and tourists on board. It is envisioned that the mass transit of goods would be via a special freight container

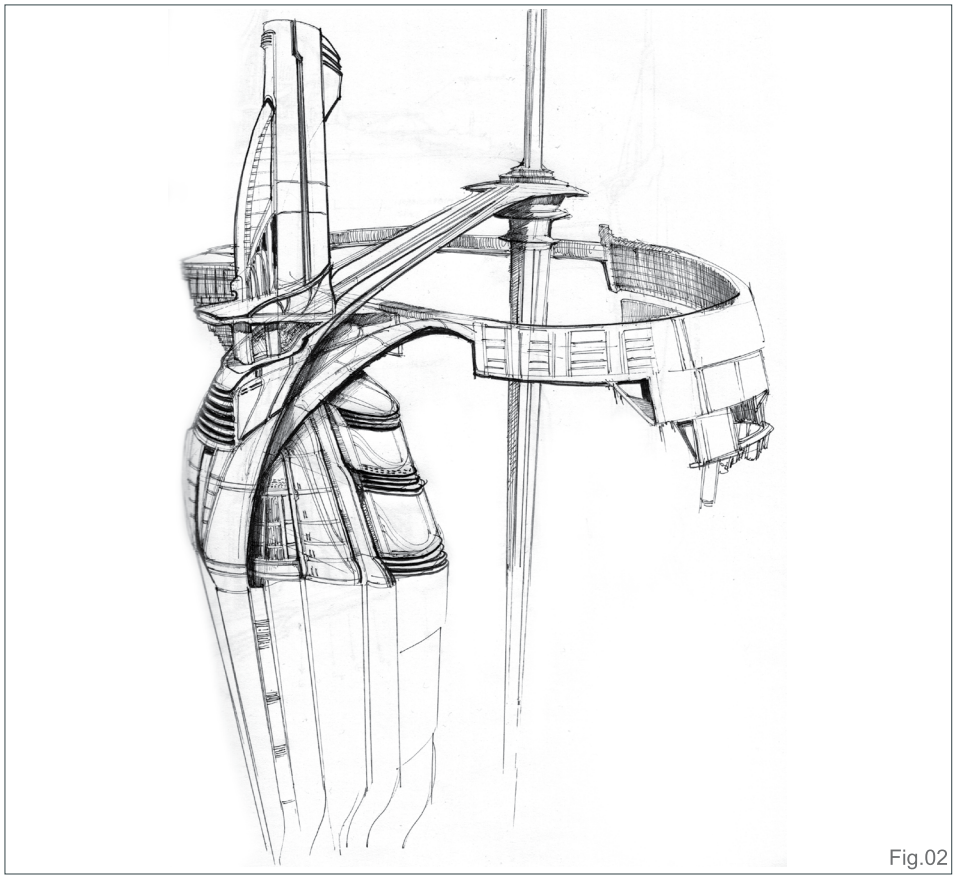


Fig.02

Fig.03: Various retro futuristic skyscrapers of the 50-60s, notably the highly graphical renderings of skyscrapers, by Hugh Ferriss.

to call it a day, or having overworked an image that ultimately is not working out), and selling the story (does your image work as the "money shot"?).

Space Elevator

The space elevator was first proposed by Russian scientist, Konstantin Tsiolkovsky in 1895, after looking at the Eiffel Tower. Subsequently, it was further explored and popularised by Arthur C. Clarke in his book, *The Fountains of Paradise* (1979). So let's explore the concept of a space elevator as a key vital mode of mass transport between a planet side and near planet side/low orbit. The key features of producing a space elevator, traditionally, have been to simplistically design the following:

- A fixed point in space
- A lightweight cable system
- An appropriate counterweight

If we consider the current day challenges of building a space elevator on Earth, we firstly need to determine a fixed point in space, known as a "geostationary point" above a planet. This point is roughly 22,300 miles (35,900km) above the surface of Earth. The reason why a geostationary object does not fall downwards towards the planet is due to the centrifugal force caused by the circular motion, cancelling out the force of gravity. It is at the geostationary point that the force of gravity is sufficiently weak enough that this horizontal motion negates its effect, thus allowing an object, such as a satellite, to orbit in an exact fixed point in space.

Now that you have a fixed point, it seems a simple matter of hooking a long rope from the ground to the geostationary object. However, due to the immense length and weight of the rope, it will inevitably drag the geostationary object it is hooked to down into the planet's gravity. To counteract this, a secondary rope can be used to compensate it, so that it's moving away from the planet. Technological advances determine that such a lengthy cable would have to be both sufficiently lightweight and immensely durable. A "magic rope" basically. For this, Japan is looking into constructing some carbon nano fibres that are 100 times stronger than the current carbon nano tube technology.

For the purposes of this tutorial, we will assume that this technological barrier and such limitations are easily achievable.

Fig.01 and **Fig.02** show various designs and concepts that explore different space elevator designs. In particular, the focus is on the main housing unit that will be based planetside. It is envisioned that, on the near space side, a geostationary space station or object will allow the tethering of the space elevator and cable.

In the future, the idea of a space dock will allow for the ease and transport of goods and inhabitants from foreign worlds via a space elevator. This presents a relatively cost effective type of space transit and will also have minimal ecological impact.

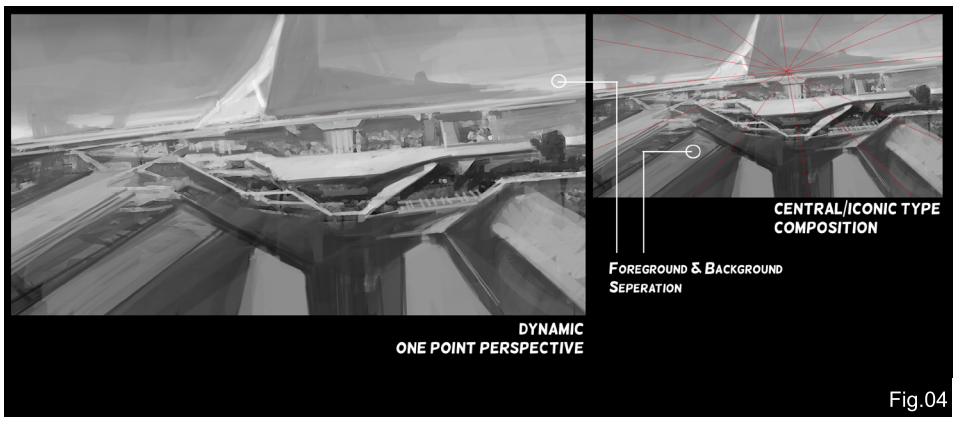


Fig.04

Skyscrapers of the Retro Future

For the design of our main composition, it

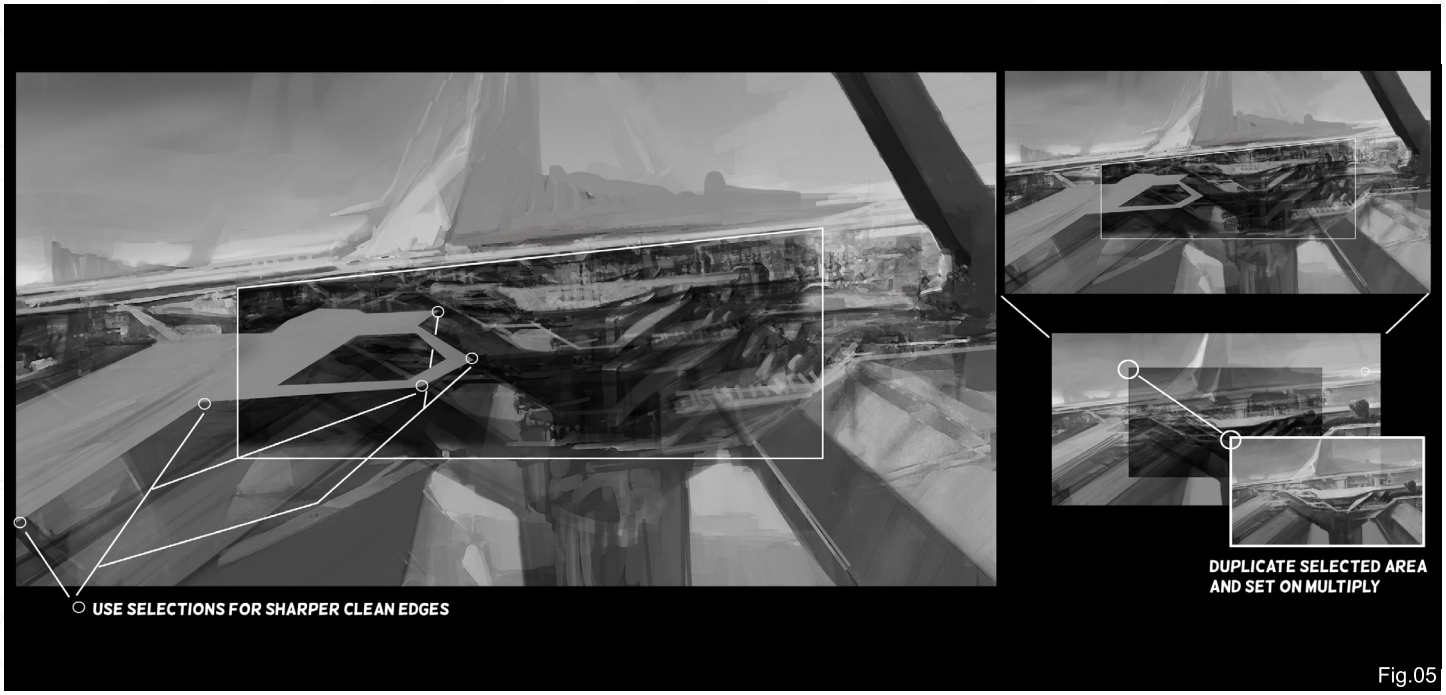


Fig.05

is sometimes best to do a bit of research to determine what styles have been explored before. This allows us a sensible base for our inspiration, exploration and the ultimate production of an alternative (if keeping with a chosen style) or new style. For this workshop, we look at the architectural genius of Hugh Ferriss (1889-1962), a master of shadow and light. His works show a technical brilliance of contrasts and towers of epic proportions (**Fig.03**).

Another inspirational source is the artist, Erich Kettelhut (1893-1979). As both set designer and later art director, Kettelhut was one of the production team formed during 1924 to work with Fritz Lang and Thea von Harbou on developing the film and preparing it for shooting. Together with the cameraman, Karl Puth he experimented with different heights and angles for perspective vistas and developed an understanding for the way film can represent architecture. His renderings of a majestic Babylonian metropolis can be seen in **Fig.03**.

The retro feel of these skyscrapers shows a refreshing sense of titanic proportions, and harken back to a time when mankind felt they had a definite purpose for the future. In the future of the retro 50s and 60s, man would one day live in mile-high, elegant and streamline skyscrapers of imposing architectural grandness.

Part 1: Painting an Arcology

For the remainder of this workshop I will take you through the design, composition and challenges of building an arcology and space elevator into our final illustration. But first of all, I'll explain a bit about an arcology:

"Arcology is Paolo Soleri's concept of cities which embody the fusion of architecture with ecology. The arcology concept proposes a highly integrated and compact three-dimensional urban form that is the opposite of urban sprawl with its inherently wasteful consumption of land, energy and time, tending to isolate people from each other and the community. The complexity and miniaturisation of the city enables radical conservation of land, energy and resources.

"An arcology would need about two percent as much land as a typical city of similar population. Today's typical city devotes more than sixty percent of its land to roads and automobile services. Arcology eliminates the automobile from within the city. The multi-use nature of arcology design would put living, working and public spaces within easy reach of each other and walking would be the main form of transportation within the city." --Paolo Soleri (http://www.arcosanti.org/)

So in essence, we are attempting to integrate the housing of a giant space elevator with the central, large, compact living environment of an arcology.

In reference to the space elevator concepts of **Fig.01**, the bottom left design, combined with those on the far right will be used as a primary base for this painting.

Initial Composition & Layout

For our own arcology/space elevator design, I imagined an angular, white, faceted style for all buildings, cities and towers.

In the initial composition, a simple one-point perspective is used, with the focus primarily on the central tower in the middle (**Fig.04**). To showcase a bit more of the overall city, a slight tilt is used in combination with a central composition.

I imagined the foreground to incorporate a large, flattish leisure area/park with verdant hanging gardens replete with fountains and pools.

Building in Some Structure & Design

To bulk out the initial design further, I duplicate the central features and set these on multiply (**Fig.05**). Using the eraser tool, various features and facets can be etched out to create and suggest buildings, roads, towers and parallel lines.

For the foreground elements, the lasso tool is employed to provide clean selection edges, and a sharper, crisper, more defined edge. Normally, when painting a whole composition, brushstrokes can be used to suggest a range of features, and in general it is only the main forms and the contrasts of these forms that the eye is attracted to. However, the foreground elements also need to be considered with extra care within any environmental composition.

Bulking Out

Having laid-out our base, the next steps are to (**Fig.06**):

- Block out simplified angular forms
- Provide contrast and relief of foreground elements
- Maintain clean geometric shapes throughout (keeping in constant with the established design of angular and geometric design)
- Create large parallel structures that lead the eye towards the central tower

These can take up a considerable amount of planning and consideration. However, it is worth sticking to greyscale in order to establish the forms, lighting and composition. It is at this stage that basic values and key design issues can be scribbled in or painted out easily, with less loss in overall time management.

On an alternate layer, I also explore the option of framing the composition further with a large

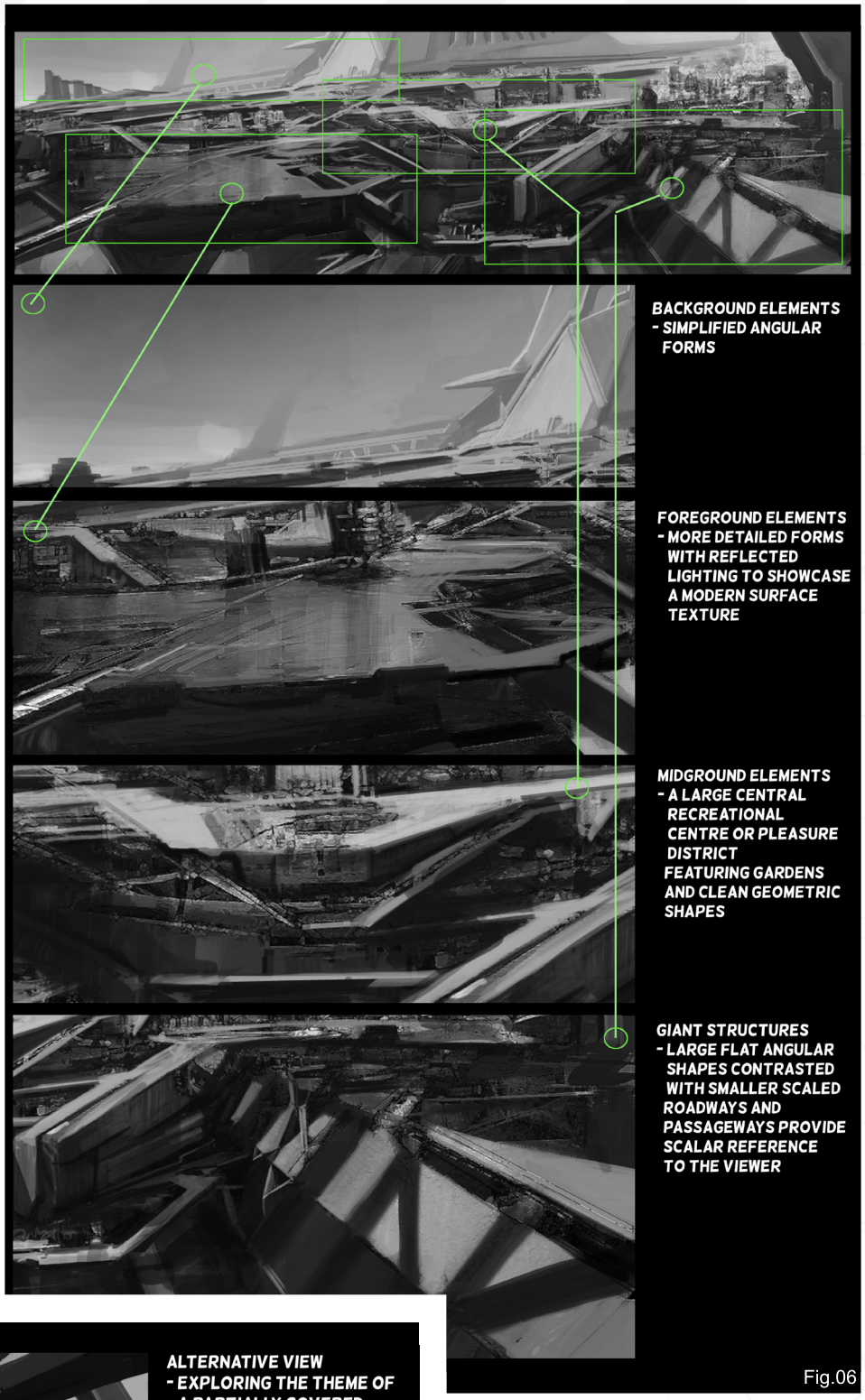


Fig.06

Fig.07

central covering, as if to depict a grand transport hub or station, whilst looking on towards the centre (**Fig.07**). Various other props, such as docked ships and giant, floating ad boards, are rapidly blocked in to add focal detail and scalar suggestion.

The next thing is to add further details to the various foreground elements and forms, such as decals and piping along our large, sewer-like structures (**Fig.08**). At the cross between super motorways and a central canal, I imagine the foreground to be cluttered with various pipes and adornments. Segmented, triangular pipe openings are added to the far right to offer potential refuse and waste into a toxic central canal.

Other issues to consider are the elements of atmospheric perspective. Because of all the grey elements, it can sometimes be easy to just detail both the foreground and background with the same values. By blocking in the background and mid-ground elements with a lighter grey value, we can suggest distance, space and forms.

Fig.08

Elements in the background merely require basic forms blocked out in order to be read well (**Fig.09**). A few new additions to the foreground include a control tower and observation balcony. I imagine the observation balcony to be a giant glass-paned deck, overlooking a curved civilian pathway. On the top right, repeating shapes of diagonally placed tower blocks are added purely as focal interest. Much like the tall Egyptian obelisks, I imagine these could serve a similar function and serve to remind the inhabitants of the grandeur of the central tower/elevator.

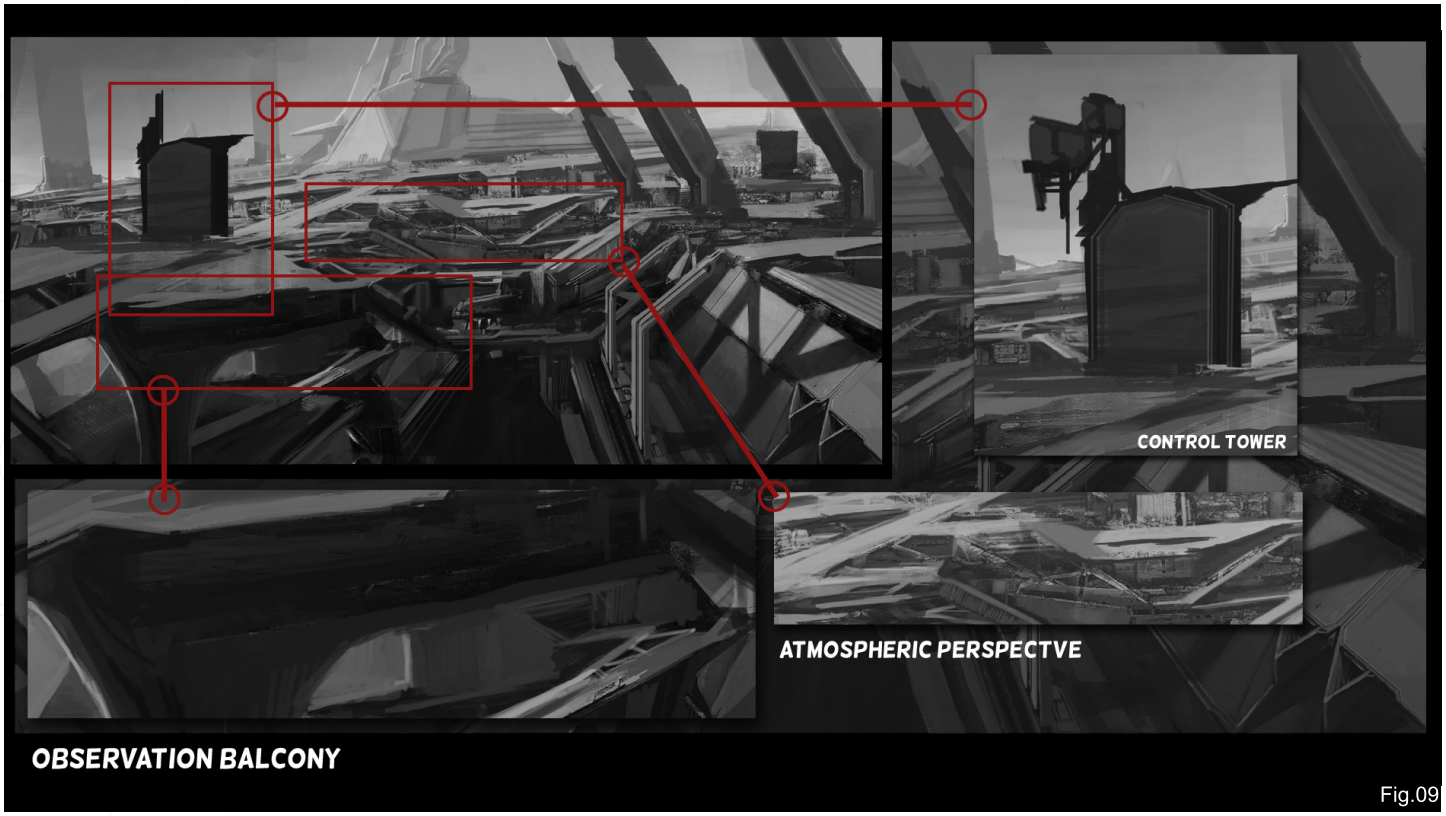


Fig.09

Rapid Vessel Prototyping

For this workshop, I would like to share a rapid way of prototyping transport vessels. The transport depicted in **Fig.10** is designed to be a basic civilian vessel. As such, various elements of underlying skeletal structure and foundations are shown. By initially designing a vessel in the side view, it is possible to generate many designs rapidly and quickly, each iteration producing a more detailed version. Simple top down lighting will help depict the transport's form, and once the general form is determined a small transformational shift (Ctrl + T) will be sufficient to suggest the transport's overall shape in perspective.

In another transport design, the use of the original shape is repeated in different proportions and can be used instantly to bulk out your design rapidly (**Fig.11**). Please note, however, that this is not a suggestion that one should throw away the pencil and design

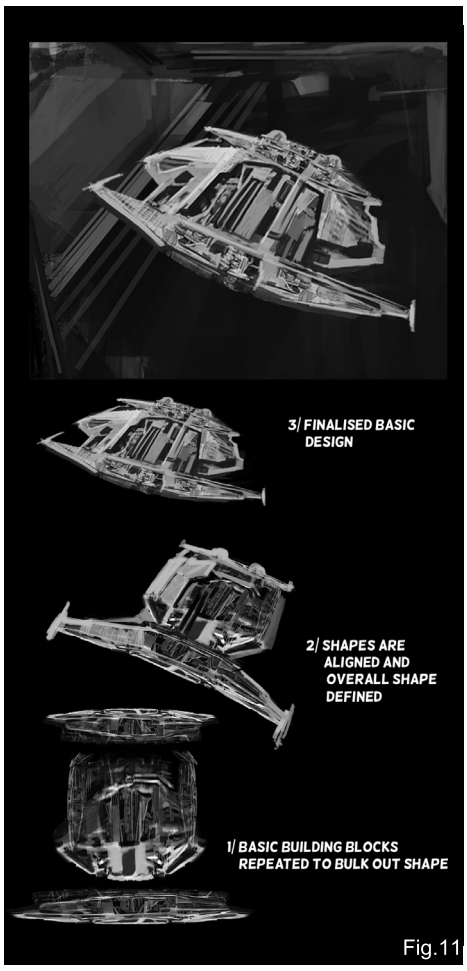


Fig.11

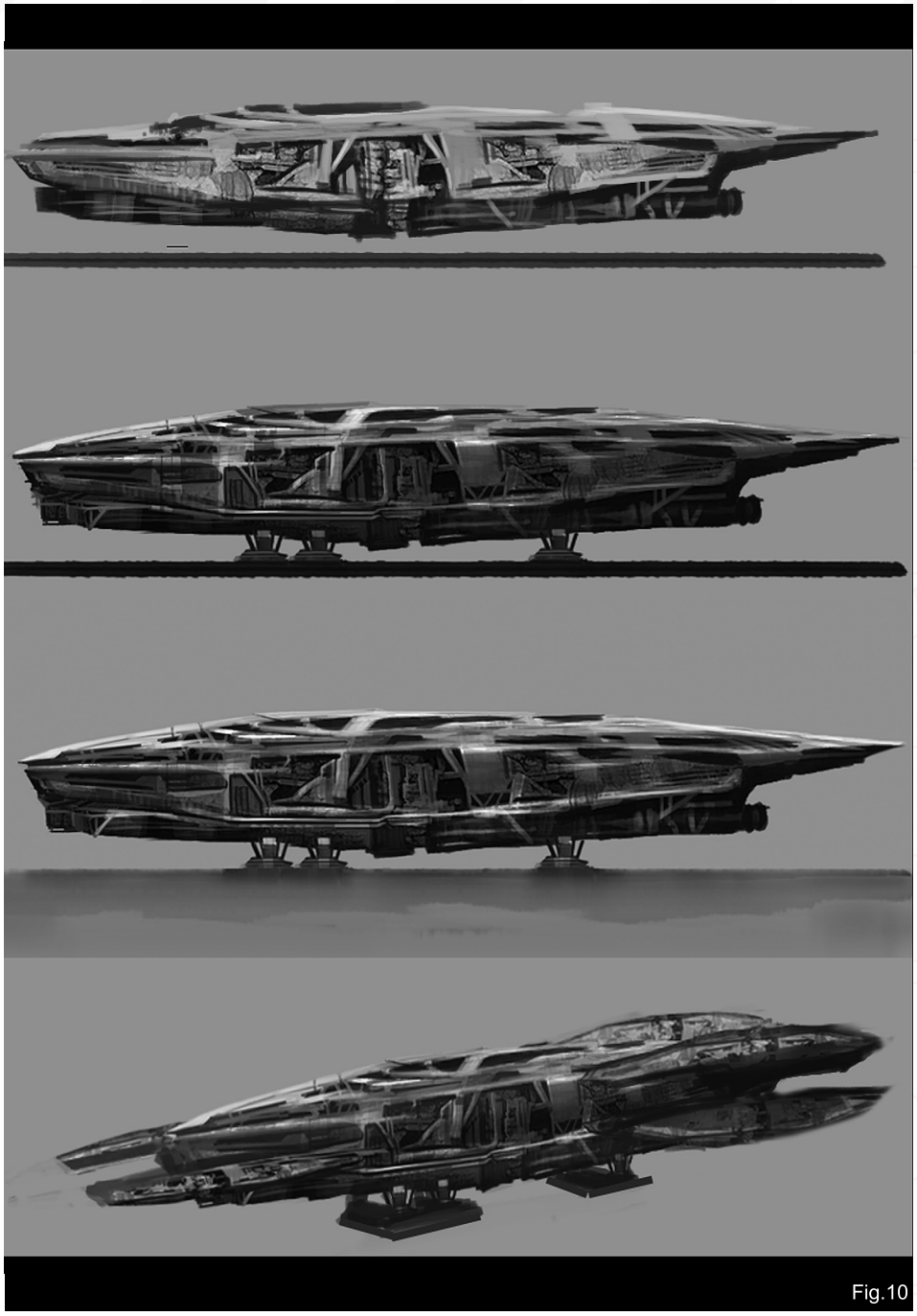


Fig.10

purely on a digital basis. The fact is that this digital prototyping method works once the basic understanding of transport design and form is well honed, which normally comes from hours of drawing transports on good old pencil and paper.

At the end of the day, personally, I still prefer designing with a simple biro and paper; fewer complications and gimmicks – just ideas. That's all it really is at the end of the day. If one can translate these ideas, even with crude sketches, then a well-executed end product, be it a 3D model or a set design, is all that matters.

Part II: Colouring & Rendering

In theory, if the original greyscale composition is well defined, then transferring the imagination into colour should be relatively straightforward – relatively. The fact is, in some cases it works out well, but in others nothing ever seems to be good enough for the image to work out. For example, the image is "broken". Nevertheless,

to add colour there are many options, and sometimes it's more of a mood issue (akin to deciding what to have for breakfast or whether to even have breakfast).

The imagined scene would work for either a thick, atmospheric, red- and yellow-hazed planet, or even a semi-Earth type planet. One consideration is to even paint a night scene, as focal lighting and up-lit reliefs can provide for a very dramatic look and feel. But anyway, let's start with the typical colour and composition of painting a futuristic city.

In **Fig.12**, a basic, monochromic, ochre-yellow colour pass is applied via the Hue/Saturation layer option (set to Colourise). Alternatively, you can use the black/white tool in CS2 and allow for a colour tint. There are two or three other alternate methods as well. All produce the same effect: a strange, blackish, off-coloured feel.

To make the typical blue sky/yellow haze look is a matter of determining the primary colour and the ambient colour. In our case, the primary colour is a yellowish red star with a bluish atmosphere. The trick is to add each colour

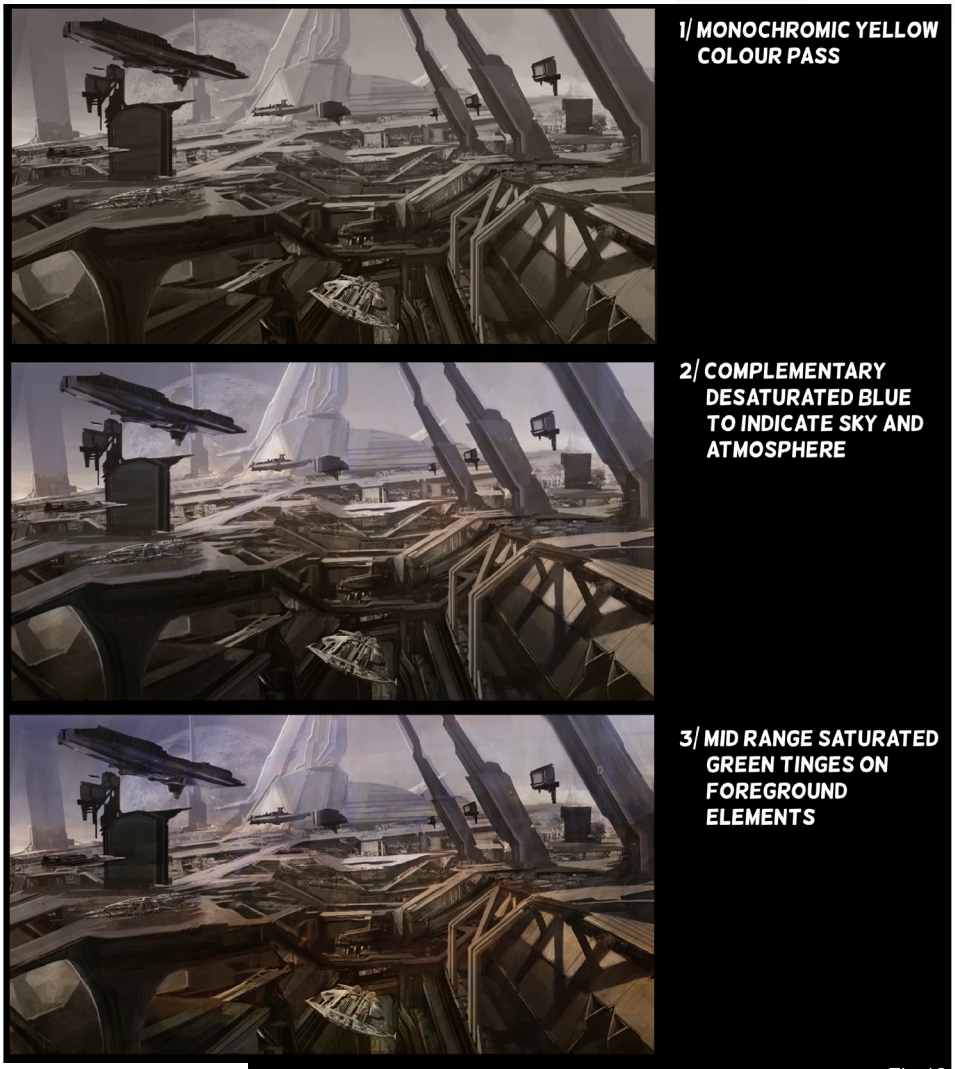


Fig.12

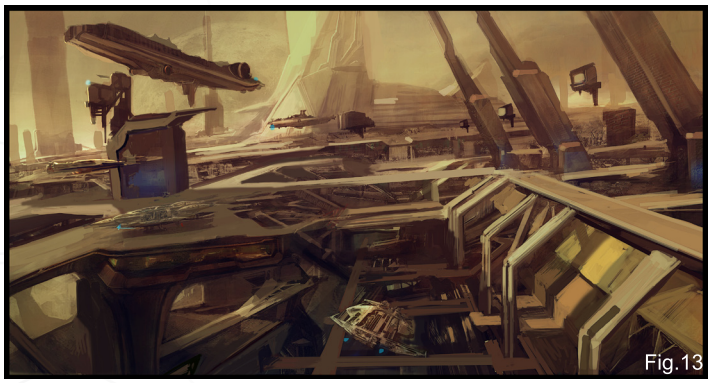


Fig.13

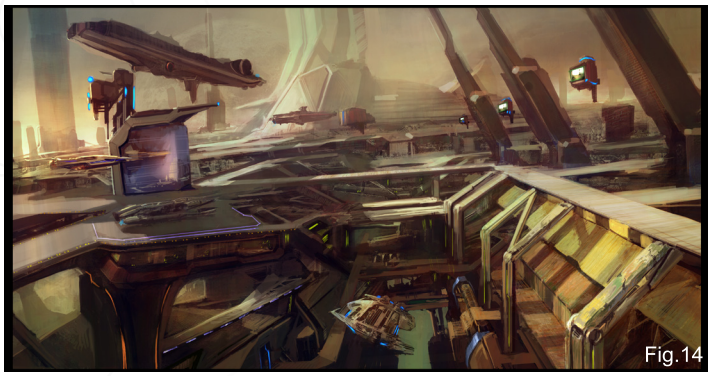


Fig.14

pass layer by layer, to create a homogenised feel (or mess). Ultimately, it is a subtle mixture of colour blends, some elements of repainting, and luck ("luck" because it is at this point that the whole image appears to work out well or look like some left over yoghurt pot exposed to the elements for some weeks).

Colour Choice: Yellow Haze

We will next look at three different times in the planetary cycle: daytime, dusk and twilight. We'll start with the golden haze approach (**Fig.13**). The overall image is warm, inviting and tinged with gold. For this colour choice, bluish complementary colours, such as engine washes or blue tinged lighting, can bring out a good sci-fi feel.

Some degree of repainting is required to paint out the blacker elements and line work from the greyscale painting. Overall, as long as the range is narrow, the image will work monochromatically.

The foreground elements show wear and tear and cast shadows, which helps provide better form and delineation. Vehicles are given a whitish-

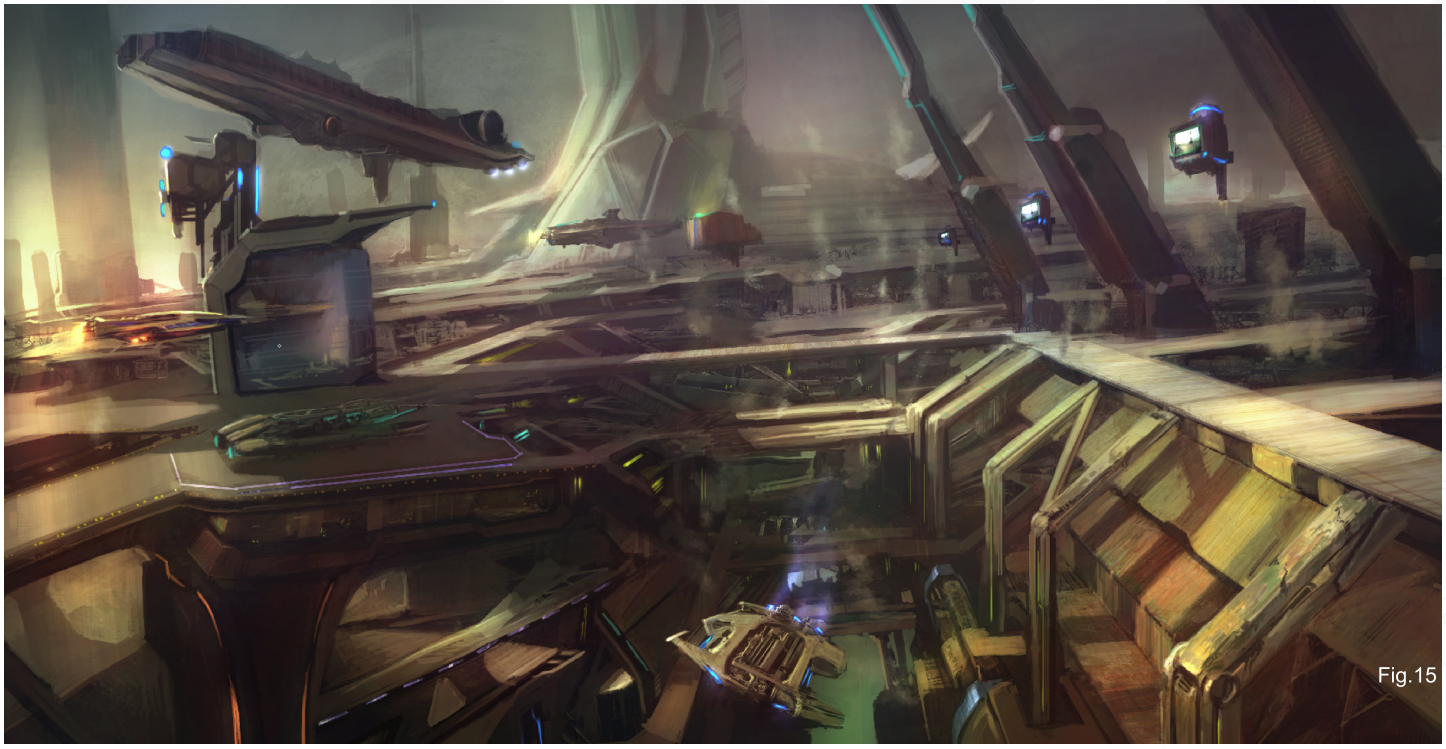


Fig.15

yellow treatment and the focal primary light source is given an overexposed feel (**Fig.14**).

A tinge of blue is added to provide some complementary relief (however, be warned that this breaks the overall monochromic approach). And finally, some neon lights are added to provide more focal detail (although it can be overdone and may ruin the overall feel of a composition – a tricky choice indeed).

For the final image, a bluish/purple engine wash is added towards the central transport, and various elements of steam and smoke help to add to the feeling of an industrial city (**Fig.15**).

Colour Choice: Blue Haze

Next, we try to tackle the same scene with a more daylight-styled colour (**Fig.16**). For a daytime approach, tinges of green and some blue and orange are required, but in more subtle

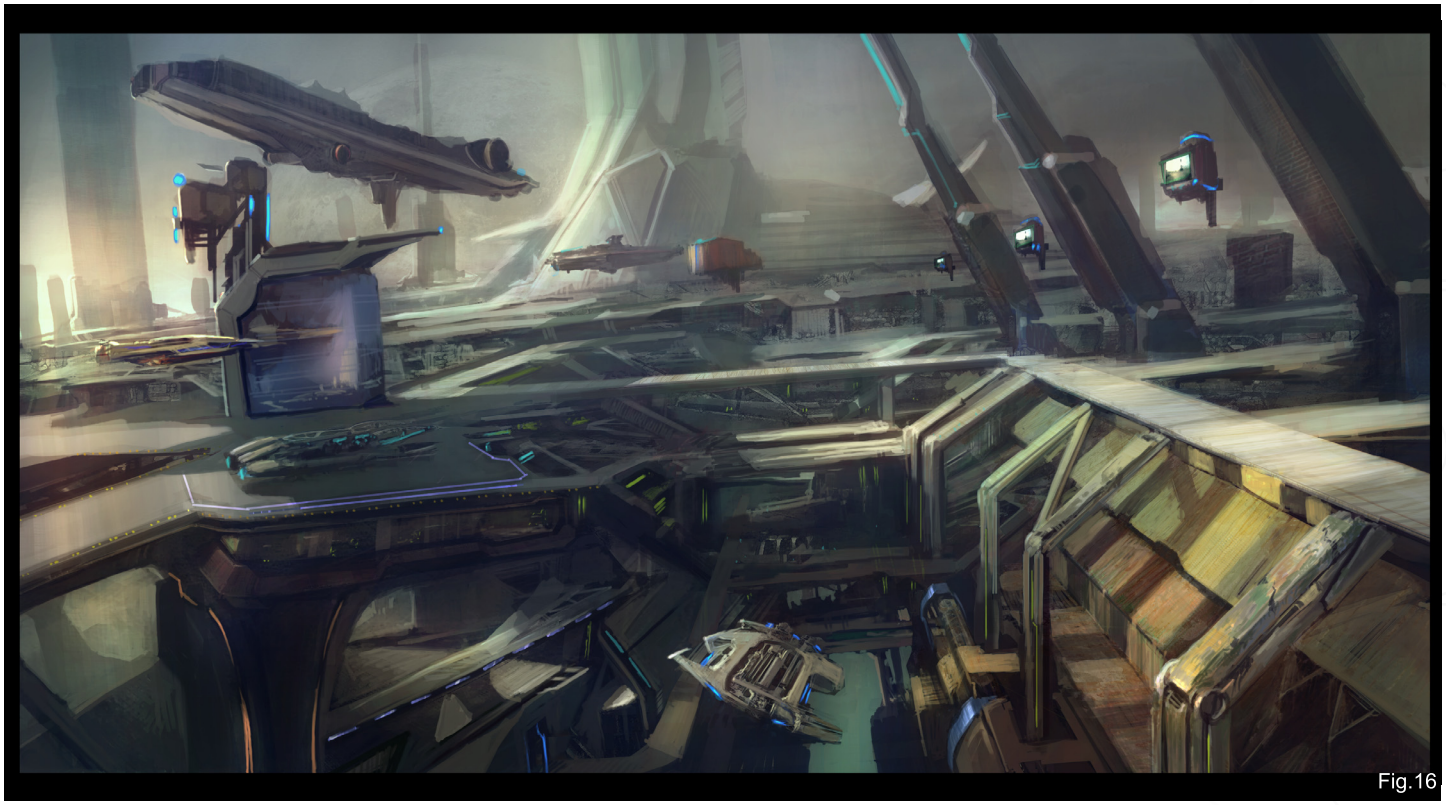
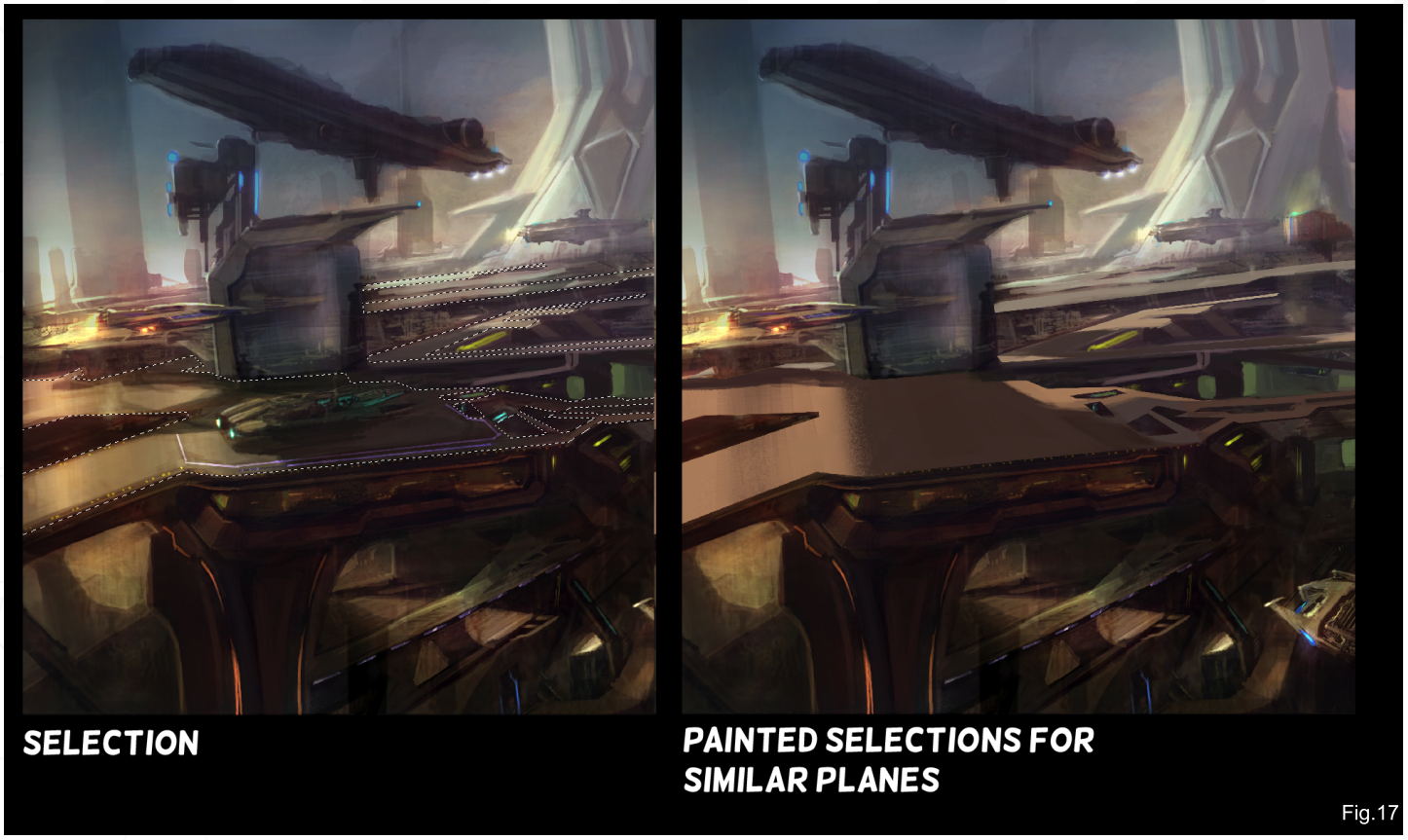


Fig.16



SELECTION

PAINTED SELECTIONS FOR SIMILAR PLANES

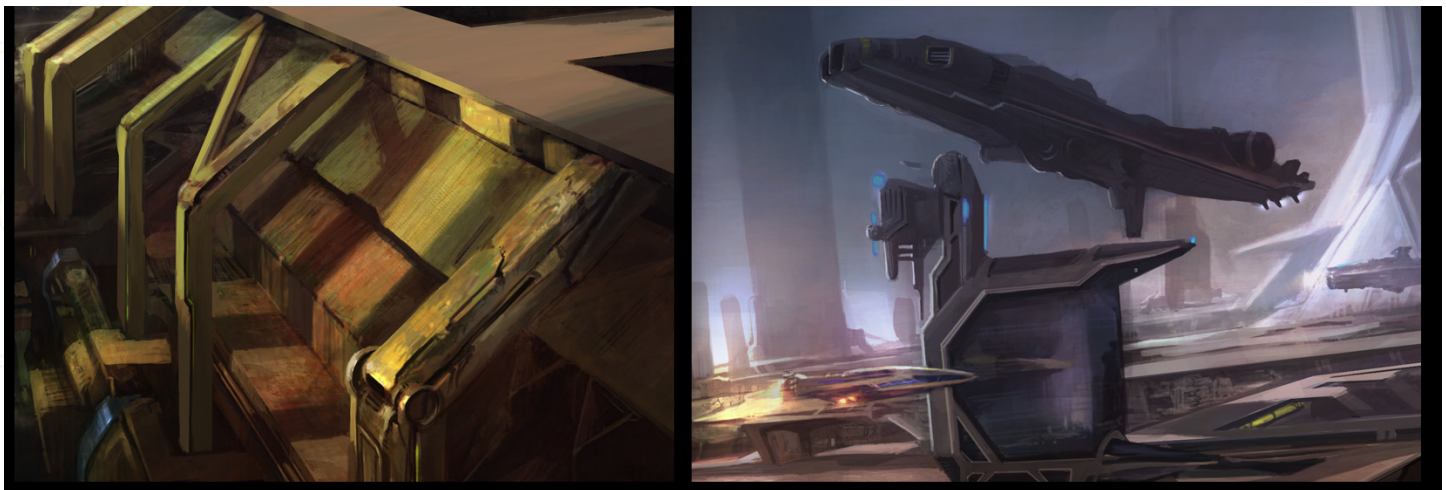
Fig.17

amounts. One thing a daytime approach is good at is suggesting atmospheric perspective.

A few simple washes of the colour balance tool, and the overall image has a daytime feel. But is it working out? Inevitably, if you stare at an image for too long, you come to hate it and find all the obvious flaws. In my case, with the last few colour choices, I noted that the overall feel was becoming muddy and I started to think that the overall composition was too busy. So what to do next?

I either have the option of pressing Delete on the overall image, or I can try to apply a production-styled approach. Time to get back to basics!

The first step is to simplify the whole design – entirely (**Fig.17**). So, let's go back to our first steps employed in greyscale, only this time we'll paint entirely in colour. This means selecting out areas that are in the same plane; using the lasso tool you can pick out the upper walkways and lower areas, one by one. Subsequently, save this selection as an alpha mask in your channels layer, for quick access later. Using a new layer, block in the same colour and value for any surface sharing the same plane/angle. Since there is a focal light source, these should



ADDING FINER DETAILS

Fig.18

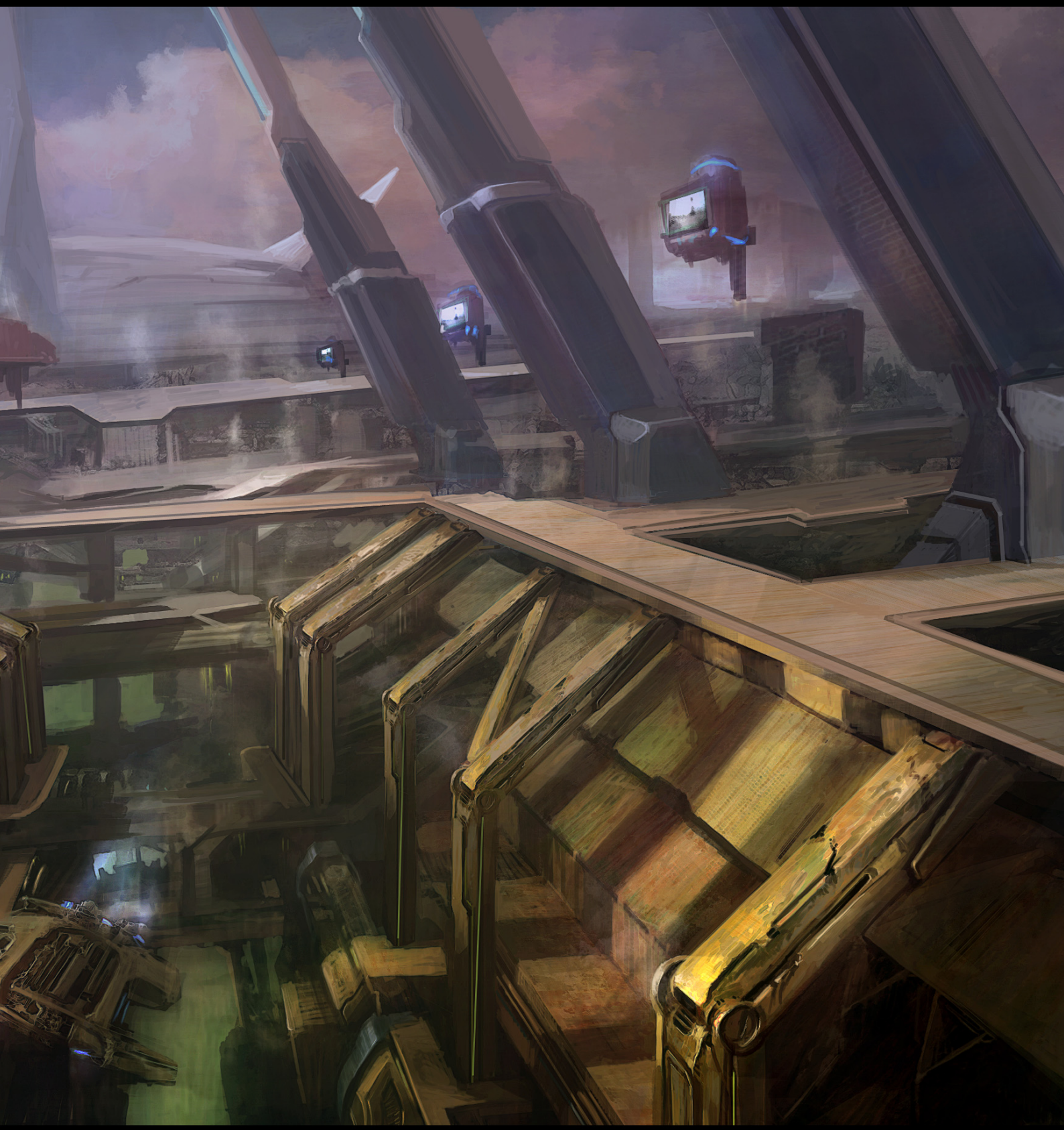


Fig.19

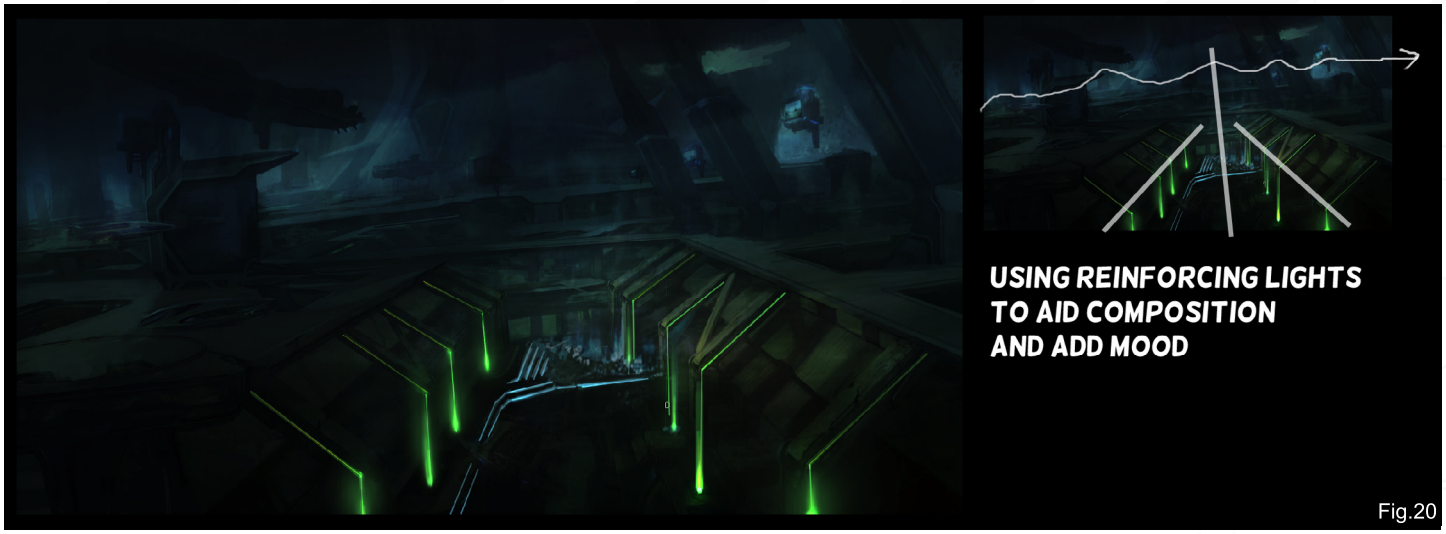


Fig.20

all share the same directional light and ambient light source. Then block out the corresponding shadows.

Coloured Details

Using the same process, we can now add further detail, and wear and tear, to various objects (**Fig.18**); texture overlays can help provide this feel. I have chosen to simply paint in various colours, based on flaking rust and worn paint, onto these large arches (bottom right).

The large industrial spaceship is now spruced up and elements of the sky colour incorporated directly to provide the right exposure and detail. The smaller civilian craft in front is painted within the reflected glass control tower and subtle reddish engine washes applied.
And here is the final daylight image, with the restructured elements (**Fig.19**). Gone is the asymmetrical design in favour of a more parallel and central feeling. Care was taken to ensure that the opposing arches were in shadow and the landing pad area has been restructured to look logical and functional.

Colour Final: Twilight

For the final alternative we will repaint the scene within a night/twilight mood (**Fig.20**).
For this scene, I apply a saturated blue/green feel. Many details from the original painting have to be culled, however, as they detracted from the overall composition. The main premise now is to use the arches as glow-lit supports heading into the centre. The horizon is painted as a thin wedge of bluish twilight, as if there is an overall cloud layer that is set quite low.
The next few stages detail further how the horizon is lit up with various clouds (**Fig.21**).

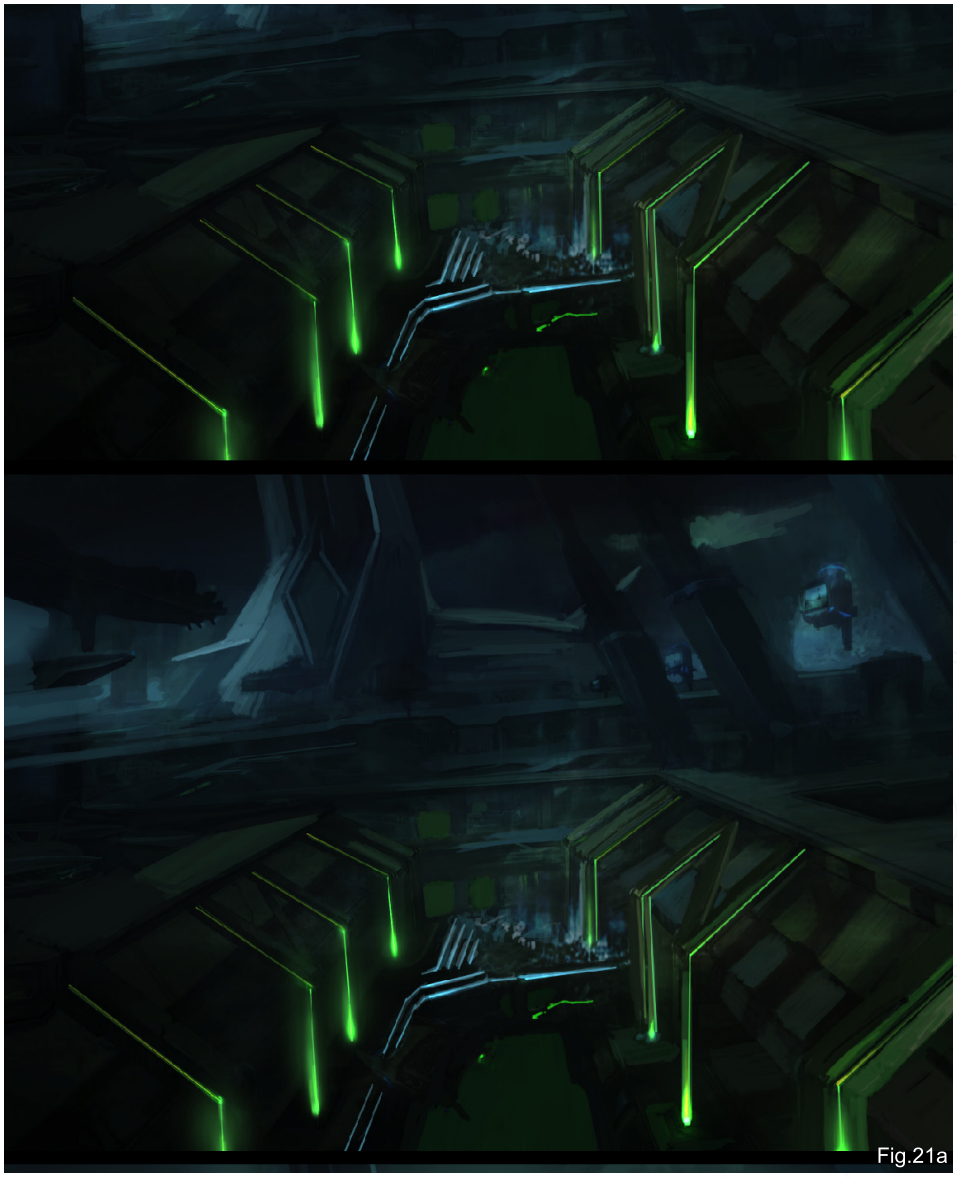


Fig.21a

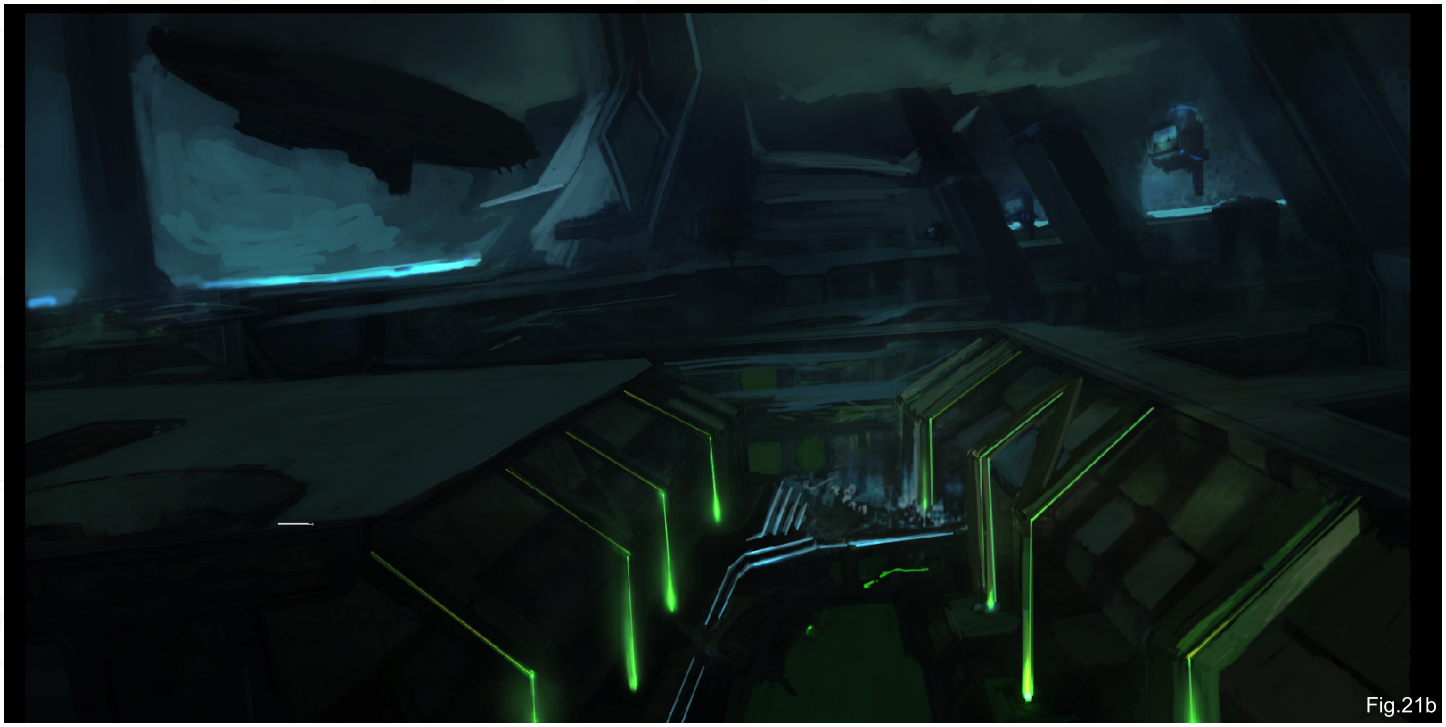


Fig.21b

Further culls involve removing elements such as the control tower and the giant, diagonal plinths (far right). The landing area (far left) is now restructured into a flattish landing pad, whilst the large spaceship is a dirigible-like warship.

For the final touches, elements of the central tower are restructured and lit with beams of searchlights and bands of horizontal lights to suggest scale and focal interest (**Fig.22**). The massive tower to the far left now serves as a secondary space elevator with a simplified form. And the civilian spacecraft is under-lit with local lighting to suggest its overall shape.

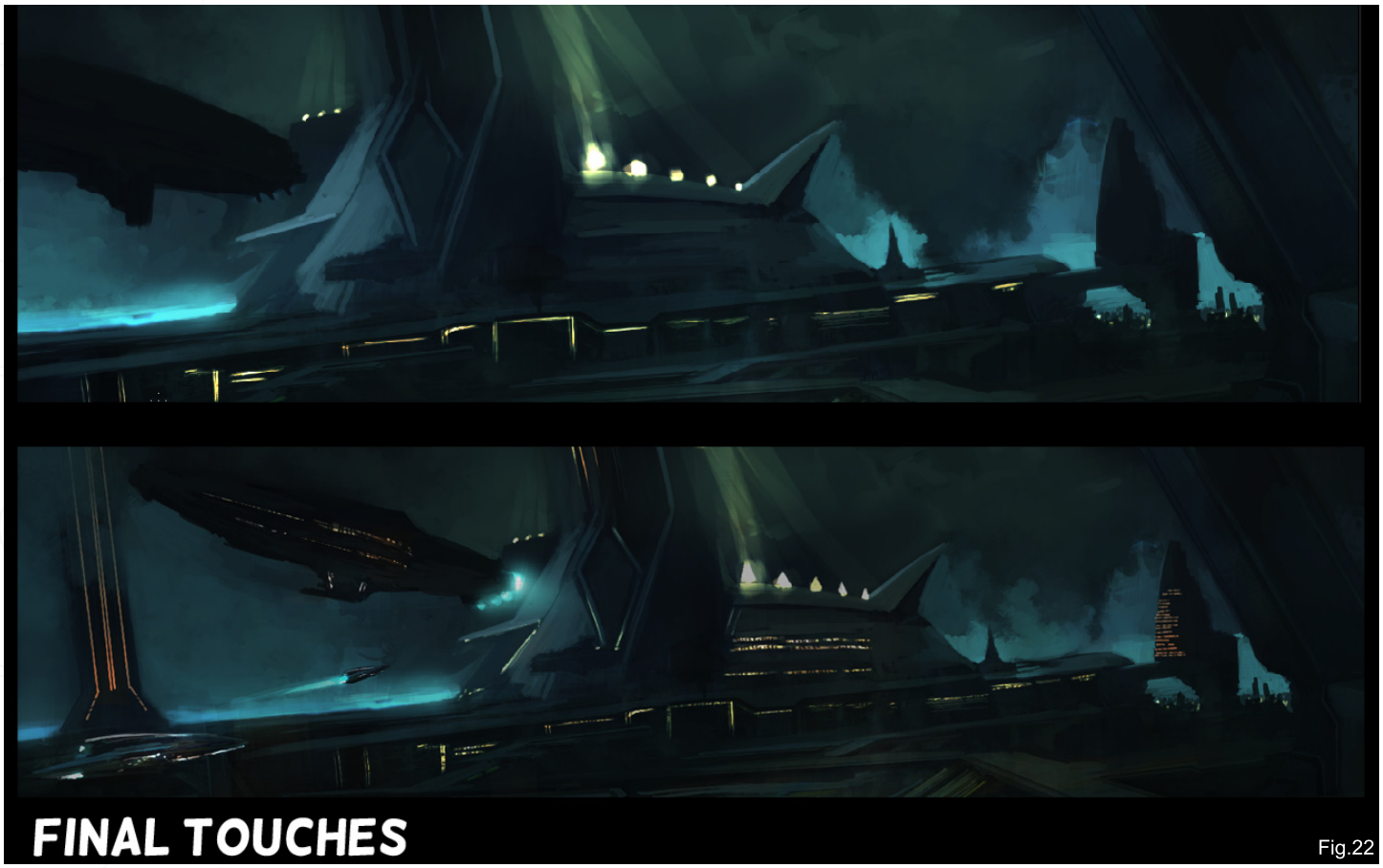


Fig.22

Summary

Overall, we have looked at various ways to work a production painting from various angles and troubleshoot various design elements in both greyscale and colour. I hope this has been an informative insight into tracking a sci-fi theme that invariably crops up in one's line of freelance or professional work, or even in one's own leisurely paintings.

Dr Chee Ming Wong

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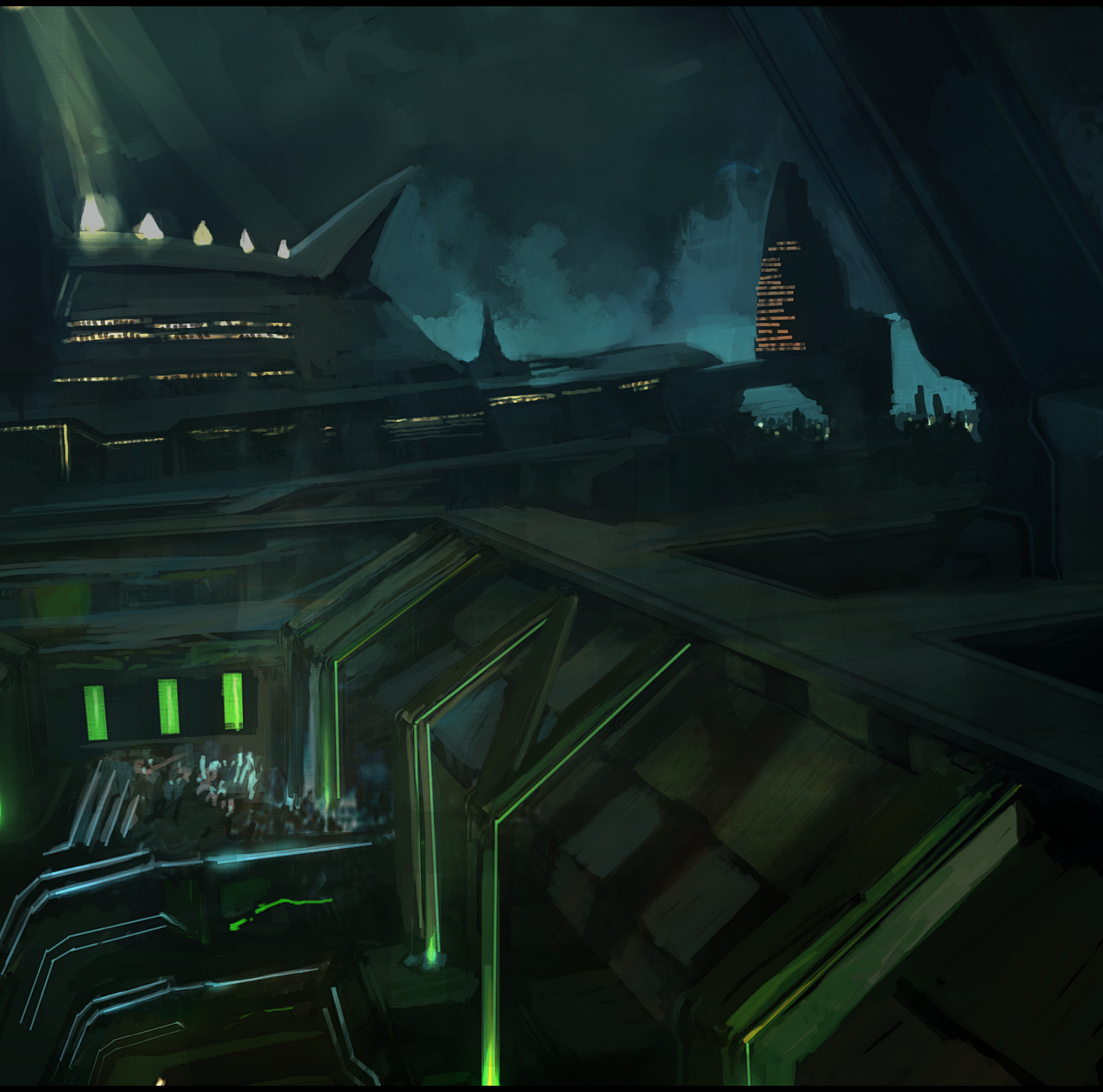

Chapter 06

SPACESHIPS

SPACE PAINTING

CHAPTER 06: SPACESHIPS

Created In:

Photoshop

Introduction

Welcome to part six of our space and sci-fi digital painting series, with particular focus on space transport. This will span over the next three workshops categorised from small spaceships, to middle, to large-sized transport (capital ships), and culminating in design for space stations. In each tutorial segment, we will consider simple traditional techniques and discuss design and function first and foremost. Effective design is being able to fully translate your ideas across in an accurate and inspiring manner towards the recipient, be it a 3D modeller, game designer, art director or a member of the public **(Fig.01)**.

Form & Function

Space transport comes in all forms and can generally be split into the following:

- Geometric
- Industrial and angular (functional)
- Organic and xenomorphic

The other aspect to consider is whether the overall shape is symmetrical or asymmetrical. Whilst it may seem an obvious choice to produce symmetrically aligned transport, with the advent of space travel which can hypothetically surmount gravitic issues, it stands to reason that symmetry and conventional existing design issue may not necessarily be adhered to. Therein lays the challenge: to produce a convincing design in whatever shape, form or symmetry.

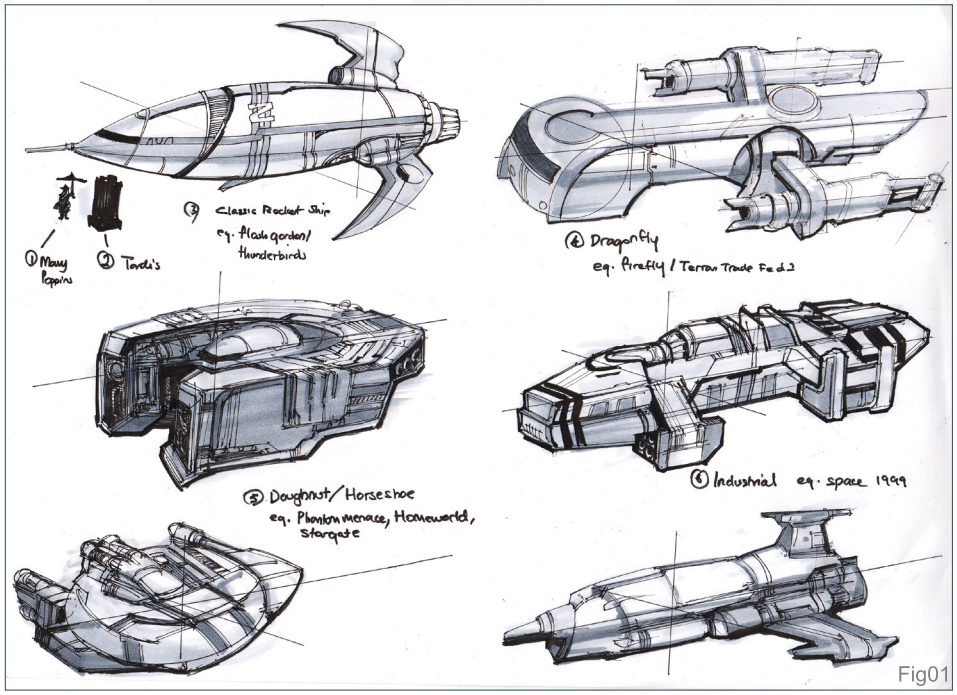

Fig01

For the purposes of this tutorial, let's consider a functional and partially geometric function (we'll cover the more exotic shapes in the 'capital ships' section of the subsequent tutorial).

Fig.01 illustrates various classical and retro spaceship designs currently known in popular culture, as follows:

1. Marry Poppins – Yes, I consider her to be but an android in disguise as a super nanny (how else can one explain her anti gravitic vertical takeoff and landing capabilities, via an umbrella?)
2. Tardis – An unconventionally shaped spaceship of the time lords (where the insides are larger than the exterior due to non Newtonian 4-dimensional capabilities)
3. Classical Space Rocket Ship – e.g. Flash Gordon
4. Dragonfly/Animal shape – e.g. Firefly/Terran Trade Federation
5. Doughnut/Horseshoe – e.g. Phantom Menace/Homeworld/Stargate
6. Industrial – e.g. Space: 1999/Aliens/Pitch Black
7. UFO/Saucer – e.g. Independence Day
8. Cigar-shaped/Jet fighter-shaped – e.g. Buck Rogers/Battlestar Galactica/Star Wars/ Thunderbirds

Let's next consider a fictional spaceship manufacturer, Azora Dynamics, who will be designing and producing a multipurpose and modular space transport. This can be used for civilian purposes, law enforcement or even deep space racing (fictitiously named Formula Double Zero based on the current Earth's Formula One). It has been tasked with producing a new prototype for mass market use, and to be kept in consideration is that this transport must carry one to two passengers, and can be used for atmospheric re-entry. In terms of technology, gravity has a minimal effect of this space

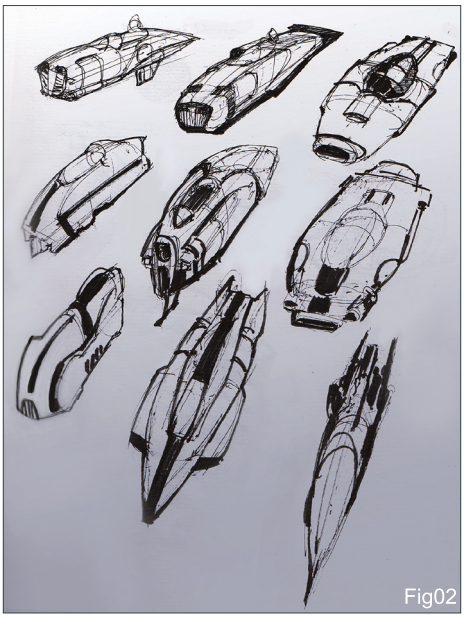
Fig02

transport, but during atmospheric flight, tiny aerodynamic adjustments may provide small advantages, crucial for Formula 00 racing.

Prototyping

Traditional Tools Required: Biro/pencil/ink gel pen, paper (any kind) and imagination (as standard)

First of all, let's consider various forms for our single/twin seater transport **(Fig.02)**. You can explore these designs in a side view or as show in 3/4th perspective view. Personally, it appears to be easier to explore forms in the latter view, but many folk find it easier with the side orthographic view. It doesn't really matter, as long as the overall shape and form is explored.

These images were rendered with a mixture of a cheap 37p biro and thick 0.7 gel ink pens. I find it particularly effective to use stripes and marks across a vehicle, or along its frontal/posterior axis, to suggest form **(Fig.03)**.

So, using the example of a sphere, let's consider designing a dumbbell-shaped vehicle. In the designs shown in **Fig.03**, various cockpit configurations and some degree of asymmetry are included within the designs. Spherical designs look good with a low slung turret/canon. Alternatively, a twin barrelled cannon can be mounted above each sphere, or on the far sides.

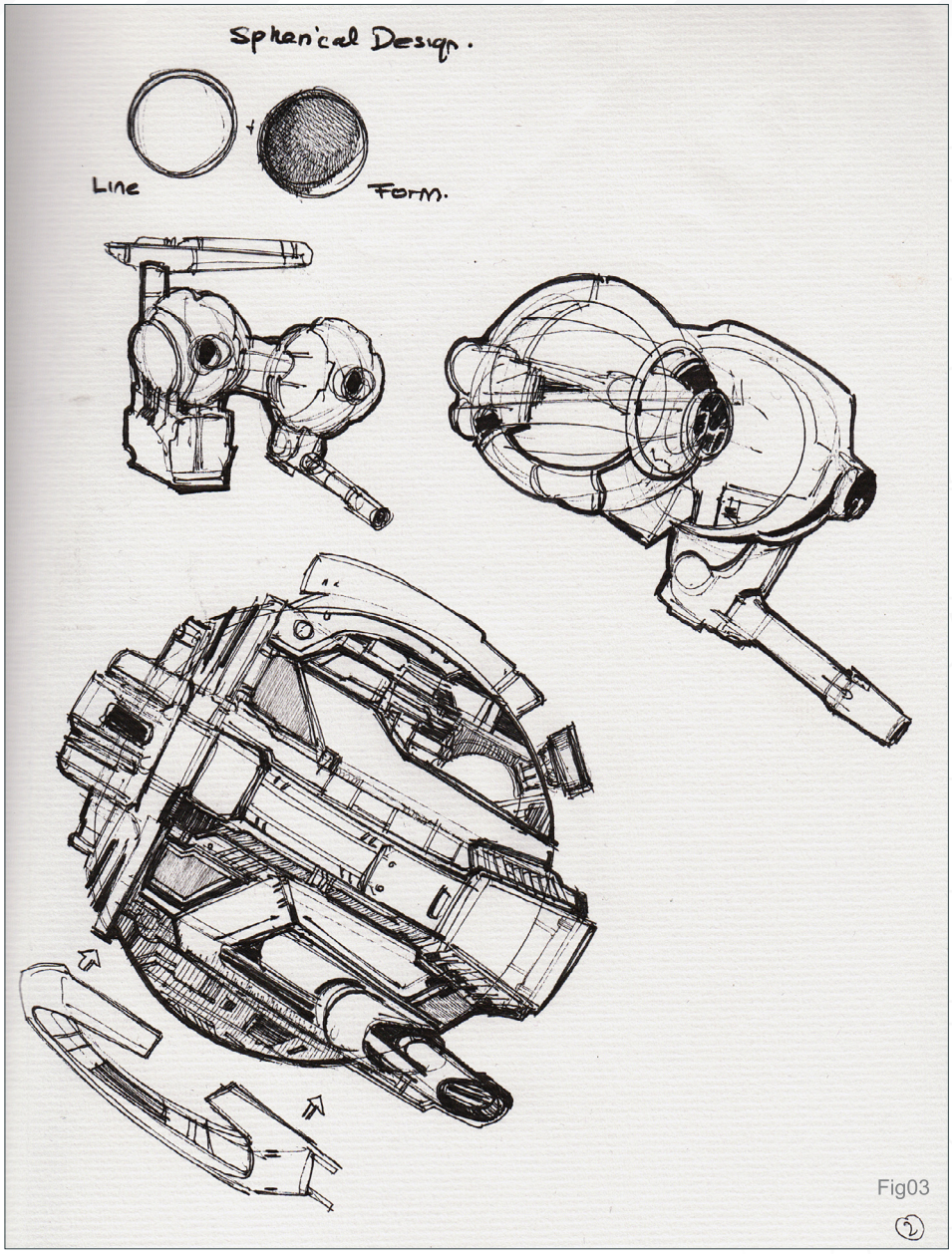

Fig03

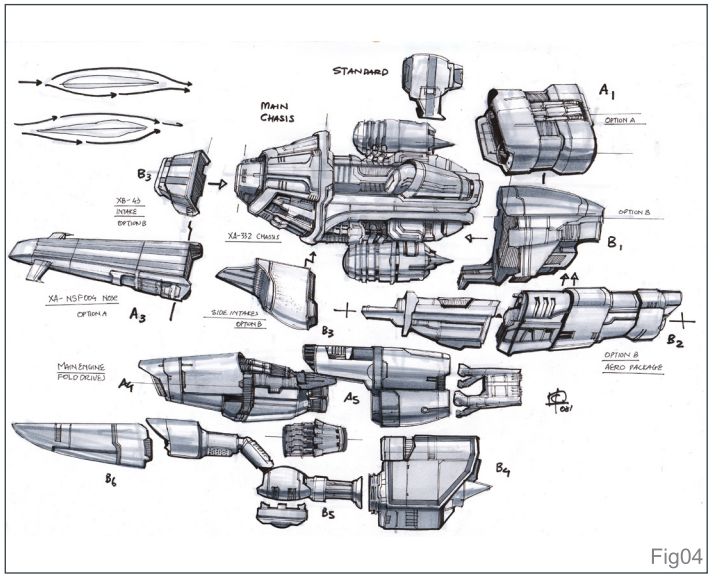

Fig04

Once the initial form is considered, it's sometimes useful to consider the internal mechanics underneath the external cowling armour plating (as shown in the singular sphere design in **Fig.03**).

Designing the prototype XA-332

Having decided upon the overall form to be a cigar-shaped shell, reminiscent of the historic 1950 Grand Prix Formula One front engine racing cars, let's attempt to spruce it up towards a probable function and purpose for space based racing.

In the exploded schematic **(Fig.04)**, a finalised view of the fictitious XA-332 is rendered using digital markers and marker paper (after years of resisting the use of marker paper, I finally succumbed when having to produce proper production art marker renderings, which the thin marker paper allows to good effect).

Working with Markers: a simplified Industrial Design Approach

Traditional Tools Required: Cool grey markers 20%, 30% and 50%, Pilot G-Tec-C4 0.25 and 0.4, Pilot G-2 0.7

Recommended Paper: Any high quality bleed proof marker pad, e.g. Letraset

The trick here is in the wetness of the mark! Working with markers, one has to work quickly and rapidly, whilst the mark is still wet. This allows you to graduate your various tones (normally I use a grey tone of 20%, 30% and 50%, primarily) repeatedly over one to two passes, and then lock the design down in ink (I prefer using Pilot 0.4 Hi-Tec-C/G-Tec-C4 pens). Shadows and stripes on the other hand are best done with grey 70%, produced in one single pass.

It's really all down to repeated practise; it's normal to destroy 2-4 sheets of paper before finding a good balance between marker renders and inks. For inspiration and reference, one can refer to the great concept art markers rendered by Doug Chiang and Feng Zhu (my personal heroes) – their treatment of value appears simple and yet communicates across so effectively.

From various experiments, I find it easiest to do as follows:

1. Basic form and perspective – Loosely mark down the overall form using a 10-20% cool grey marker. Take note to plan your vertical and main axis (the line stretching from the front to the rear of your transport design). Don't worry about leaving residual marks or unsightly construction lines; the whole idea is to communicate your overall form using the values established by your marker pens.

2. Tonal values – Next, whilst the markers are still moist, proceed to lay down your tones using 30% and 50% cool grey markers. You need to ensure you have a relatively good idea of your light source to enable you to show reflectivity. Some simple observation of how light forms bands on a cylinder or a shiny parked car can provide immediate and simple reference.

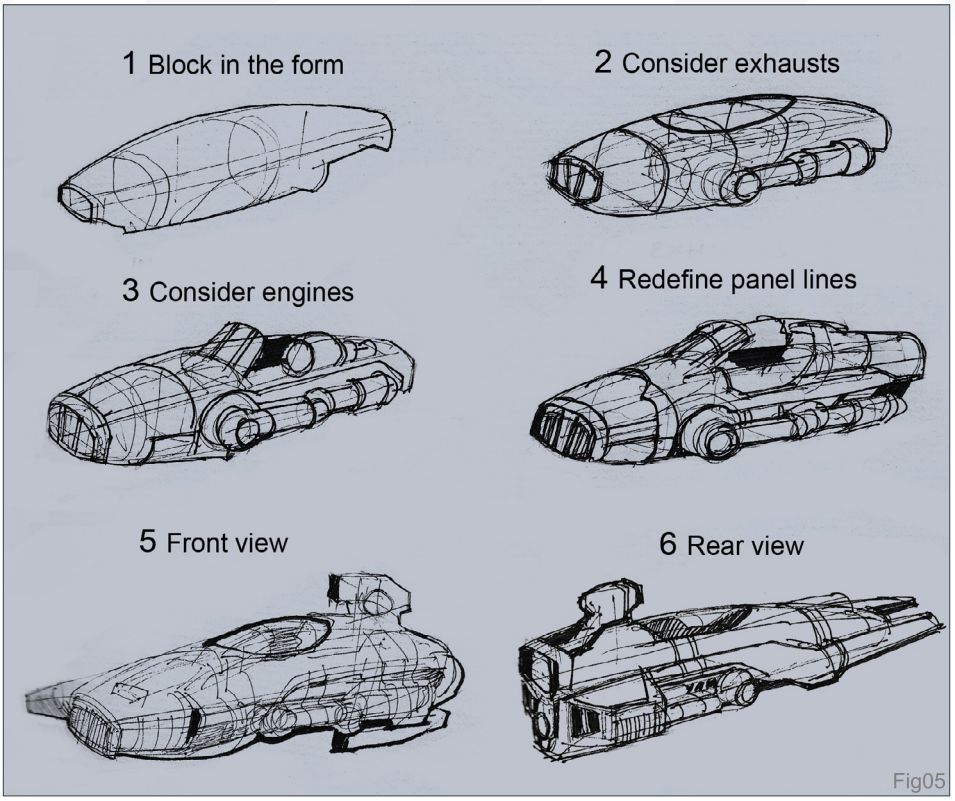

Fig05

3. Overall form – You want to outline your design now with your smallest ink pen available. If available, use a fine tip 0.25 pen to ghost the various outlines.

4. Accentuate your lines – You can further accentuate this with a 0.4 diameter pen, ensuring that you start blocking in further details, panel lines and considering how various parts may interlink to form logical but functional shapes.

5. Research and Knowledge – These designs do not require a Master's degree in engineering, but some rudimentary knowledge of how transport is put together, and can be front, rear or mid-engined, will be helpful. Some basic reference/research will also stand you in good stead – in the UK, this is available via the free Imperial War museum exhibits or various historic aircraft and motorsport parks/facilities, e.g. in Duxford (Cambridgeshire), Donnington Park (Derby), or the Brooklands Museum (Surrey) to name just a few.

I've taken the opportunity to collect and provide some reference images first hand from the following locations:

- Imperial War Museum: Engines, Planes and Decals
- Duxford: Engines and Planes

Basic Design

Traditional Tools Required: Biro, pen or pencil

Let's now look at how we can approach the design of a semi elliptical and cylindrical object **(Fig.05)**. How to draw a cigar, with reference to **Fig.05**, the approach (3/4th perspective view) is broken down into four simple steps, as follows:

1. Blocking in the Form – Ensure the main axes are drawn first, to suggest a horizontal and vertical axis relative to the perspective plane you intend to use. Then roughly outline how you would like the overall form to appearEnsure the construction lines start from one side

and continue on the other. This ensures that a modeller can understand how the form is lathed on both sides, and whether the form is symmetrical or asymmetrical.

2. Consider Exhausts – Next, try to consider if there are any external ports, engine exhausts or thrusters. These will suggest how the transport will be propelled.

3. Consider Engines – Most of the time the engines will not be obviously shown externally, and it may seem strange to consider it at this point. However, if you consider very simply that if it will be located in the front, mid or back, then this allows you to determine where aspects such as seating, cockpits and avionics, electronic equipment and countermeasures can be located. In this instance, the design suggests a central engine starting with intakes from the nose and travelling through the underbelly towards multiple rear housed engines.

4. Redefine Parallel Lines – This last step means to add panel lines in parallel to the main axis, and also to add smaller details such as access hatches, further panelling and plated areas.

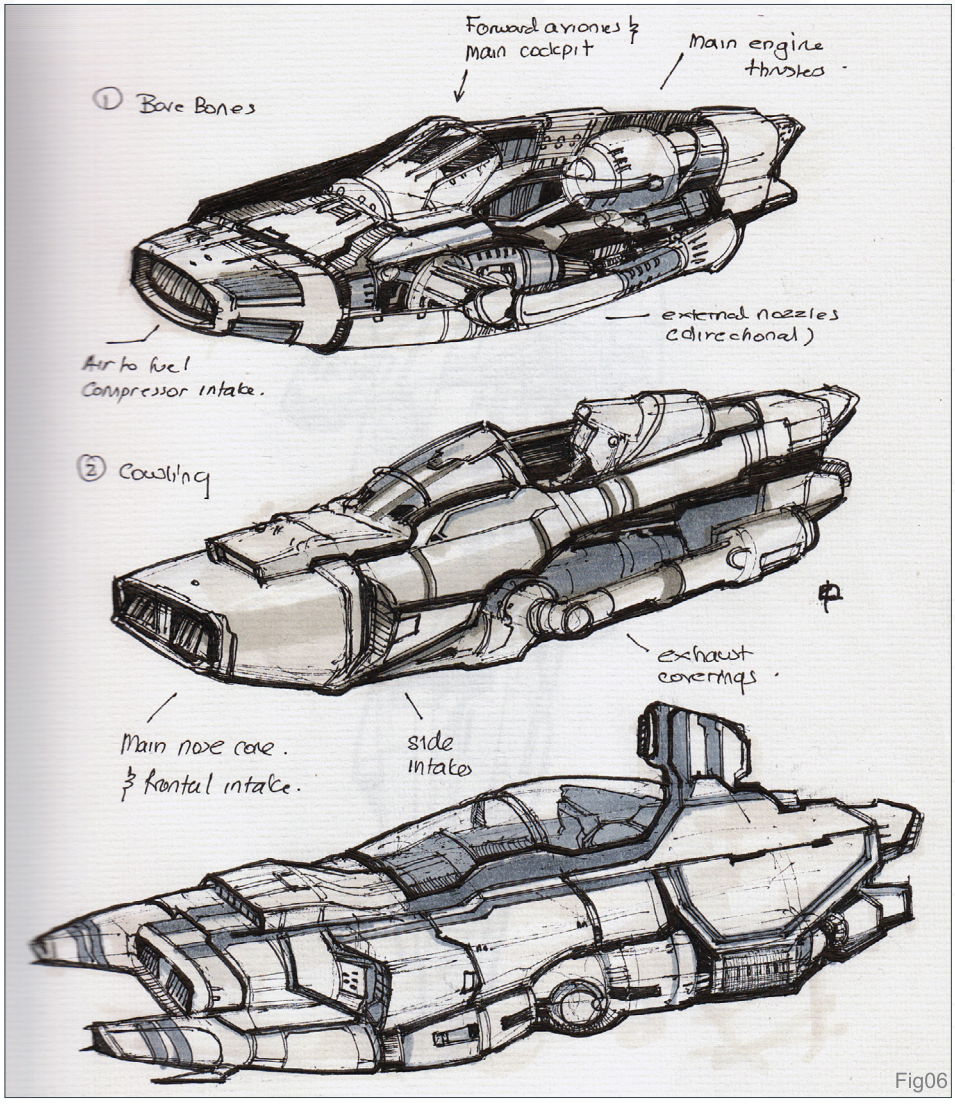

Fig06

Engines

Engines form a distinctive character towards any form of transport, in particular aerospace related vehicles. There are a whole host of engine types that can be categorised into two types: funnel-shaped and needle-shaped. Both may incorporate small adjustable fins to better control and direct thrust. In addition, engines tend to feature smaller sets of piping and tubes that regulate fuel, an oxygen/fuel mixture and combustion, and multiple pressure valve controlled feedback loops.

Within our designs, we'll stick primarily to circular exhausts, although they may be housed in different shaped external housing – as both an aesthetic/aerodynamic consideration.

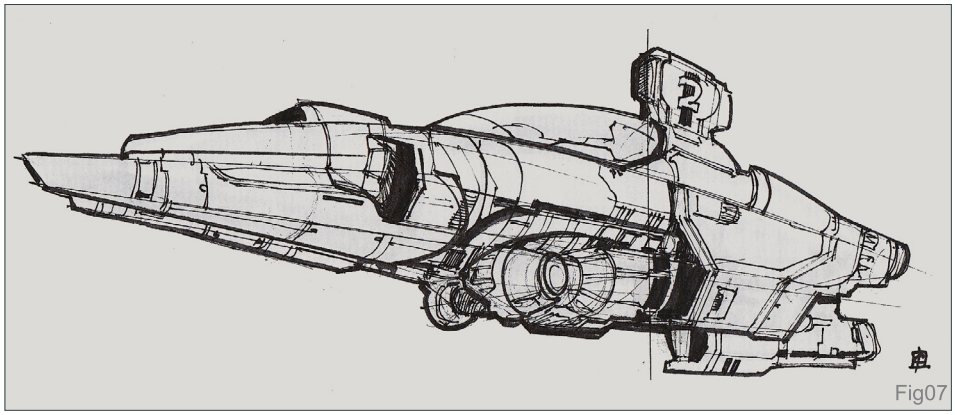
Fig07

XA-332 Sunred Prototype

Let's take a look at some shapes and designs for the XA-332 **(Fig.06 – 08)**.

Fig.06 – Three part process illustration the working mechanics of the XA-332 from inwards to out

Fig.07 – Shows the low shot view of the XA-332 side

Fig.08 – Illustrates the underbelly of the XA-332 Sunred

We're going to settle on a rudimentary design which we now need to consider in different angles, views and perspectives. Sometimes,

if your design is going to be considered for production or initial 3D prototyping, then it's useful to consider breaking the design up into three parts **(Fig.06)**, as follows:

1. Internal engine and mechanics
2. External frame/exoskeleton
3. Full armour plating and final external form

Much like dissecting being required to understand the anatomy of a species, of bone, muscle, organs and flesh, we can use a similar analogy to understand transport design, such as:

- Organs – Are analogous to the combustion engine that receives fuel from its storage parts.
- Fuel – Is analogous to the blood that carries vital nutrients to supply the organs and ensure the body/machine has power for locomotion, sensors, weapons, defence and life support.
- Bones – The underlying main skeleton that holds the frame of the machine together; it tends to be a rigid structure that can be split into an internal basic frame and a external exoskeleton frame.
- Flesh – Analogous to the overall rigid skin of a machine, which can additionally be toughened with conventional armour plating, energy fields e.g. force fields, kinetic and chemical armour.

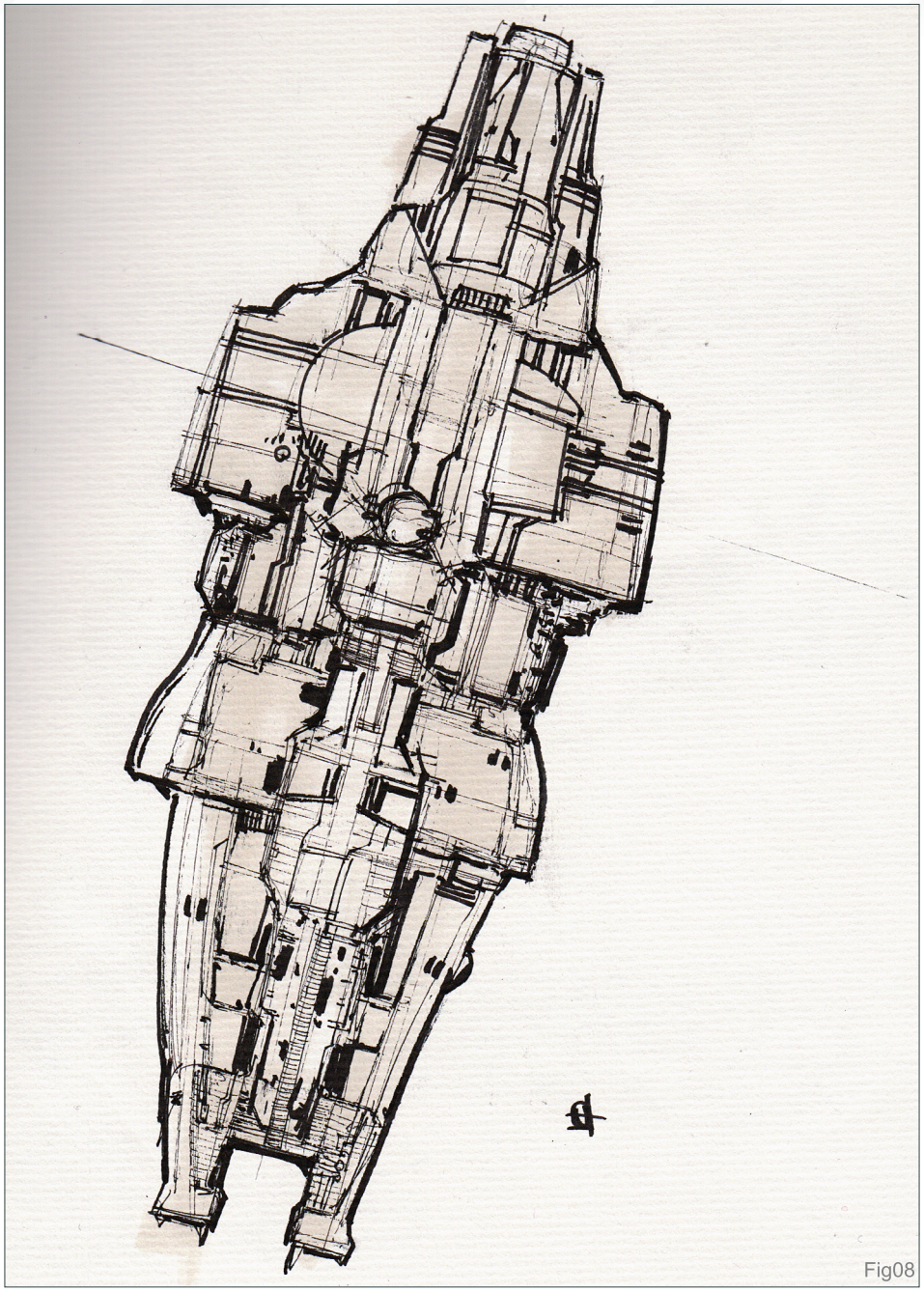

Fig08

For the XA-332 Sunred, we have determined that this will be a multipurpose fighter/civilian craft that has a central cigar-shaped shell, ideally built for a single seated pilot **(Fig.06)**. From the inside working our way out we have as follows:

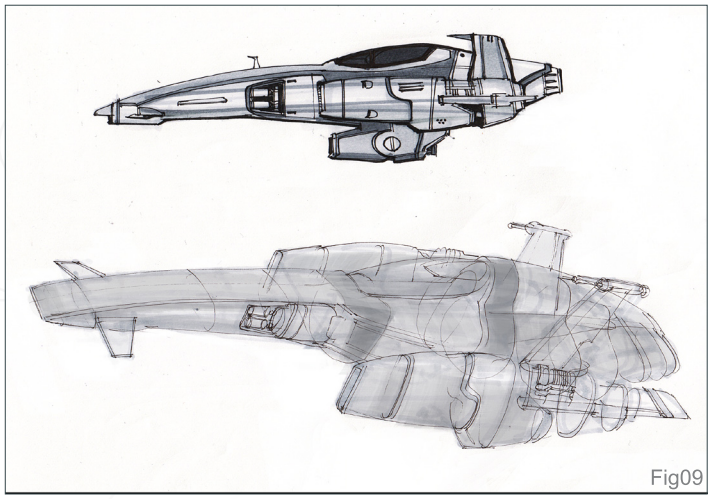

Fig09

1. Bare bones – Depicts the internal working mechanics, engine and basic cockpit.
2. Cowling – Depicts the internal frame that shelters the mechanics above and provides basic protection.
3. Full frame – Shows the full external view that is hardened and built to withstand the various extremities of the environment.

Having determined the basic working mechanics of your new prototype, it is now important to consider the main views of your overall structure **(Fig.07 – 08)**. Take the opportunity to finalise any major design changes

and explore the underside of the vehicle (as these are often poorly designed and prone to attack/prove vulnerable).

Advancing the Design

Having established the primary design of your prototype, known as the first and second pass, you have the opportunity to explore different iterations/variants and finalise your design for production culminating in a full illustrated production design **(Fig.09 – 11)**.

Fig.09 – Starting with markers (side view)
Fig.10 – Finalised marker design

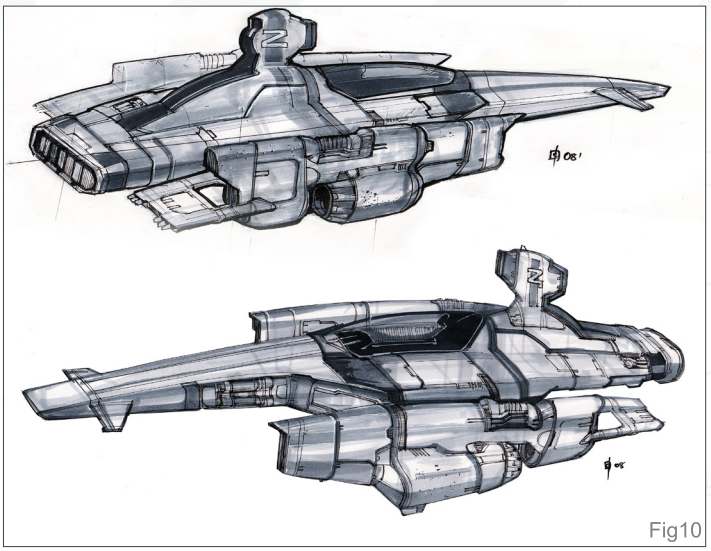
Fig10

To consider an alternative design but still enable the XA-332 to function, let's take a look at old F1 racing cars. Then let's look at modern F1 cars which feature strange 2008 winglets in the front, and giant front loaded wings as large as the rear for the 2009 F1 event. F1 requires tremendous amounts of downward thrust to keep the cars hugging the road as closely as possible, whilst hurtling forward at tremendous speeds. With spacecrafts, the need for aerodynamics can be arguably minimised. However, the way to translate a speedy vehicle is to design a relatively streamlined design.

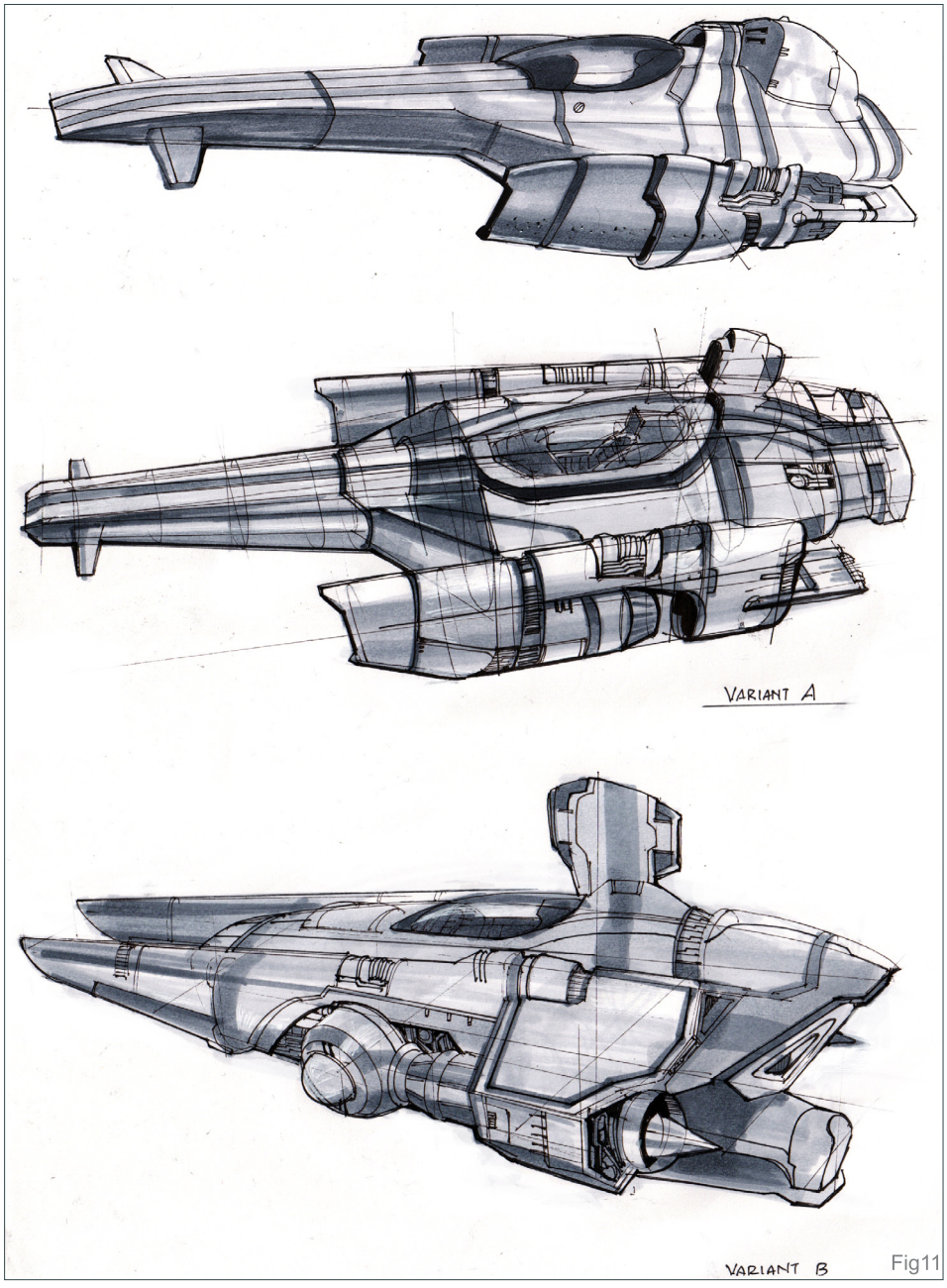

Fig11

XA-332

Taking a leaf from F1, let's take the option of streamlining the XA-332 further with a frontal nose cone **(Fig.09)**. Included are two large directional fins situated within obvious sight directly behind the side engine thrusters.

In view of the inspirational race by Lewis Hamilton of the final race in Brazil (Grand Prix 2008) which lead to victory by a stroke of a race thought to be lost, I would like to dedicate the next design to this inspirational young driver, and I've called it the Hamilton NSF22; think of it as a Formula Double Zero – aero package and streamline treatment of the main chassis XA-332.

In addition, in this initial sketch we'll briefly explore the use of two large stabilising vertical fins. These, however, look perhaps too conventional and are removed for the final

production design. The start of the design is a low wash of grey 20% and 50% to bulk out the form in grey values. The overall feel is kept low contrast. Only a thin wash of ink outlines the major key areas in this initial step.

Production Ready

Once the final key designs are accomplished, it's time to produce the finalised marker designs **(Fig.10)**. A frontal and rear 3/4th perspective view are chosen to illustrate the XA-332. All the basic steps are employed, only this time we wait for the markers to dry out before adding in further details, and give it a second pass of markers and inks.

The key thing to note here is to add only an additional heavier line weight on the bottom of the transport, to further bulk and accentuate its overall form. If the line weight is too heavy, it will contrast dramatically with the overall design, so a careful maintained balance is necessary.

To finish up, included are three additional variant designs that explore different engine designs or placements and accentuate the overall feel **(Fig.11)**. In this instance, the best designs are still the earliest designs for both the XA-332 and Sunred transport.

Scanning

Working with markers can be both a joy and a pain. The thing about markers is, eventually the alcohol based ink dries, and the vibrancy that you get when the ink has just set is not as discernable 1-2 days later – and much more faded over the next few weeks, chapters and years, until it is but a mere shadow of its initial glory. So, as advice goes, do try to scan your designed works in within a few hours to a day at the most after conception. Nevertheless, even if it does fade, you can apply a few corrections with Adobe Photoshop.

In **Fig.12**, the illustration shows a scan of a design that was 2-3 days old; some simple steps were taken to clean and correct its levels

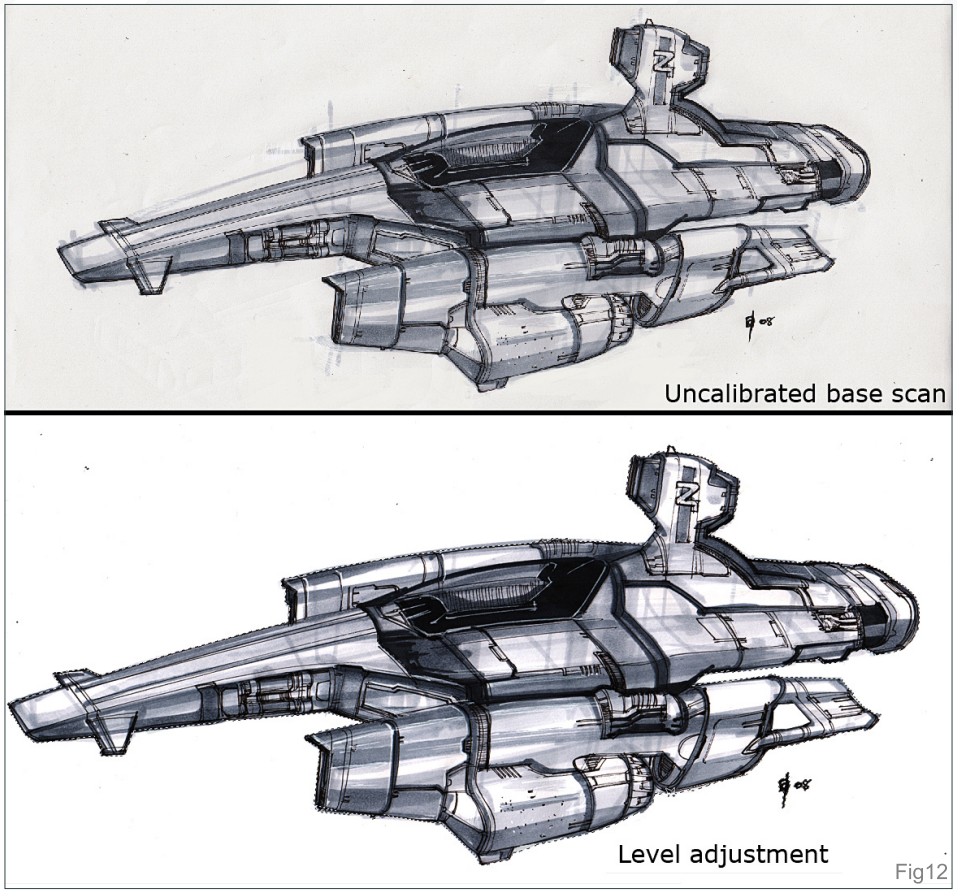

Fig12

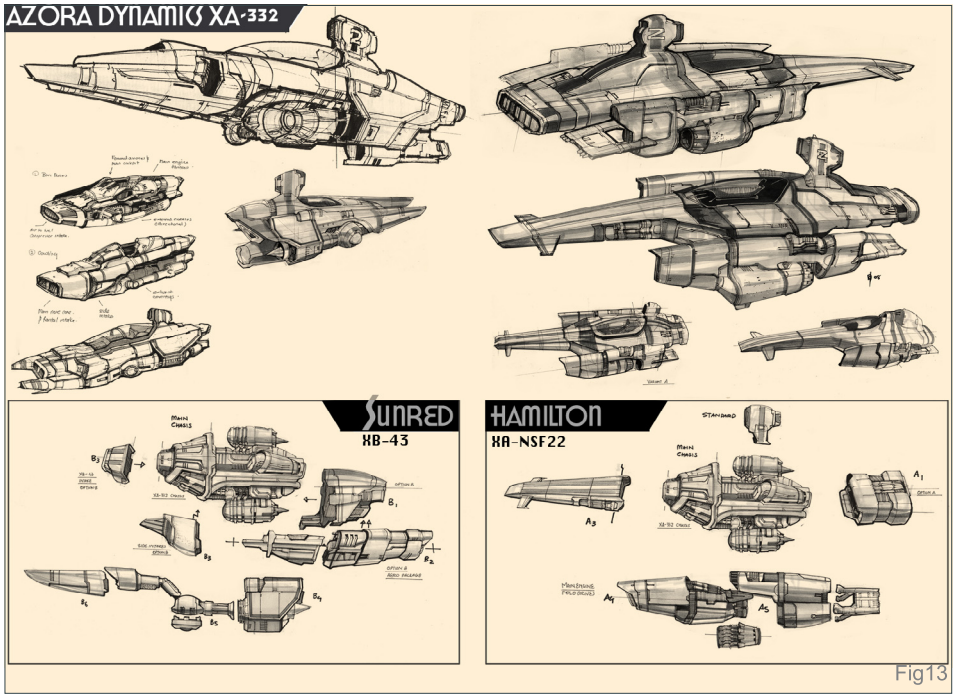

Fig13

in Photoshop. All you need to do is access the Image > Adjustment > Levels function tool (Ctrl + L), and move the sliders in the middle slightly to the right, and the slider on the far right towards the level (corresponding to the peak of the histogram). That should get you a relatively clean marker sheet as good as when it was freshly created.

To finish off, you can scan in all your marker designs and present them in a logical and clean fashion **(Fig.13)**.

Storyboard 101

We're two-thirds through our workshop and the end is in sight. Well … almost! Before we present our designs to the head chief of engineering for consideration of use for a production model, it would help if we could imagine this transport being used. As such, we can rely again on simple basic techniques: storyboarding **(Fig.14)**. Now, you can use any form of media to storyboard according to your personal preference. Digital is as good as traditional. Some folks even use post it notes to storyboard different beats.

In **Fig.14** there are five different views of a space race taking place on the surface of a planet/moon, as follows:

1. A – Canyon Run
2. B – Near Collision
3. C – Tight Turn
4. D – Flyby Tower
5. E – Whirlwind Run

With each panel, try to use one to two keywords to describe the scene. What I find is if the panel is strong enough, those one or two words are more than sufficient to describe the whole scene. In fact, because it is so minimalist, the headline words can accentuate the story with great impact.

For our illustration, I would like to go for a mixture of A (Canyon Run) and C (Tight Turn) set on a desert surface of a moon.

Space Canyon Race Illustration

Great, so now that we have spent all this time preparing for our final illustration and all the steps are in place, ensure that all the key transports are scanned in and cleaned – it is the clean crispness of the edges that determine how successful the final image is, relative to the line work.

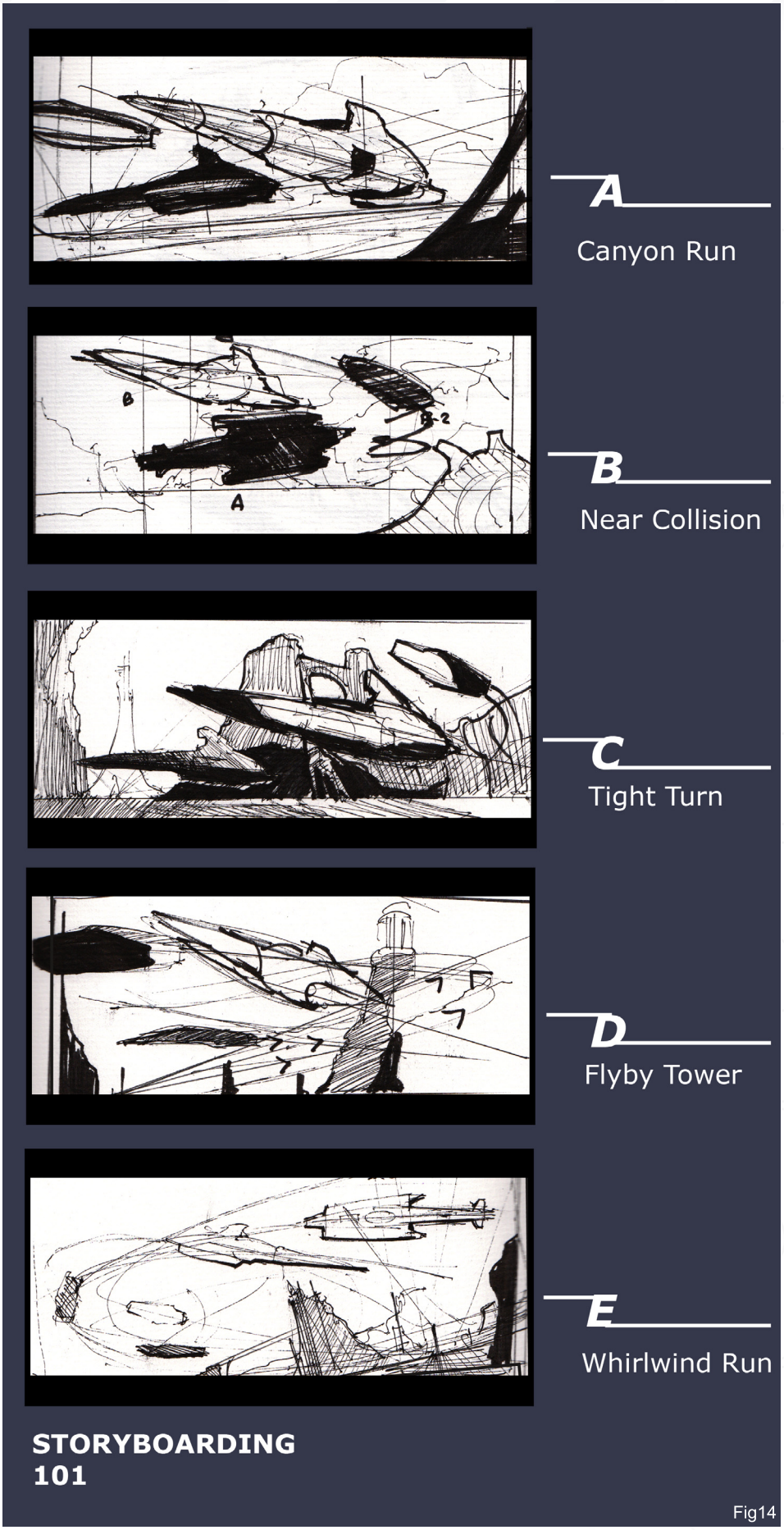

Fig14

In addition, be prepared to lose some of the original lines for a more logical layout.

- Perspective and Layout – Using the established designs and storyboards, lay out the composition grid and align vehicles accordingly **(Fig.15)**. Save these grids on a new separate layer, which you can turn on/ off at will.

We have opted for a three point perspective and an aerial view. One of the vanishing points is located on the lower third right, so that it is close enough to follow the rule of thirds but does not conform to it totally (for a more naturalistic feel).

- Establish horizon line & perspective – Add vehicle drawings on new layer set to multiply. Clean the edges and make clean selections of the overall form to save as an alpha mask **(Fig.16)**.

Next, establish the background plane relative to the horizon using flat washes. In this instance, feel free to use colour directly, to establish an initial image.

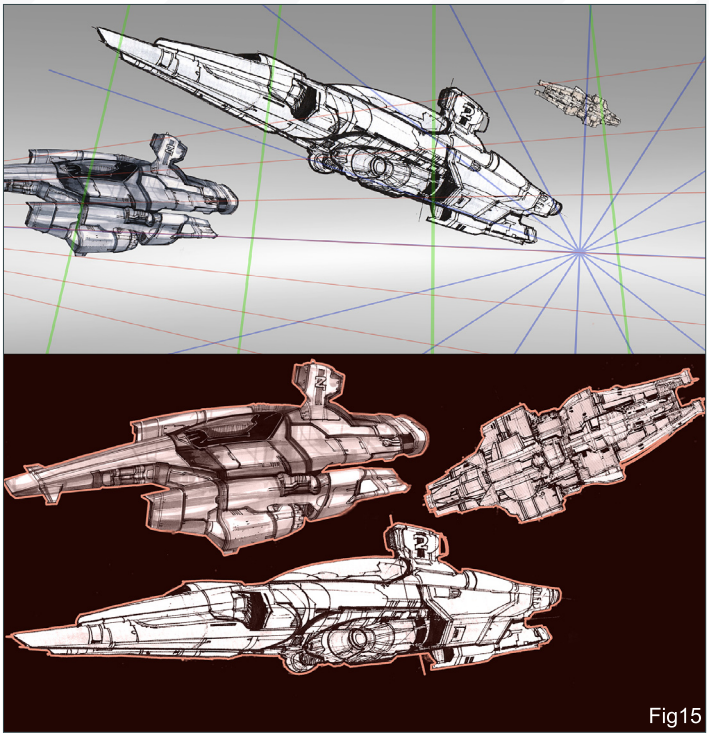

Fig15

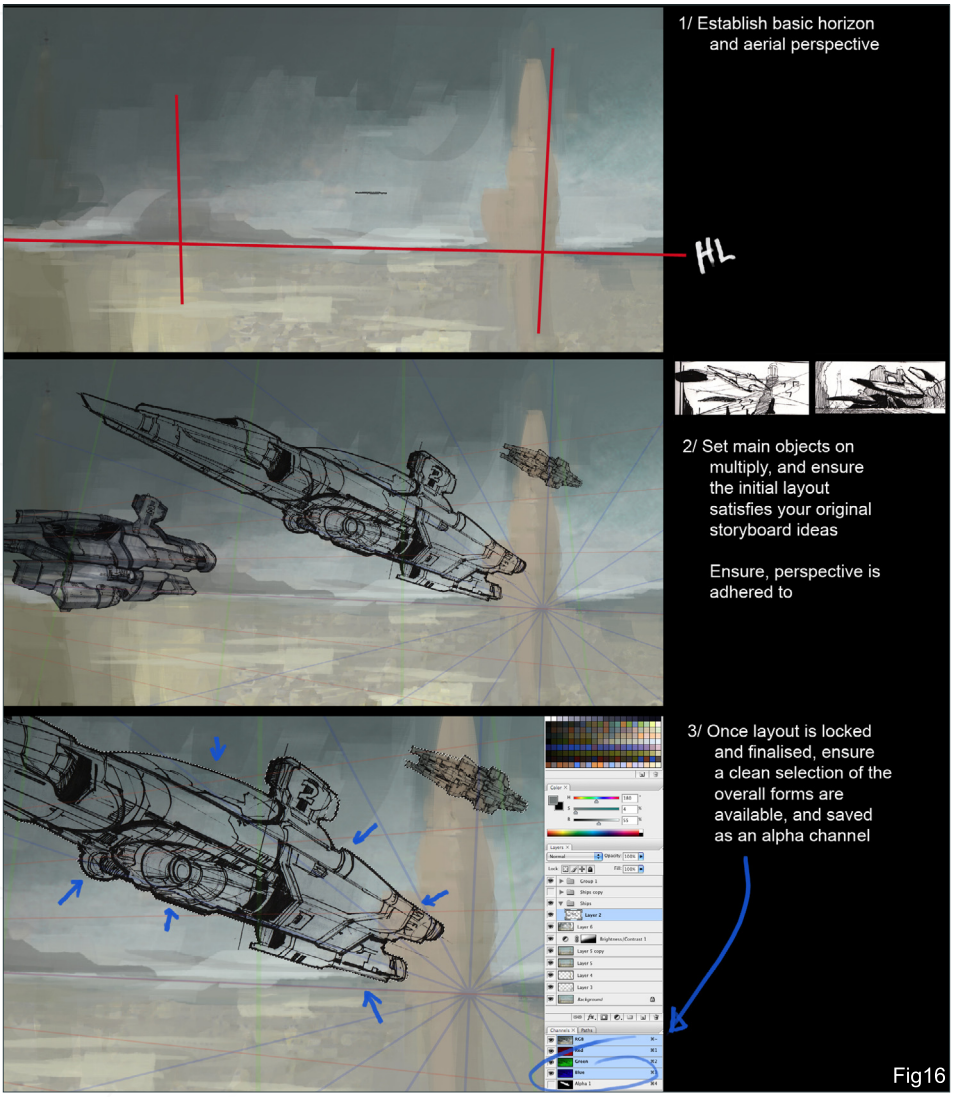

Fig16

I have taken the liberty of ensuring that there is both a diffuse light source pooling down the centre, and a vague shape of an observation tower (far right) and large looming structure in the far distance (far left). The large structure is much shorter, relatively, to allow for perspective as well. These both occupy the areas corresponding to the rule of thirds.

Bring your vehicles into the image (on a separate layer), and do check again that their outlines are saved onto an alpha mask/channel, as you will be constantly reusing this throughout the whole illustration.

Colour Tone: Earth & Sky Colour

Once the vehicles are included, you need to consider how to colour and light them. Observe images of Formula 1 cars, for example, and then consider how the light reflects off shiny surfaces – take some photographs as reference to help you to better understand light, colour and reflectivity. You can then apply your direct observations into your painting **(Fig.17 – 18)**, as follows:

1. Block in – Select your main transport and provide a flat wash of tone; I tend to paint from neutral dark to light. This is painted directly on a new layer above your lined art, and this is where Form and Line are in transition. In an illustration, the quality of an object is in its overall form, whereas in a schematic, the line work takes more precedents. Both are interdependent but convey different overall aesthetics. Images that have flat washes of colour and form, and are outlined with line, are termed graphic design/images.

.2. Warm and cold – Once the general shapes are blocked in, you can use your observation of warm and cold colours to give light and shadow to your objects **(Fig.17)**. In general, a shiny metallic surface reflects a sky tone (whatever colour the direct ambient light is above), and similarly the underbelly/underside reflects an earth tone. Sometimes the reflected or bounced light for the earth tone can even be as bright as the direct light.

3. Establish a swatch/palette – Once the basic forms are blocked in, it can be useful to establish a colour palette for use **(Fig.18)**. This is like an immediate colour guide (handy paint by numbers colour) to apply from

Fig17

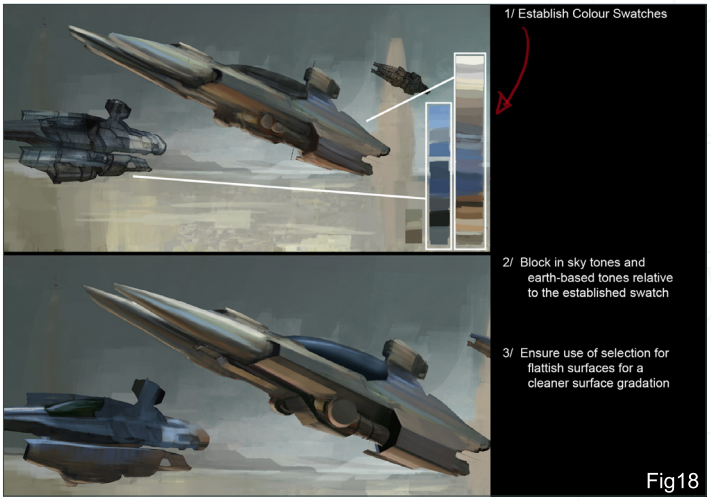

Fig18

areas above and below. Once you have worked out the colour tones, it saves a lot of additional guesswork and can lead to very methodical workflows.

4. Selections – Try to establish selections of flat areas that share the same tone/shade. This allows you to quickly apply flat washes of colour or graduated gradients to help you suggest form quickly and relatively painlessly.

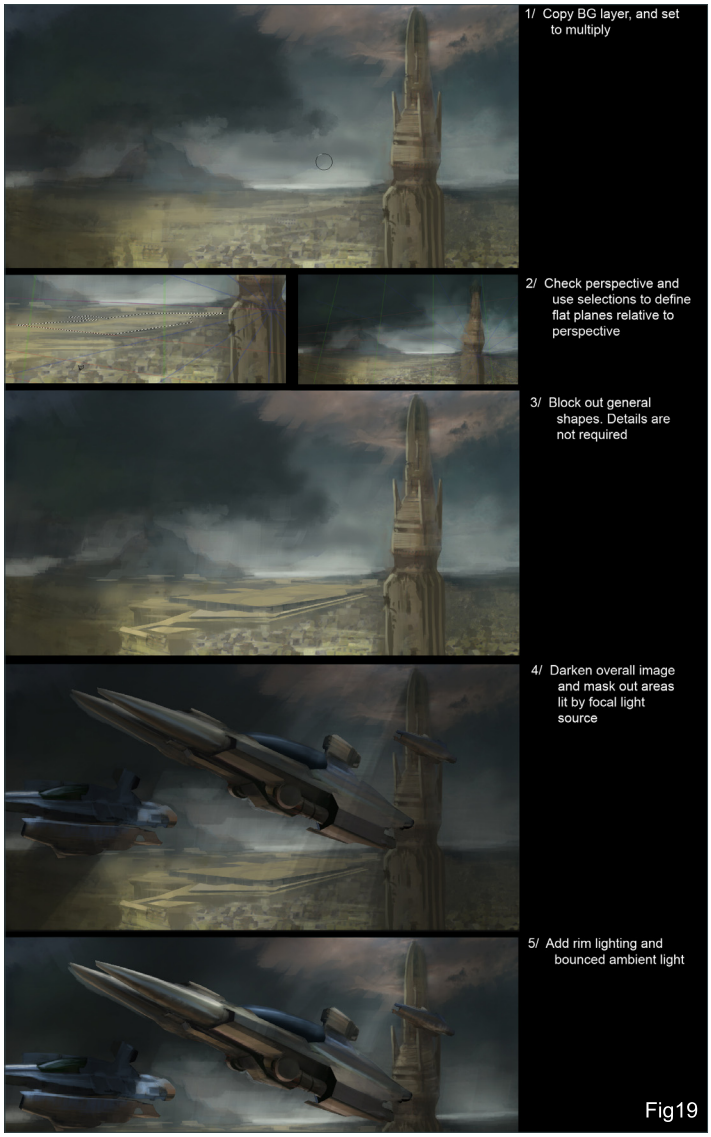

Fig19

Bringing it all together

1. Background Environment – This is probably the most important step to help sell/support the image you are presenting **(Fig.19)**. An interesting background or environment for your vehicles will lend it an appearance of being within an illustration.

2. Instant Contrast – So far our background has been mainly neglected and relatively low contrast and indistinct. That is alright though, because by rapidly copying the whole layer onto a new layer (set to multiply), you can subsequently erase out areas that are too dark to produce a quick fire environment.

3. Check – Ensure your perspective and composition work by bringing up your established perspective grids.

4. Block it out – Similar to the transport, use the largest brush size you can tolerate, and quickly work out some general shapes in block form. All

these do is to add some suggestion to the background. Try not to add any details as such. We want to keep it loose but also realistic (in the sense, objects in the distance appear blurred and just general shapes, however our brain fills in all the missing details from its established database of forms and established shapes).

5. Focal lighting – We darken the whole image (on a new layer) to allow for more focal lighting. In reference to **Fig.20**, we are allowing light to suggest the form across both the transports and the environments.

6. Rim lights and tightening up – Now that we've reincorporated the transports into the image, we need to establish the areas which have the highlights and the areas which reside in shadow. Please note that all areas covered by a shadow should have the same tone and saturation unless it varies by distance (or local effects e.g. local fire).

7. Bounced ambient light – Ensure that the underside is also reasonably lit from the bounced ambient light.

Almost There!

The overall image is almost complete now, and it's just a matter of taking that extra step of ensuring details are correctly in place.

1. Add jet wash – I choose to use some diamond-shaped thrusts based on existing research by XCOR/JPL/NASA using methane rocket engines. Ideally, some more exotic engine washes like laser or light propulsion emissions which may feature doughnuts on a string appearance may feature (but in this instance, may be too far from the general public's perceived idea of an engine wash). The vehicle in the distance features a more bluish engine wash, characteristic of ion engines.

2. Add motion blur – Using the motion blur filter, copy the whole image onto a new layer by selecting the whole canvas (Ctrl + A). Copy all the layers (Ctrl + Shift + C) and subsequently paste as normal (Ctrl + V). Ensure the blur occurs in the general direction of the vehicles (in this instance, the blur is almost running from 9 o'clock to 3 o'clock). You can then lower the overall opacity (20-40%). Ensure that you erase out the blur from the transport to provide you with a freeze frame capture image (similar to taking a 1/800 s shot).

3. Smudge leading edges – For the final touches, ensure you smudge lightly various edges and try to blend the vehicle and environment together well. The use of some atmospheric perspective (dust) may help.

4. Optional – Decals may help accentuate the overall feel; however, in this instance, none were used.

5. Finish – A few colour corrections and subtle lighting changes, and you are finally finished **(Fig.20 - 21)**.

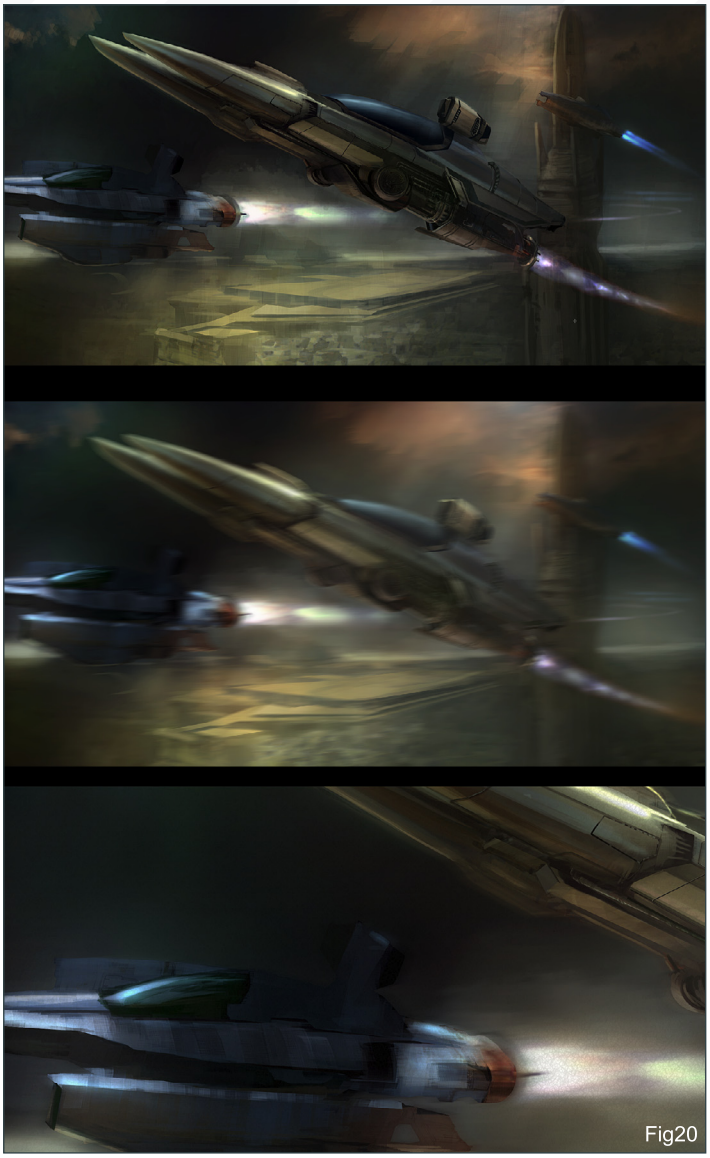

Fig20

Final Thoughts

To conclude this initial spaceship workshop, I have taken you through the basics of industrial design; we've talked briefly about form, and how to establish and present form using light, colour and temperature using both traditional media (which can be low cost, relatively cheap and straightforward) and digital to present your ideas across effectively. At the end of the day, it's about effective communication – communicated effectively.

In the next instalment we'll take a look at giant destroyers and capital ships. As always, I hope this has been helpful and informative.

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Fig21

Chapter 07

CAPITAL SHIPS

SPACE PAINTING
CHAPTER 07: CAPITAL SHIPS

Created In:

Photoshop

Welcome to the seventh instalment of this space painting series. In this segment, we continue our discussion of spaceships with the consideration of the larger and sometimes impossibly grand capital ships that can span up to a few miles in length in popular culture and media. Sometimes these ships are so large they are deemed battle stations in their own respective rights!

Overview

Continuing on our theme of futuristic space transport, I have grouped together the large collection of ships that are able to carry groups and large numbers of inhabitants under the heading of “Capital Ships”. Current naval equivalents of these are termed (from small to large) as frigates, destroyers, deep space sensor arrays, mass troop transports, battleships, massed array destroyers, multi-assault super destroyers, battleships, carrier, fleet carriers and leviathan classed battleships. These terms roughly describe the range of militaristic space capital ships. The more mercantile and non-militaristic class of space vessels will be covered in the third instalment of the transport arm of this series.

I: Grand Design:
Construction of a Superstructure

To start the construction of something that is relatively quite large, we have to scale it down significantly in size. Large or small objects, when they are all scaled to the size of a thumbprint, leave very few discerning details.

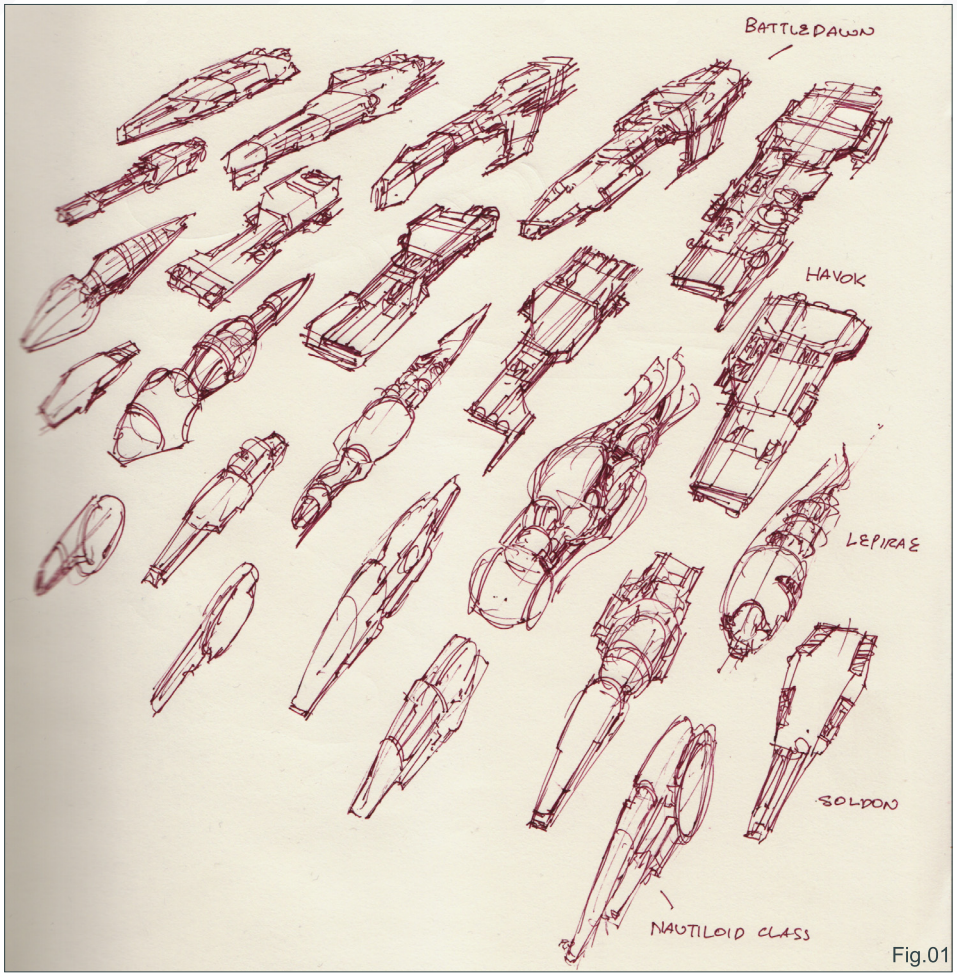

Fig.01

The main thing to therefore observe is their overall form and shape. It is with this issue in mind that I often want to label the design of spaceships as “sexy bricks” (**Fig.01**).

Design – Sexy Bricks

When you consider the look, feel and design of a very large spaceship there are a few useful everyday considerations that can help translate and convey a sense of relativistic realism and aesthetic beauty. You could in essence look at capital ships as a hybrid of U-boat, yacht, battle tank, naval warship and bullet train, all mixed to different extents and styles (e.g. industrialised versus sleek organic Luigi Colani-esque). The thing about space is: there is no real need to consider atmospheric aerodynamics - in general.

One could string together a cluster of turnips on a piece of string and race them against a group of pancake and waffle-shaped crafts (**Fig.02**). Chances are, if they all had the same engine output, acceleration profile and manoeuvring – it would be a close photo finish if you had an imaginary drag race in space!

The purist and scientist, however, may argue that waffle and pancake-shaped ships make for a large frontal profile, and thus may meet greater incidental damage from micro meteorites, space debris, and so on ... which means the turnips have a slim marginal advantage (not to mention they are kind of more aerodynamic, almost resembling a super food torpedo!).

However!

We are not in the business of designing sexy hot potatoes or flying toasters, no ... what we really want are designer sushi rolls armed with slender slithers of avocado and deep fried tempura!


Fig.02

Alright, bad food analogy, but the real point is about a compromise that sees a fusion of real world industrial design functionality and sufficient external packaging to appeal towards the aesthetic sensibilities.

Capital Ships: How To

In general, you could take any cylindrical or relatively rectangular object and these would serve as a very good base to make a spaceship. The way I would like to approach the construction and design of a capital ship is to assume that I could produce the same functional design given the right technological level, to perfectly build a spaceship.

The closest production method would be to take a leaf from both naval ship construction and the car manufacturing process. With this methodology, a combination of semi-schematics and loose sketches allows both the designer and viewer (modeller/architect/director) to appreciate how the forms cross from one side to the next, and also presents the designer (and their subconscious) with additional data on how to refine, and improve on, the design process.

Fig.03 shows a five step approach towards this aim:

1. DRAFT – In the draft form, keep the lines loose and ensure they cross from one side to another

2. PANELLING – Start to divide and construct separate sections for your spaceship, e.g. forward bulkhead, engine section, living quarters, observation deck – all of these get considered here

3. BULKING – Additional plating and armature are added to the overall exoskeleton

4. SOLIDIFACTION – This represents the pre-prototype before you complete your initial design. The whole ship should look solid, well-built and capable of performing its intended role

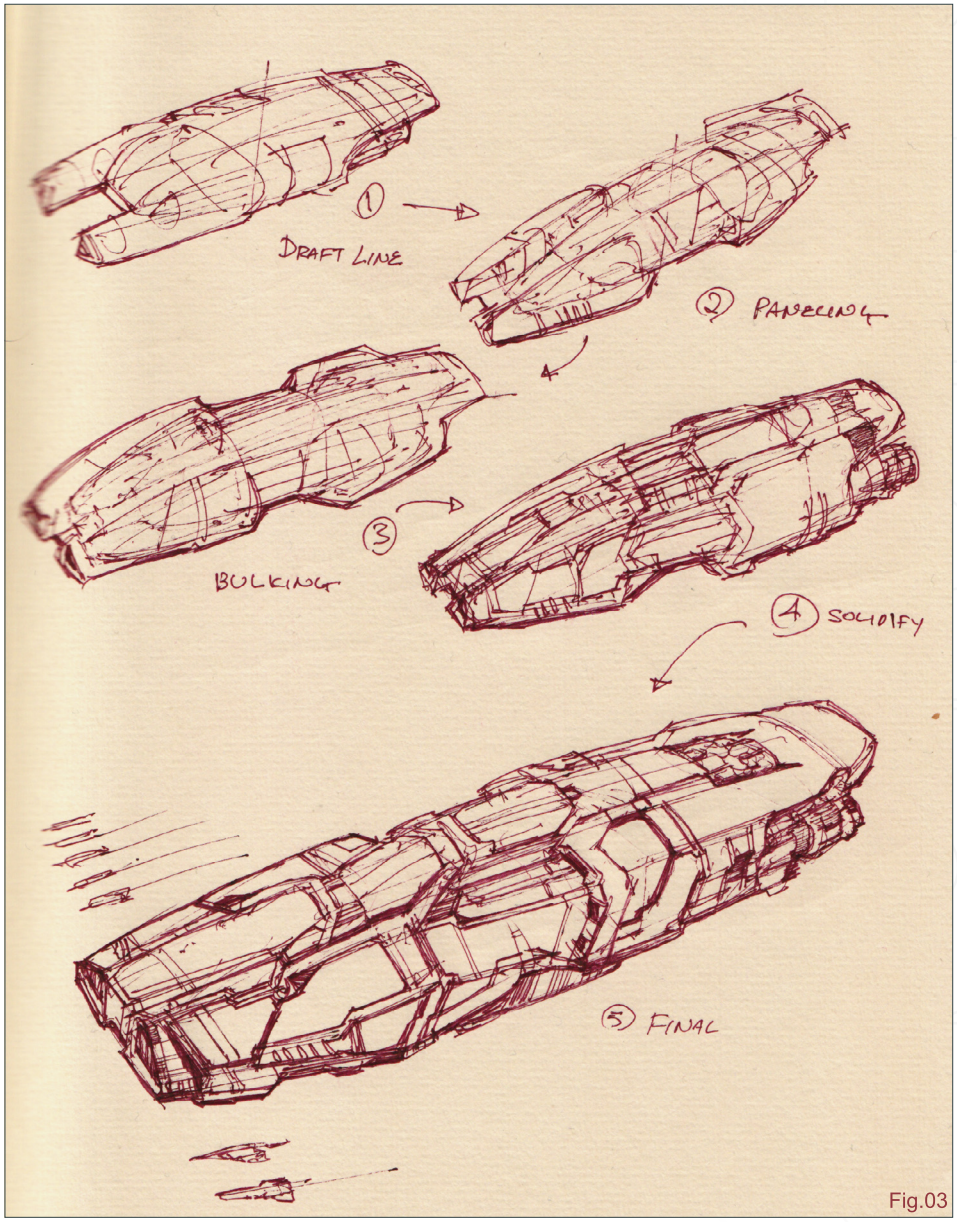

Fig.03

5. FINAL – The design is considered finalised when all the additional details such as markings, panels, piping, engines, hangars and such are drafted into and considered in the final plans.

Capital Ship Types

The next few steps to consider are the individualistic styles your design may have. Often, the style of the ship design may be considered initially, or alternatively you can consider how it may look once a suitable selection of ship shapes and designs have been drafted.

Determining how a ship should look is akin to determining the type of fabric, weave and pattern that goes into a finely embroidered rug. In gaming terms, it could be representative of which guild or faction a particular make belongs to; in terms of functionally, the type of look can lend credence to how your current ship line has been built.

Fig.04 shows a range of three representative styles:

1. Retro-Industrial
2. Fused
3. Organic

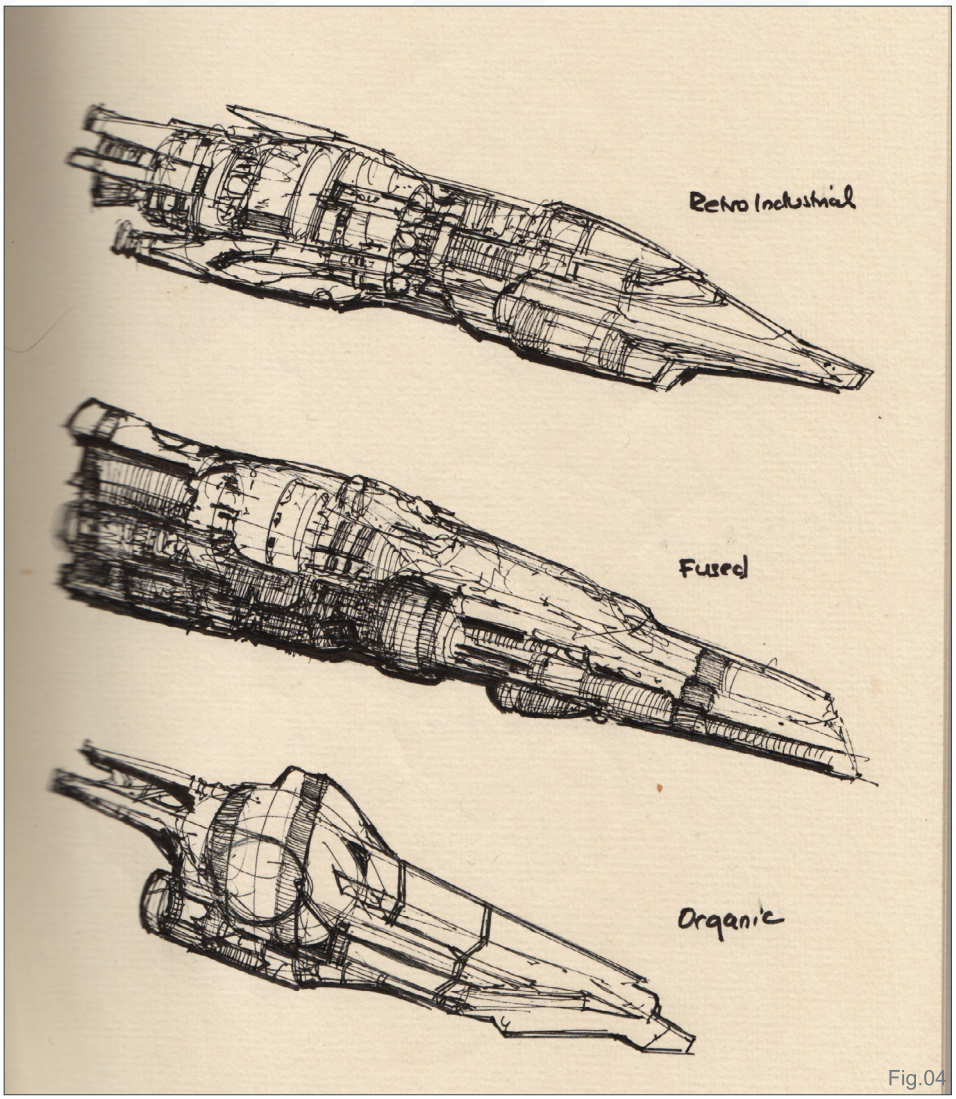

Fig.04

Retro-Industrial

This represents a more industrialised feel, where many elements such as tubing, pipes, engines and overall superstructure is exposed. The term “retro” represents 50-60s futuristic design, which is shockingly more futuristic than our current day design aesthetic. If you desire to look at truly futuristic design, look to the past; it’s probably one of the few reasons why ships of old look so good. Another genre to look into is streamline moderne. Together, retro and streamline moderne represent a collection of functional and very handsome ship designs.

Fused

This represents a fusion of industrial and angular shapes, combined with slight elements of a smoother and more organic shape. Our current modern day design aesthetic is roughly within this sphere of design sensibility.

Organic

The more exotic or alien-esque shapes of various spaceships can be termed “organic”. Smooth flowing lines, hidden pin-point engines and seamless joints all suggest a more exotic origin of space design language (for reference, look up Luigi Colani).

Capital Ship: Superstructure

Lastly, let’s put all these various elements together. In the previous space painting tutorial part on spaceships, (Part 6), we looked at various methods of illustrating and designing space vessels. Therefore, it is with this general assumption that we move onto the meat of actually designing.

As a general workflow, I tend to:

1. Start the design – With pen and paper, on any paper/sketchbook available and explore various shapes, forms and aesthetics
2. Refine the design – Utilise the design language and reference to establish a ship line, and narrow the selection process into two or three designs that show promise
3. Finalise the design – Using markers and pens to depict 3/4th perspective views of the space vessel’s front-to-rear and rear-to-front views

To refine our design, I also tend to consider a space vessel in terms of structural composition. Similar to the way biological entities are constructed from skeletal frames to retain organs, with muscles and thick fascia to enclose it all, and the external skin representing the armour and plating of space vessels.

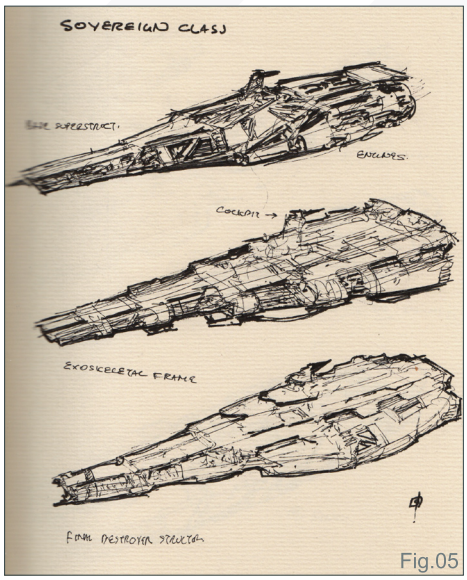

Fig.05

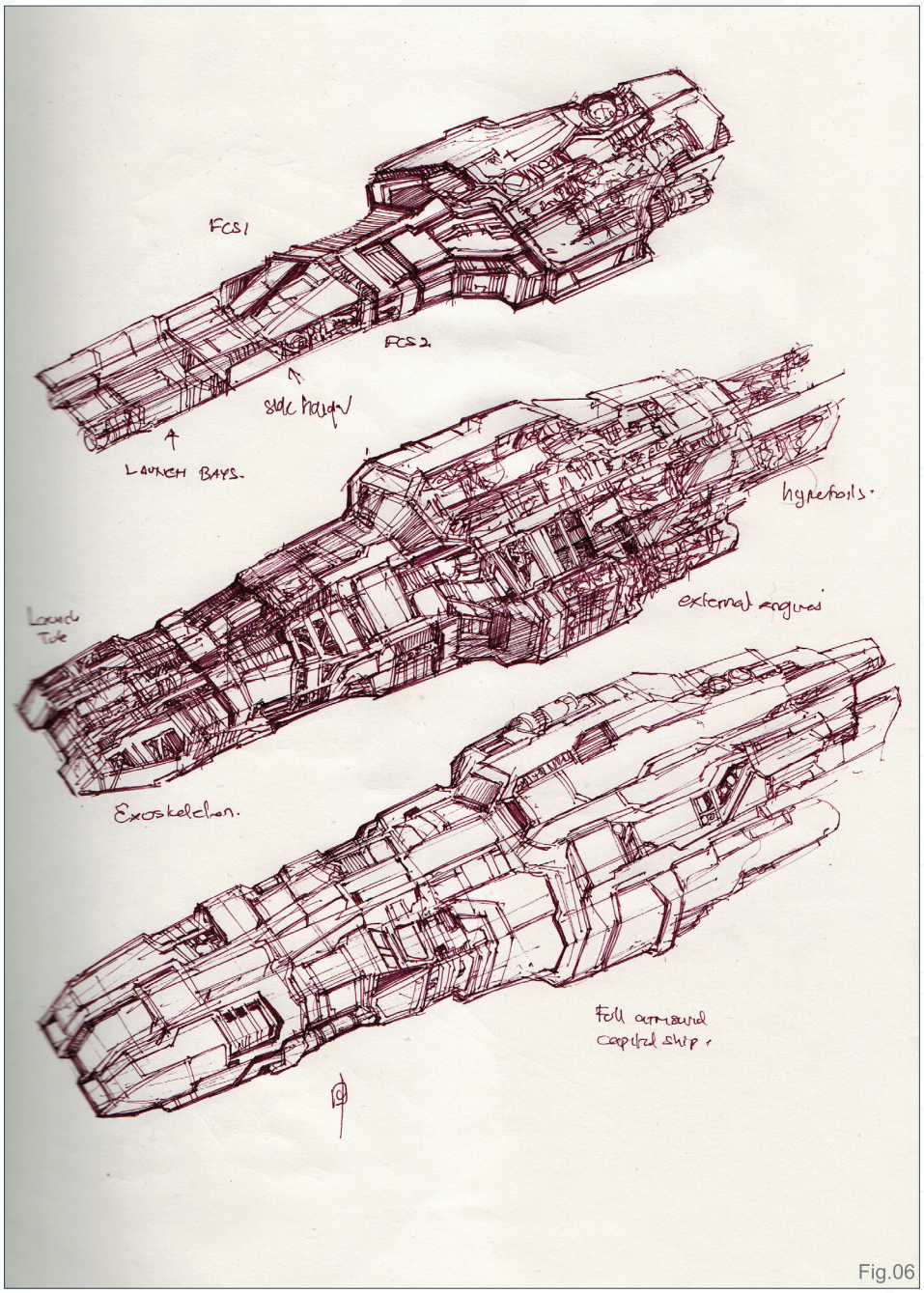

Fig.06

In **Fig.05** the Sovereign ship destroyer design is split into the three aspects:

1. Basic Superstructure
2. Exoskeleton
3. Completed structure

This represents a warm-up sketch, to explore both positive and negative shapes. As such, it was produced free hand with a quill pen and Indian ink, which allowed for thick and thin flowing lines. For a pen equivalent I tend to use a Pentel Stylo liquid fountain JL30. The overall size is relatively modest: rendered simply on a 5”x6” (inches) area on a slightly textured classic Fabriano paper.

In **Fig.06** this design process is taken further, and a larger carrier/battleship equivalent is explored. Using the same process, more care and deliberation is used and the overall draft is produced on a A4 moleskin paper. The finer lines are produced using a brown Pilot 0.4 G-TEC-C4 pen.

Years of admiring cut-out illustrations and popup books have lent towards a style that appreciates showing the ship super structure in its various states of construction. Now this can come in extremely useful, if one were asked to produce a scene showcasing a space vessel being constructed e.g. a trailer for the new *Star Trek* movie by JJ Abrams.

Next time you are in an industrialised area or near a construction facility, keep a vigilant eye out for transports being constructed, or keep your eye glued to *The Discovery Channel*. All knowledge is good trivia to fulfil your inner industrial designer!

II: Space Fleet Scene

In part two of this workshop, let’s take you through some basics of how to produce a space fleet scene. Often, in popular culture, you may notice gratuitous flyby shots of masses of capital ships in fleet formation. This can bring up a slight contentious issue of realism vs. artistic license. The thing is, trying to showcase your latest hot-of-the-press designs with all of your ships in formation can often be a large undertaking that falls flat for one primary reason: reality.

In reality, these ships in serene and majestic flight in deep space will no more reflect light than appear as a multitude of blobs. Or a single blob. Because light from the nearest stars appears as faint twinkles at best (and appears as nothing on film and tiny points of white light

on high resolution video). As for the flotilla of ships: nothing, just dark outlines of nothing … against a sea of dark.

So imagine a blob against the darkness of space. Perhaps a small smattering of local lights may help define its form better against the backlight of ... nothing?

And there we have the appeal of artistic license! The proponents of realism will find shots of:
1. Ships running past a nearby star
2. Very close-up shots of ships lit by local lights, and the ship material being a very desaturated grey (for there is insufficient nearby lighting to show off colour)
3. Ships running past planetary rings

Problems arise in depicting relative scale and atmosphere. There are no visibility issues in reality (unless there is a rare chance of navigating through space debris/cloud of space dust). You either see a ship or your do not, and the scale of a large ship vs. a small ship is impossible to discern by the naked eye.

The proponents of artistic license will happily use:
1. A backdrop of ships going through a nebulous region (often the density of nebulas are so heavy that all forms of organic, structural and latest state-of-the-art ships crumple into nothing, or are fried into space dust from the intense radiation)
2. A group of ships running through space gas and clouds (runs again into the nebulae issue)

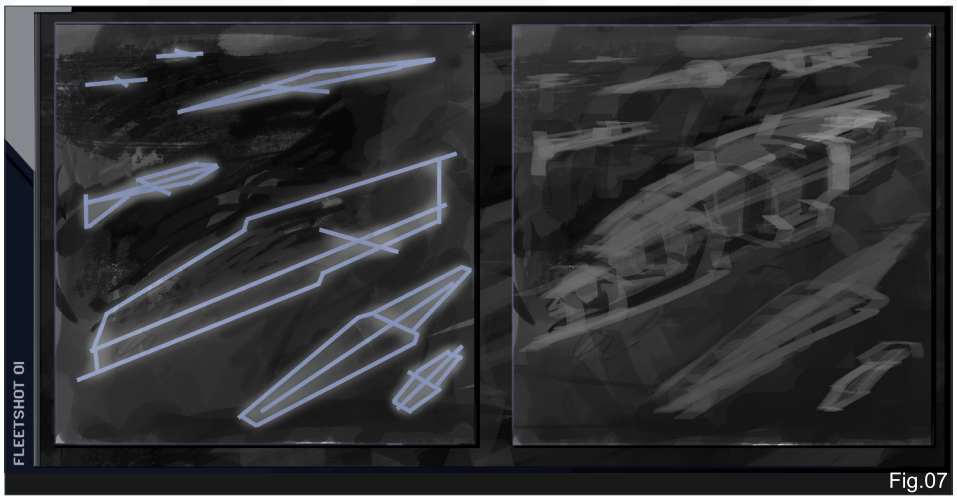

Fig.07

Nevertheless, artistic license allows for gratuitous use of atmospheric perspective to suggest depth. For example, painting brightly coloured clouds in space and throwing caution to the wind (galactic hiccups, burps and leftovers gasses notwithstanding).

Fleet Shot – The Drawing Bit

We really must get back to the drawing and painting bit now, so with the mini science/rant bit over, let's look at how to showcase your latest designs in action!

1. Grey Layout

In **Fig.07** a bunch of capital ships are depicted in greyscale. On the far left, rough outlines of the basic geometry have been employed. And on the far right, the ships are depicted using rough and large paint strokes.

The argument for depicting a deep space scene in greyscale is that it allows you to concentrate on design and composition. The difficulty that arises is the transition to colour.

Let me correct that last statement: The transition from greyscale to monochromic colour is not difficult, but looks very unimpressive. In fact, it looks very grey. The transition to happy, impressionistic, artistic license Technicolor is a whole new kettle of starfish altogether. Colour will imply saturated colours. And desaturated highlights ... well, you will see it is challenging to just look normal, much less make it decent.

2. Orientation & Composition

With reference to **Fig.08** and **Fig.09**, the canvas appears cramped and requires further expansion. This may involve readjusting the canvas to keep all the ships in relative perspective.

For in space, all forms of orientation of up, down, left or right are nonexistent. There is

Fig.08

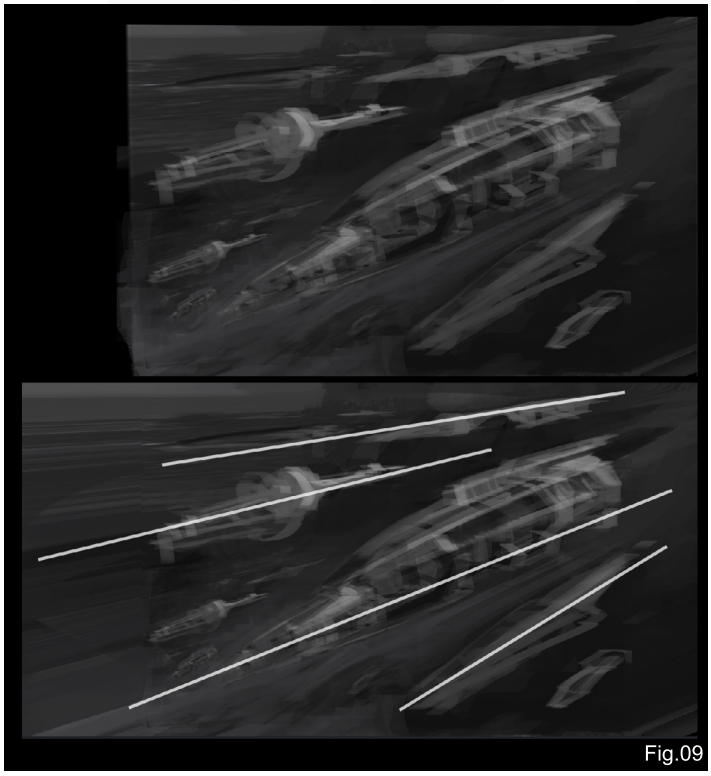
Fig.09

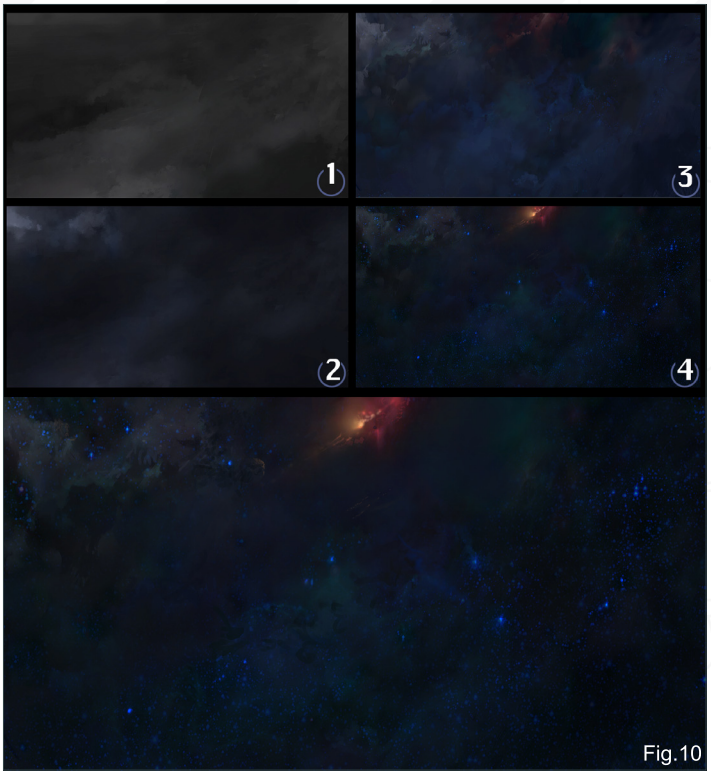

Fig.10

no magnetic north or south, only the way forward or stationary. For artistic purposes, it would be convenient to use a one or two point perspective. All notions of including a horizon are often nonexistent, and a string of stars to form a false horizon may often look more disconcerting than clever.

3. Background

With reference to **Fig.10**, we now make the transition to colour. In this instance, it is just as if you are painting desaturated clouds in space. This process can be both satisfying and very time consuming. This stage actually took around four hours of laying out the values, painting in faint glows and accentuating a few stars and depicting a nearby galaxy cluster.

And here is the crux: Sometimes it does not pay to zoom on in and detail every nut and bolt. Often there will be a trade off between readability, fit for purpose and details. Focal detail is the mark of a quality illustrator, and it is towards this goal that every artist strives by spending a lifetime polishing and refining.

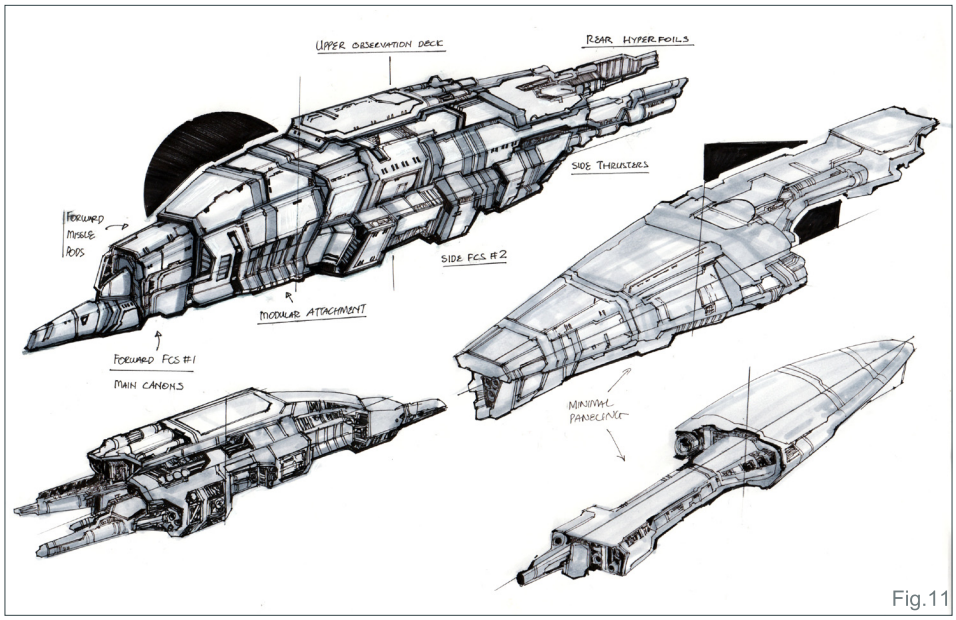

Fig.11

4. Capital Ship Design

Paradoxically, I stop the painting process to take time out to design the capital ships. What I liked about the rough forms of the initial greyscale is translated in essence onto markers and pens (**Fig.11**).

I use this opportunity to take the design as far as I dare. And it is at this juncture I would like to briefly talk about scale and panels:

Scale – In space, the size of a space vessel may be hard to gauge. And thus, care should be taken to block out segments. Generally, a large vessel has more segmented shapes than a solid, singular, small space transport. However, when an object is large, its multiple segments can often blur into panels.

Panels – The size and variety of panels can be both a stylistic and relative scale that can be used to compare a large ship to a small one. Panels with windows, vents and lighting are therefore very useful for this purpose of

comparative relativity. In **Fig.11**, the warship on the left is depicted with multiple panels and detail. In comparison, the warship on the far right is minimally detailed and panelled. Yet, the object on the far right can be perceived to be bigger, even though the warship on the left is intended to be the larger and more powerful warship.

In summary, it can be generally said that the object with large panels and lesser details can be seen to be bigger than a similarly sized object with details and panels throughout.

5. The ships

The ships are brought back into the coloured background and a few issues are immediately apparent (**Fig.12**).

Fig.12

Fig.13

Firstly, the values and lighting are different from the original greyscale background. To remedy this, you can use the following approaches (relative to **Fig.12**):

1. The ships are on a separate layer, and set to luminosity
2. A duplicate copy is set onto multiply above
3. The overall forms are masked out and save to alpha channels
4. With the forms selected, I utilise the lasso tools to cut out various panels and selections relative to each plane (for example, the top surface of the main warship is selected, and faint washes of coloured grey are applied in perspective)

6. Final Details

To bring it all together, the overall image is flattened and each respective ship has the following applied to **Fig.13**:

1. Panels cut-out relative to nearby bright objects
2. Upper edge reflecting the red-orange highlights of the nearby galaxy
3. Bounced light applied to its lower edge or across a flat surface.
4. Overall colour determined by the local colour of its ambient surroundings
5. Engine washes applied faintly towards the rear of each ship
6. Atmospheric perspective – I judiciously added a faint hint of dust and pushed objects into the distance. In reality, this effect would not be evident, and the nearby and far objects would be equally lit and provide comparable luminosity.

7. Final image

In the final image, the vibrancy of the greens and blues are more saturated. The far right warship is edited out of the final image, as its overall shape is poor and distracting (**Fig.14**).


Fig.14

III: Impressionistic Burning Ship

To conclude the third and final section of this tutorial, we will tackle a more colourful and impressionistic approach towards painting space capital ships - and give a small nod towards John Berkey, famed granddaddy of sci-fi and space art who unfortunately passed beyond into the stars earlier this year, April 29th 2008. He was one of the truly great greats who was so versatile that he was trained to paint in any media, theme and style throughout his early formative years.

It was later in his prime and twilight years that his arts formed the crux of our cornerstone of sci-fi and space art illustrations. In turn, his approach to painting art has made a daily impression on the way I perceive space art. For who else would consider painting space in hyper saturated blues, with vessels painted in cream, shaded in sky blues and reflected in reds?

Although this scheme exists realistically in atmospheric conditions (but not in space), by deciding to take space art into an impressionistic manner, it has a vibrancy all of its own.
So let us do a Berkey!

Fig.15

Painting Inspired-by Berkey

The key to one of Berkey's image is being loose and impressionistic, but grounded in relative realism, coupled with big fat strokes to suggest form, colour and lighting (**Fig.15**).

1. Form and Pallete

In **Fig.15** a basic colour palette is determined beforehand and adhered

Fig.16


Fig.17

to. In this instance, I desired to use a greenish yellow background (namely because Sparth is predominately reds, and Berkey is blues with reds). For the vehicle itself, I stuck to:

1. Primary – typical cream white for the ship's main colour
2. Cool – reflected ambient colour, greens and blues
3. Warm – Reds and purples

Notice the visibly improved aesthetic compared to the greys of painting more realistically in deep space. In addition, I have masochistically painted everything on one singular layer. The idea behind this is to ensure the background and foreground elements reflect one another. The brushstrokes are bigger and fatter than the norm - although one could argue this is how one should paint! Big to small, that is. Instantly, this helps achieve a sense of volume and form. Amazingly effective!

Fig.18

2. Directional Lighting

Subsequently, the canvas is expanded to incorporate a more traditional portrait view (**Fig.16**). On the far left are some small thumbnail cutaways:

1. Top left – small thumbnail to assess overall form and composition
2. The bottom and mid left thumb – to depict the lighting issues; ideally, the space yacht would have a sharper rim light as depicted by the small thumbnail, but it is at this juncture that I am still undecided as to how close/far the light source should be

3. Colour & Mood

The next thing to really consider is the colour and mood. The original green colour is very interesting, although I really prefer the warmer orange-based palette (**Fig.17**).

My main idea is to depict a burning space vessel as it re-enters atmosphere (**Fig.18**). This can be due to a variety of reasons, and it might be best to leave it vague as such, to lend to a stronger composition. The finer details and colours are picked out, and added accordingly in this instance, but only hinted at rather than spending too much time selecting and laying it all out. In addition, the clouds and background are given more volume. This means determining that the clouds have:

1. A hard edge
2. A soft edge
3. A bunch of volumetric forms
4. Do Not Pass Without Checking!

This stage is all about checking (**Fig.19**) Ensuring that:

1. The values allow the forms to read well
2. There is appropriate use of colour as a compositional tool
3. The comparison with levels adjustment to ensure the image is relatively balanced
4. Painting in bounced light, ambient light and allowing the form to have soft edges and suggesting how light turns around the forms

Fig.19

5. Pyromaniacs:

The last aspect of the illustration is to add fire and destruction, debris and explosions. On the far left, we explore briefly the possibility of a swarm of fighters shooting the vessel down (overkill surely for a vessel that appears doomed to fall) (**Fig.20**).

On the far right is the final composition as it stands, burning with wreckage being strewn everywhere. Note the moderate the amount of glows and fires. Careful study of explosions and fires would show that there is far more smoke and glowing deep embers for any burnt up object travelling at velocity. As such, the image depicts it accordingly (**Fig.21**).

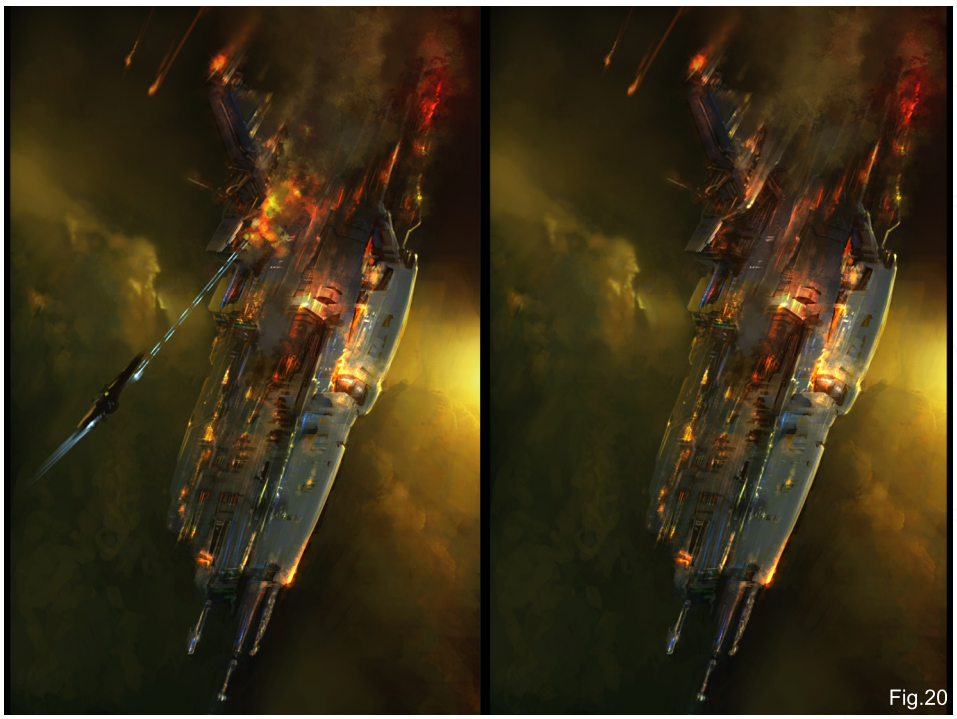
Fig.20

Conclusion

So, there you have it folks. We have taken you though a relatively wide ranging topic, choosing

a few select object and illustrative methods from which to use and discussed how to briefly design your objects of desire as sexy bricks.

In the third instalment of the space painting transport segment, we will look at the granddaddy and grandmommas of the space world – the space stations, refurbished asteroid mines and space colonies. Until then, may your painting arm be strong and swift, your ideas uniquely your own and bountiful, and to everyone, a positive outlook in the New Year and beyond.

Dr Chee Ming Wong

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Fig21

Chapter 08

SPACE STATIONS

SPACE PAINTING
CHAPTER 08: SPACE STATIONS

Created In:

Photoshop

Introduction

Welcome to the eighth instalment of this twelve-part tutorial series on space painting. Previously, we examined moderate to relatively large capital ships. This time around, we get to examine the depiction of truly large installations in space – namely space stations and their primary uses (for human inhabitation).

Overview

When given a typical brief of designing a space station for either illustrative or pre- and production design, there is a certain limitation to how radical the design forms can be. The more exotic the design, the more non-human it's appearance (unless that is the intent of the brief), and thus the design of such large installations should be based on existing technological limitations and designs, and extrapolated around 20-30% into the future (based roughly on a 70:30 percentage rule whereby one can define effective design being based on 70% realism, and 30% imagination).

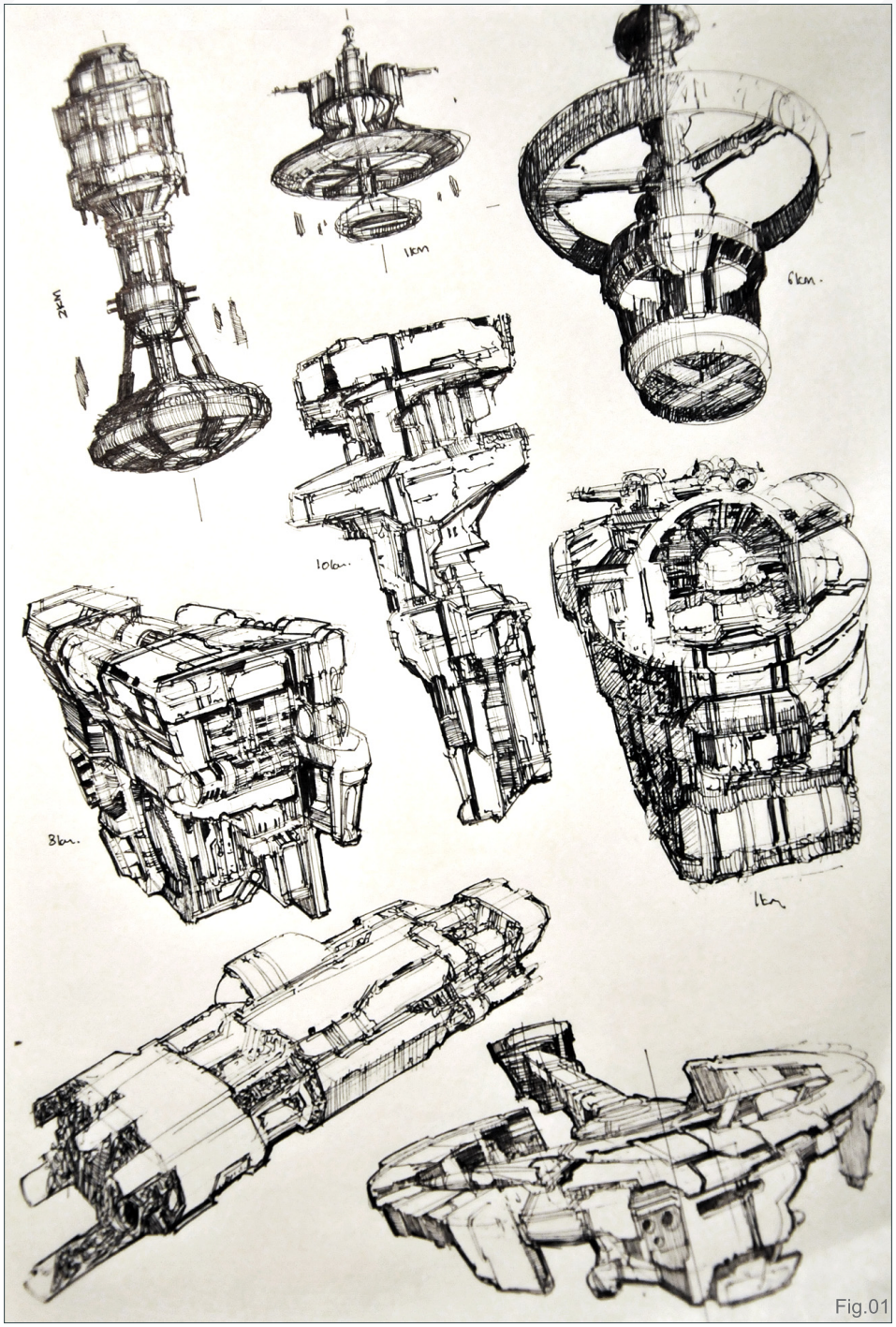

Fig.01

Another consideration to keep in mind for structures larger than 100 feet in height and width, is panel lines. Capital ships and smaller space vessels tend to have more discernible details and obvious panel lines (that suggest the vehicle comprises of various parts) and other details such as piping, gears, thrusters, windows, hatches and signs. The larger an object becomes, the less discernible these become, and it may appear to consist of almost featureless, flattish positive and negative shapes and surfaces. This is not to suggest there are no divisive lines; however panel lines on objects such as space stations may truly be a giant canal or a great grouping of massive tubular structures.

I: Shapes

To continue with the idea of construction via an exploration of shape and design, we need only look at the classic *Wipeout* racing game series. These games featured strong shapes and overall centric design aesthetics by the (unfortunately now defunct) legendary, Sheffield-based graphic design agency, **Design Republic**. Similarly, space stations can be generalised into variations of cuboids, cylinders or trapezoids with permutations of irregular extrusions, angular facets or smooth surfaces. **Fig.01** shows an assortment of semi-detailed thumbnails that begin as a general outline form, and are subsequently worked into with various divisions and aesthetics, and layers of extrusion

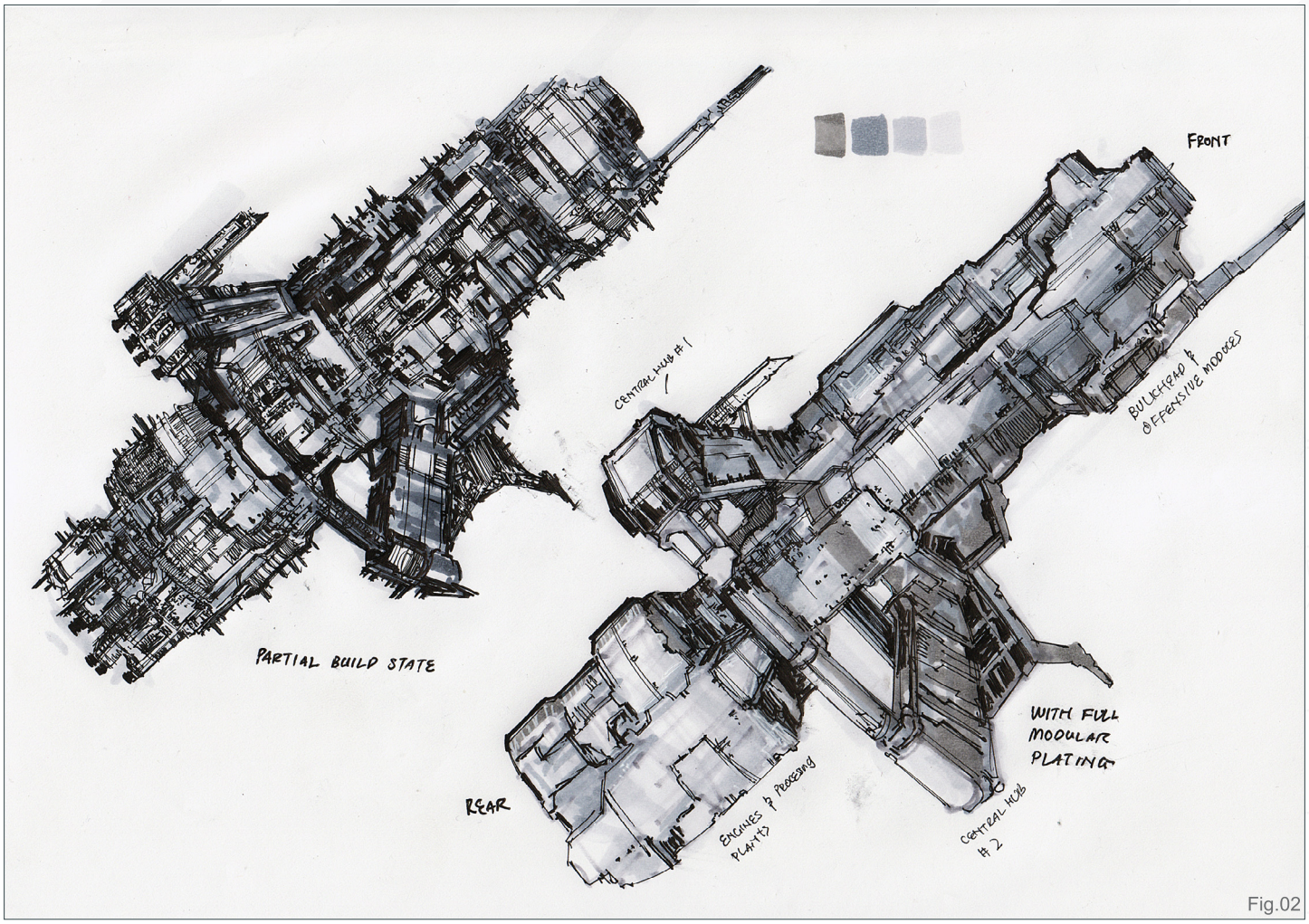

Fig.02

and intrusions. Working from the top left down towards the bottom right, the various styles and shapes that are explored range from industrial, cylindrical and modular towards the more exotic. The images at the top represent more conventional modular and symmetrical designs, whilst the middle images are more cuboid and lack a distinct shape. The lower images are more semi-organic or seamless, as if cut from a single slab of the same material.

Essentially, you can explore space technology as follows:

1. Conventional – Cylindrical, modular, semi-industrial, almost pin-point LED lighting and symmetrical

2. Advanced – More streamline or grandiose forms with less joins, piping and streamed lighting

3. Exotic/Alien-esque – Forms are more organic and smooth in nature; asymmetrical and fantastical shapes may be employed; generally appear highly advanced or non-manmade

Feel free to explore conventional and unconventional designs to achieve something that suits your production or environment, whilst keeping in mind the technological restraints of what your designing.

Battle Space Station Design: Construction States

In the production of space stations, it can be useful to envisage how it is built. Generally, the idea of a partially built, fully built and fully ruinous state comes to mind when considering the production of a space station.

In **Fig.02**, we depict a more militaristic space station in two states:

1. Partially built

2. Armoured

Using grey markers and marker paper, the structure is loosely based upon a cylindrical structure with four core values of grey: 10%, 30%, 50%, and neutral grey 50%. The overall forms are explored initially utilising the grey markers, 10% and 30%. One can create a varying stippled effect and abstract shapes using the chisel edged tip of most popular markers.

With regards to the **partially built** station design (far left), a state of construction can be accomplished by imagining the entire form bristling with partially connected tubes, external rigging, semi-formed plates and extruded layered forms. Another way to consider this is to imagine a gigantic circuit board overlaid onto a long cylindrical object when you design your space station.

In contrast, when considering a **fully armoured** station design, the main idea is to convey a

sense of interconnected plates and joins that fit together logically and with purpose. In addition, to add that menacing look, some suggestion of various weapon modules such as an extended frontal spike or a set of snub cylindrical shapes can help show-off the more aggressive form when viewed at a distance. As such, study of various predators can help convey the sense of power such as:

1. Wild Boar – Squat and powerful

2. Barracuda – Lean, mean, aerodynamic and armed with an amazing array of teeth

3. Crocodile – Missile shaped, low profile, powerful and heavily armoured top carapace; armed with multiple saw teeth, powerful jaws, powerful limbs and a tail

4. Anglerfish – 'Lophiiforme' lure (bony growth from its head acting like bait) complimented by a wide jaw armed with rows of long, spiked teeth, with a jaw and stomach that can be extended, allowing it to engulf up to twice its body size

Other predators to consider could include **eagle, cat** (**lion, tiger, panther), wolf** (etc.)

Fig.04

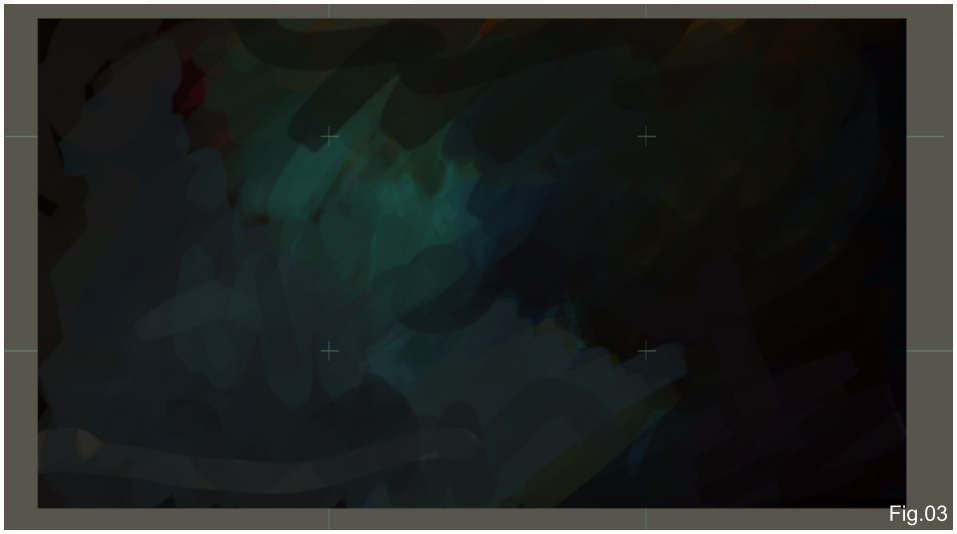
Fig.03

II: Illustrating Galaxy Space Station X

Setting up a space scene can take all sorts of routes. Previously we've explored an impressionistic **John Berkey** approach to illustration, a greyscale to colour approach, and lastly an industrial design with a 'form follows function' approach. In contrast, with this chapter we can now explore a more theatrical lighting situation, favoured by movies/game concepts, with the added free range "artistic license" for extra seasoning.

The thing is, for any production within a project, company or non personal work, one needs to constantly be aware of the fact that the artist has to balance realism with the target audience (i.e. the vision the client desires, the evocation the end viewer desires, and what someone wants you to achieve). It's about what the other person wants to feel, see and envision. Art for oneself, however, can sometimes produce some very interesting results. For when you are your own art director - your own painter for your own desires - then how realistic or abstract your image is depicted is entirely up to you. You can determine what the end audience feels.

Sometimes, the end result may not be as polished or finished as a professional piece requested by your client. Perhaps this may be because work produced for a client taps into a wider pool of design constraints and specific art direction, and involves at least two people in the creative process. Whereas, as your own art director, this feedback and to and fro process is less evident.

Setting up a Galaxy

For this illustration, the shot is produced without any preliminary study or definite design worked out. All that I know is that it will involve a typical widescreen/landscape aspect ratio.

Step 1: With reference to **Fig.03**, a greenish blue hue is the intended colour palette. The canvas is partitioned into thirds to provide compositional tools if required (the rule of thirds). A light source is established early on, but nothing too bright, to allow a narrow range of colour and value to work with initially.

I've chosen to provide an extra "bleed" area, reminiscent of how one may paint on a traditional canvas/watercolour canvas. Marked on the edges of these borders are also the one third marks (**Fig.04**).

Step 2: The next step is to expand this canvas more to include a counterbalance, such as saturated clouds of ochre (faint hint of yellow-orange - complimentary towards the cyan) and neutral blues. Broad strokes are best used for this initial stage to provide a rich gas cloud style in space. Clouds tend to have hard edges, and

thus the use of broad strokes would work well (**Fig.04**).

Step 3: Once a general palette is established, areas of contrast are defined and areas where the forms are softer can be blended to produce mid tones. In addition, economic brushstrokes are applied in the direction of the plane or counter to that. It's sometimes nice to leave some remnant strokes to help build up a random textural feel towards the background.

Step 4: The next step is to establish the light source and values as a compositional tool (**Fig.05**). The eye is drawn to areas of light and high contrast and thus the warmer orange-yellow gas clouds are softer, with less contrast.

Step 5: It is at this juncture that star systems and the brighter stars are established. Clusters of faint stars are unlikely to be seen by the naked eye, and will just appear as a lighter shade of gas clouds within a nebullaic region. Try to keep all the glows in check and not too bright compared to the brightest region in the nebula cloudscape.

Step 6: Try to finish the overall cloudscape as best as you can at this point. The chances are that once this is locked down and "signed off", you will not need to come back to it.

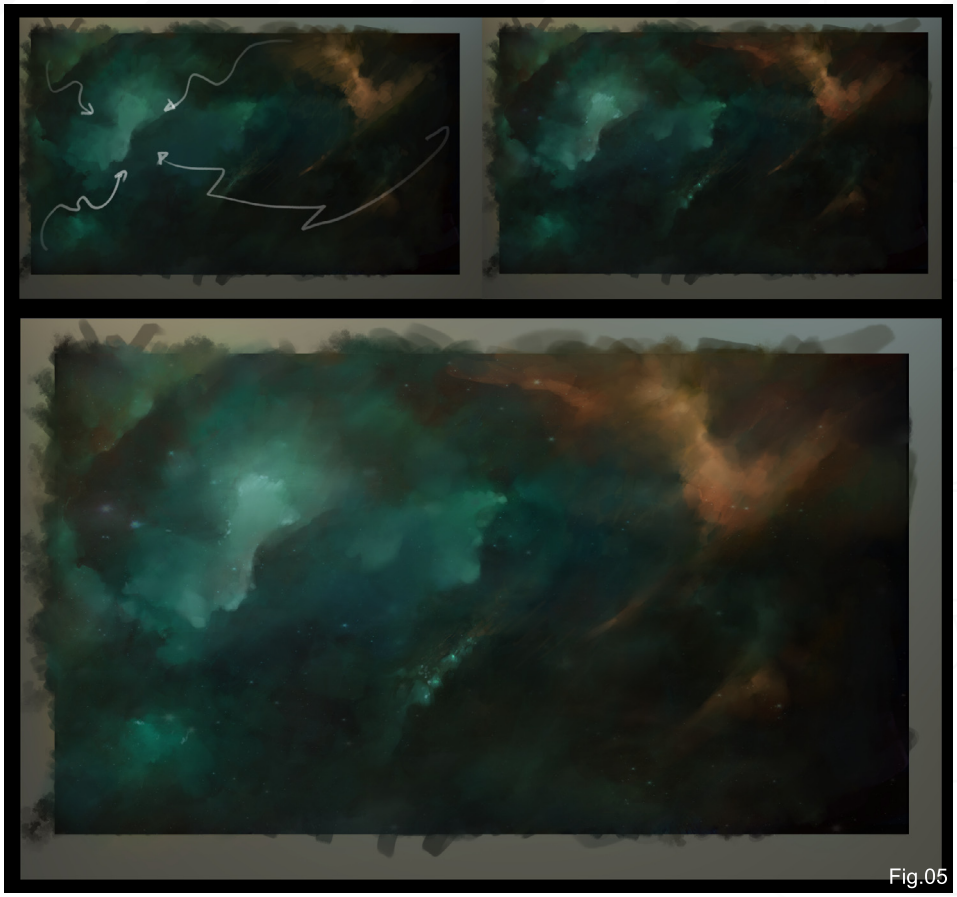
Fig.05

III: Space Station

The next step is to incorporate a typical space station design within the environment. Unlike the previous tutorials there are no finalised designs and we are exploring this illustration purely on an ad-hoc basis. What I can venture at this point is that the cylindrical 1950's style modules hold a certain retro appeal, and perhaps we can explore this further in the next section.

Painting with Light and Form

Step 1: Using primitive shapes of just cylinders, toroids and various flat panels, the initial design is blocked out as various interlocking shapes and forms (**Fig.06**).

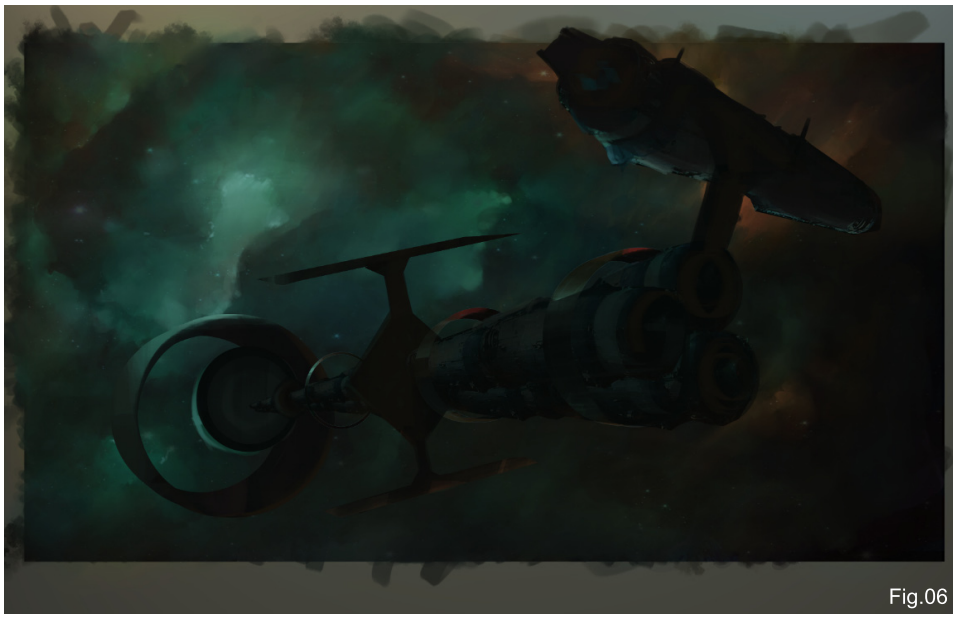
Fig.06

Subsequently, using the colour and light sources established in the background, these are painted relative to the plane and angle of incidence to the light sources. For example, light travels in straight lines, and as such, any material that light encounters is both reflected and absorbed (to an extent) towards the viewer accordingly.

Step 2: Now, if a realistic image is being sought, then the current illustration can be said to reflect the actual conditions as seen by the naked eye in space. And therefore could be said to be almost "finalised". However, for artistic and illustrative purposes, further levels of detail need

to be included to help the viewer read the overall image even more clearly.

A point to note is the strange horizontal cylinder near the top of the image. This depicts the first part of a large toroidal ring being constructed on top of the space station. This can provide a visual point of interest.

Step 3: The next stage is to make the level of detail and form more discernible to the viewer. Towards this end, the forward segment of the space station has appealing shapes that suggest a cluster of cylinders grouped together, and surrounded by a larger band of a toroid (**Fig.07**).

Fig.07

This outer band has a freewheeling longitudinal axis to provide a subtle artificial gravity for long term space travel, commute and habitation, and as a simple solution to counter bone density loss until alternative solutions such as bone supplementation or gene therapy are developed.

Step 4: Finer subtle details such as rim lighting and graduated edges are to be painstakingly added next, using a mixture of selections and simple painting techniques to blend various direct and ambient lighting sources. In addition, simple numerical decals are selected, warped and masked (onto a new layer) on various modules to help reinforce that element of human manufacture. These include adding tiny banks of lit windows, access panels and hatches that are probably not seen immediately except by those with a discerning eye.

Step 5: The next few steps are merely applying a methodological discipline towards the whole space station design without risking over-detailing on areas which do not require detail (**Fig.08**). This involves ensuring shadows are cast accordingly onto the various cylindrical forms, and, utilising the same principle, have painted bands of alternating darker colour onto a base white (of the overall station) – which is incidentally useful for reducing internal absorbed heat and thus allowing a nice use of hot and cold complementaries.

Fig.08

John Berkey would famously paint ambient, cool blues onto areas of relief on his primarily white base ships, with bands of red, orange and warm yellows for areas with light. And this works very well in depicting illustrative examples of space stations and space transport.

Step 6: Further details applied towards the front and rear sections of the space station involve adding further rim lights and glows accordingly (**Fig.09**), so that the overall form may read reasonably well. These include adding subtle panel lines and colour gradation similar to that produced by bouncing lighting off an aluminium coated pipe.

Step 7: Lastly, it can be useful to check that all the proportions are in place and fit accordingly (**Fig.10**). Areas to probably correct are the large toroidal shapes housed towards the rear (area situated furthest from the viewer) end.

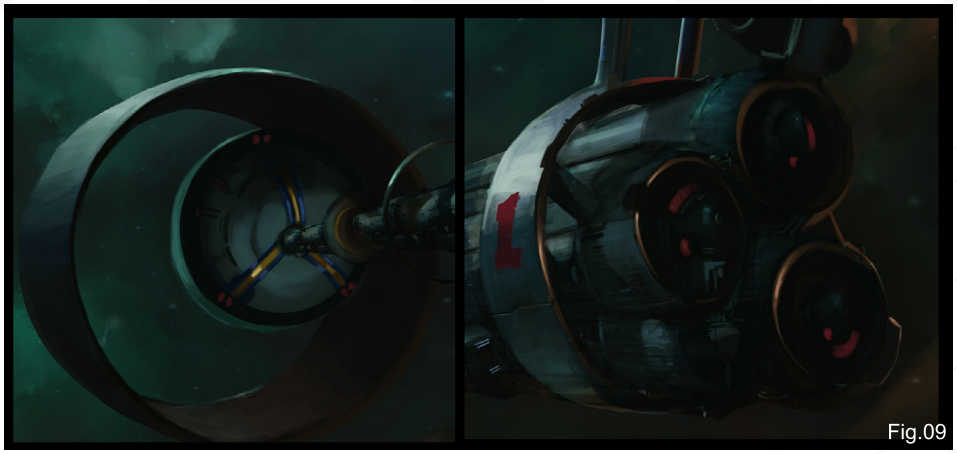
Fig.09

Getting Your Space Station Up & Running

To finish off your space station illustration, you can liven it up with various objects of interest.

Step 1: Various capital ship shapes are added in the far distance to help give the space station a sense of scale (**Fig.11**). In the foreground element, a basic tri-pronged cylindrical object is painted in to denote larger space ships. These have relatively short plasma contrails and a specific point is made to ensure the wingman is significantly smaller and closer towards the space station, again to show its potential scale. In the mid ground there are three groups of sorties that help denote a flight of active space vessels performing their protective defence roles.


Fig.10

Step 2: To reiterate, relative scale is hard to judge in space due to the lack of atmospheric


Fig.11

perspective. Having said that, one can cheat a little by adding some very faint atmospheric perspective, which can be deemed as reflected light from space dust and debris.

Step 3: In **Fig.12**, the core structure of the larger outer ring is finally installed. Along this circular path, various modular segments and panels will be installed to form a new toroidal segment for future low gravity habitation and storage areas.

Step 4: In the next step (**Fig.13**), the close-up details of the toroidal ring structure are being


Fig.12


Fig.13

constructed. To further reinforce it, negative black shapes are cut into the ring to give it depth, breadth and three-dimensionality.

To finish up, various perspective issues are addressed, including the upper flat solar panels and the large spherical engine quarters (far left end), and there you have it – a fully working space station (**Fig.14**).


Fig.14

IV: Blowing It Up

In the second element of this workshop, we plan to blow up the space station. Yes, we're going to blow it up to explore how light and large explosions can be depicted whilst still using only simple forms, to cast light and shadow and minimal detail.

Step 1: The first step is to break the whole station up (**Fig15**). Assuming you have kept the whole station on a separate layer/group from the background, it is only a matter of selecting different segments and relocating them at variable distances from their original location (as a whole). The trick is to not scatter the various parts too far from their point of origin. This is so that you can depict the station as part-drifting-part-exploding/burning in space.

The thing to remember is that unless there are reservoirs of oxygen in abundance, it is unlikely that these fires and explosions will last long. Chances are they would appear as a bright flash, whilst electrical fires arc from point to point. Nevertheless, capturing such key scenes are fundamental as the pay off for main shots within any film or game project.

Step 2: Next, on a layer below, a base colour of orange is applied on areas which may contain reservoirs of oxygen (**Fig 16**). Again, one may

Fig.16


Fig.15

argue that such explosions will tend to burn blue primarily, but choosing a more realistic option tends to clash with the ambient colour chosen.

Step 3: An artistic choice would be to stick to the familiar orange-yellow fires seen in typical land-based explosions - so long as one understands the active myths and choices made in perpetuating such images in popular culture, all in the name of artistic license. Sometimes, you will not have a choice in the matter. It is therefore advisable to keep this "effect glow" on a totally separate layer so that you may change its hue, colour and saturation easily in the future. To go one step further, have the whole form of it masked out onto an alpha channel (just as a precaution).

Step 4: Subsequently, a base yellow glow should be applied towards the central areas of the explosions. Fire tends to be bright and desaturated in the middle with tinges of saturated red on its periphery.

Step 5: As before, it's a matter of methodically applying the same principles of glow and lighting throughout the whole image and lighting every area behind the forms (whereby the overall forms act as a mask against the glow in contrast).

Step 6: Now that you have tackled depicting the glows behind the space station, repeat the same principles in front of the station onto a new layer (**Fig.17**). The nice thing is that a judicious use of atmospheric perspective is entitled to suggest various objects being in front and behind one another, relative to the explosion.

Step 7: In the bottom right is the whole illustration applied with a Blur > Radial Blur set to zoom at 10%. Ensure that the whole image is duplicated beforehand, before applying the blur. Then apply a layer mask onto the whole image, as if the whole effect has not occurred, before repainting the blurred elements onto any peripheral edge of the explosion and objects. A good source of reference for this are racing photography, which enable

us to study the effects of objects in firm focus whilst the edges or backgrounds become blurred. Such study is critical in being able to determine your field of focus, and how you choose to depict the action of your scene.

Step 8: The next step is to add some small degrees of debris, depicted by tinier fragments exploding from the central explosion (**Fig.18**). Such finer details may not always be necessary, however it can help to add a further degree of realism to your illustration of a key scene.

Step 9: Lastly, you can depict various vessels escaping the blast by producing various shots of large vessels heading out from the centre of the field of focus. Towards this end, we will block out a number of different shapes without any set design (**Fig.19**).

Step 10: In **Fig.20**, a relatively aesthetic looking form is used to depict a large frigate-like ship (lower left). Using the local lighting from the explosion, red and green complementaries are applied throughout the whole form, with tiny rim lights on areas that turn.

Similarly, the larger destroyers (upper left) are blocked out using ambient green values initially, with bands of orange to help define the whole form. On second analysis, these shapes appear not as streamline and thus a small

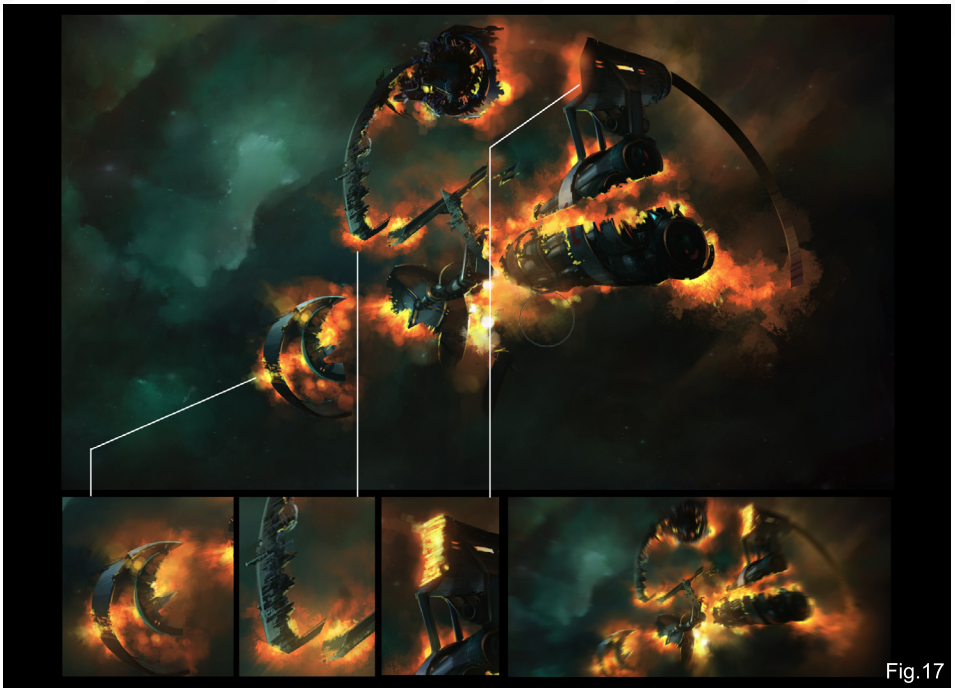
Fig.17


Fig.18


Fig.19

transformation and erasure help provide a more streamlined form.

These shapes are duplicated at various sizes and placements to depict distance and scale. To really finish it all off, add some subtle contrails and glows to suggest engine washes and that these vessels are escaping from either the station or departing from a successful raid.

And there you have it – a fully blown up space station!

Conclusion

This concludes the transport section of this space series. For those who have followed this tutorial series from the beginning, I hope that a good range of basics and fundamental (no holds barred) approaches towards tackling each theme and design according to the desired end result has been of some use. Our next step will be to cover Sci-Fi environments, interiors and mood shots that depict key scenes within movies and games. As always, please feel free to drop me an email with any enquiries, feedback or help in relation to the content within these space tutorial series.

Dr Chee Ming Wong

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Fig20

Chapter 09

SCI-FI HANGAR

SPACE PAINTING
CHAPTER 09: SCI-FI HANGAR

Created In: Photoshop

Introduction

Welcome to the sci-fi and space painting series. In this ninth chapter of the series, we'll be exploring sci-fi hangars.

A hangar represents a unique set design in the production of any sci-fi genre blockbuster film, or interior set design for games. Namely, it has to achieve a few functional qualities, offset by providing a relatively bland backdrop. As such, let's first of all explore and discuss the methods used in production for this purpose.

In production, the focus should primarily be efficient and effective methods of communication in the generation of ideas. Time is often not a luxury, with turnarounds generally occurring within a day or two.

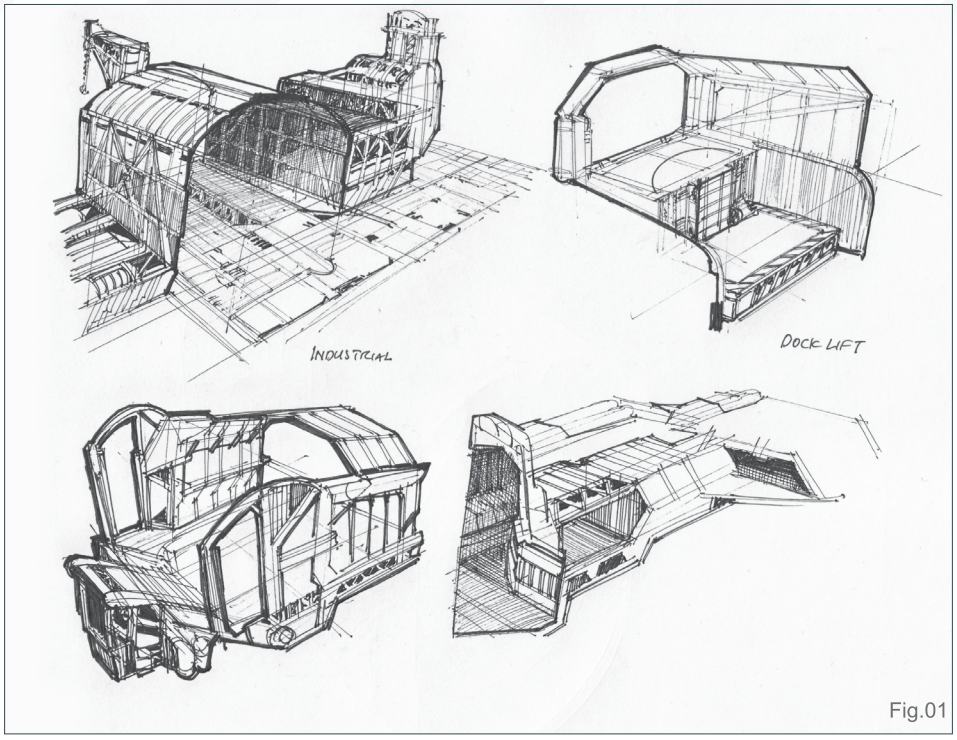

Fig.01

For example, an ideal workflow for a single asset could involve:

- **Day 1** – Thumbnail and idea generation
- **Day 2** – Based on the approved idea, you may be given half a day to explore the asset further or to flesh the design in additional detail. If lucky, your design is really taking off now and will be heartily approved. You'll start a basic colour and mood pass
- **Day 3** – You may spend the day bringing your idea to completion. Often, you will be asked to start work on other art assets and, as such, time management is the key

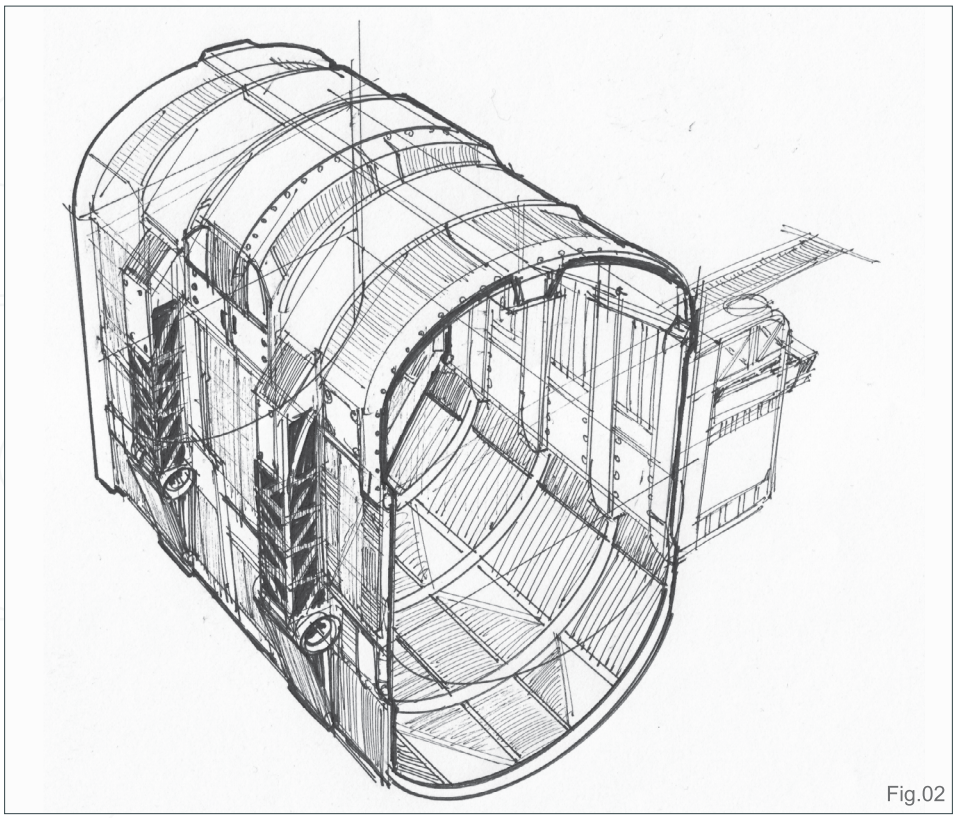
Fig.02

So let's first examine the practical and safety issues required with the commissioning of a typical military/commercial-type hangar installation, and extrapolate from there.

Overview

To begin, let's consider the establishment of a new base of operations for a commercial port/airbase, or military airbase. All of these installations would require or benefit from a systematic systems analysis of the various strategic, commercial, defensive and operational considerations of establishing a new base of operation. As just a basic overview, the following would be the various aspects to consider if one were to commission and build a new base.

Fire & Safety Features:

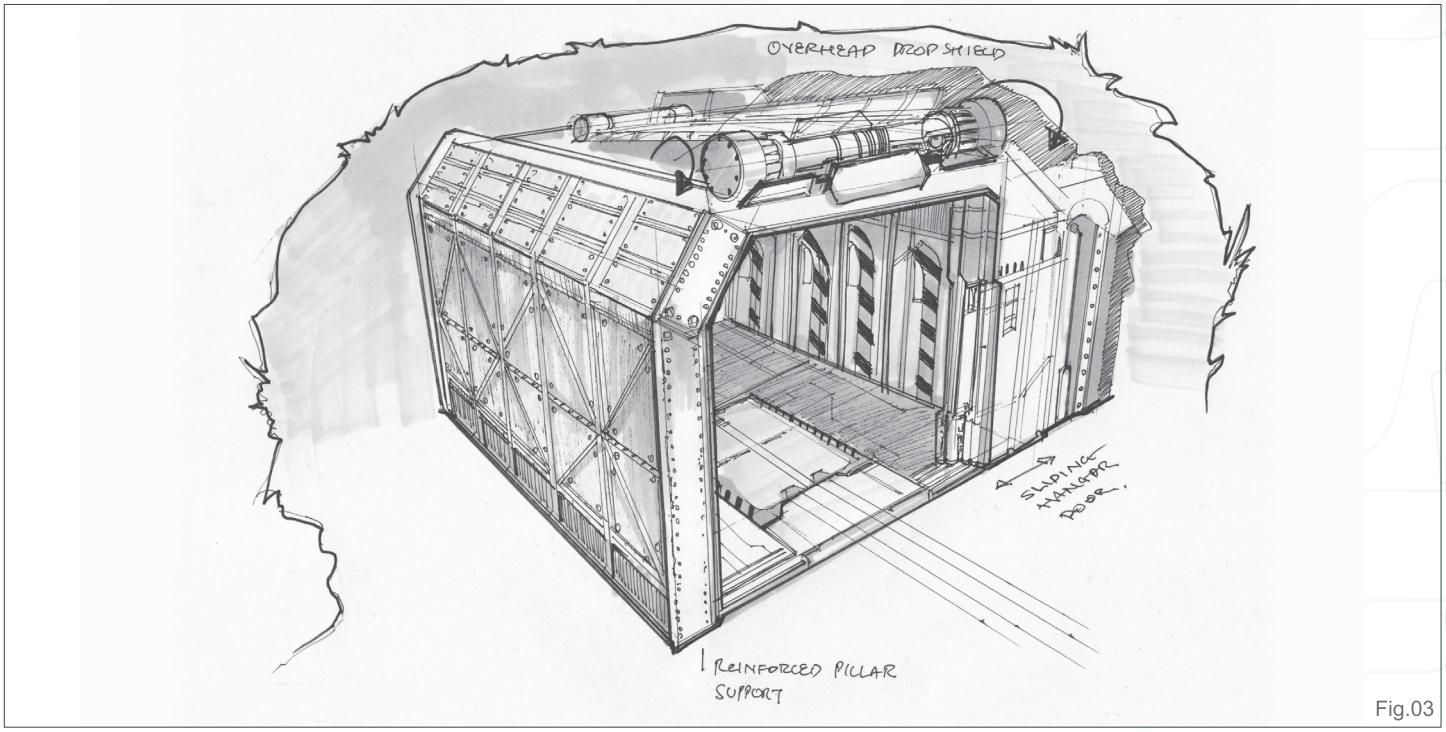

Fig.03

- Fire safety clearance
- Fire protection – foam & sprinkler systems:
  - Electrical
  - Fuel/explosion
  - Static
- External durability
- Internal rigidity

Defensive Features:

- Concealment
- Armoured and structural integrity
- Security

Base Cost:

- Strategic location
- Upkeep
- Cost of building installation
- Cost of refurbishing/extending existing base of operation
- Logistics
  - Fuel, resupply and storage
  - Personnel training and efficiency
  - Augmentation of personnel
  - Costs of operating in special/ extreme weather conditions, e.g. arctic, underwater, underground, zero gravity, etc.
- Critical operational distance
- Political considerations
- Overseas/offshore bases
- Duration of base operations
- Maintenance and repair facilities

Thankfully, for the entertainment industry, the aspects of believable functionality and relative authenticity are the key issues when working the above into a production set.

1: Set Design Production

Hangars are primarily built for aerospace transport, and serve to provide some rudimentary protection compared to exposure to the four elements. Early 19th Century hangars were from adapted woodshed, cattle pens and were of a makeshift nature. In fact, the earliest hangar producer, REIDsteel was established in 1919 following the landing of the famous French aviator, Louis Blériot (who was the first to fly the English Channel) when he landed his monoplane and stored it within a cattle pen. Subsequently, he ordered three new hangars from REIDsteel and they have been in the aircraft hangar business ever since, producing hangars for all sorts of commercial, business and military purposes.

In **Fig.01** we're looking at a variety of possible hangar designs that may be suitable for a futuristic hangar set. The main thing to note is that there is limited variation of how tall, wide or shaped a hangar can be, due mainly to practical issues such as wind force and natural weather issues, or the simple fact that a variation of a rectangular box involves having primarily either a taller A-shaped frame or semicircular roof, or various shapes in-between the two.

The industrial semicircular hangar design (**Fig.01 -** top left) is quite reminiscent of existing hangar designs; due to simplicity and ideal characteristics of its shape and construction, these simple hangar designs would be seen to persist in the future.

The futuristic design (**Fig.01 -** bottom right) hangar is envisioned to be built of sturdy reinforced materials. To translate these as a sci-fi design, often the main choice involves the incorporation of a semi-octagonal-to-hexagonal-and-angular type frame.

For military purposes, hardened hangar designs are incorporated. These can range from steel clad hangars with local environmental factors,

such as high winds, local rain and weather, incorporated into the commission. Towards the opposite extreme, reinforced concrete and additional protective measures (e.g. camouflage, building into local geology, etc.) are factored into a commission when these are built.

In **Fig.02**, the industrial shaped design from **Fig.01** is taken one step further, to perhaps serve as a multi-purpose hangar/dock for future spacecraft that can land on both water and in the air. The natural buoyancy afforded by water-based structures can often be appealing from the matter of an underwater concealed base. To serve both a dock/hangar and dry dock function, the additional vertical depth is considered and allows for versatile functionality for a variety of transport. This leads towards a simple, but important, matter … The door.

Hangar Doors

Hangar doors tend to be quite simplistic:

- Vertical lift doors (can be expensive if the entire width of a hangar entrance is required)
- Shutter doors
- Crossover doors (part of the entrance can be opened, but not the width at the same time – the more leafs, the more expensive)
- Outrigger doors (if the whole entrance width is required, out-rigging allows for lesser leafs, and full access to the entrance)

Non-commercial/civilian hangars can be more complex and can include the following for consideration:

- Reinforced (built to withstand an immediate direct assault)
- Blast and pressure sealed doors (heavier, thicker and built to withstand extremes of pressure/conditions)
- Concealed

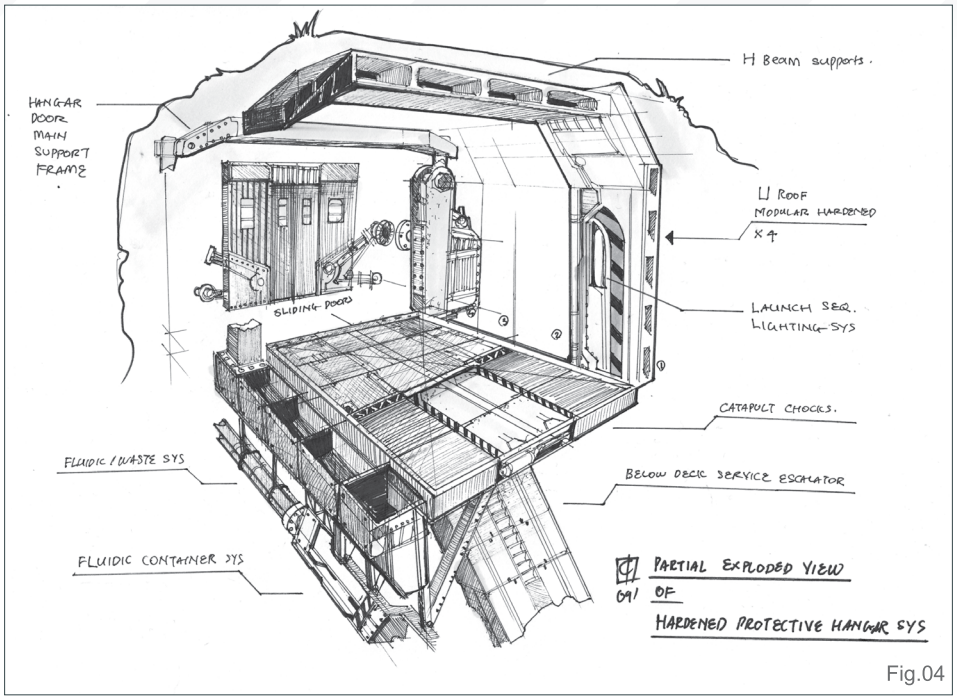

Fig.04

II: Hangar Design Production

The Traditional Approach

The next aspect to consider is to bring our existing knowledge of hangars and apply them towards a fictitious sci-fi setting. During the production of art for games and movies, a simple three-quarter perspective view (**Fig.03**) can be quite informative. This provides some degree of three-dimensionality and various aspects of the design can be immediately considered:

- Functionality and believability
- Scale
- Local geology
- Surface material used
- Allows for simple and direction annotation
- Media – traditional/digital methods may be employed

In essence, from this one single view, the artist should be able to determine if the set design is functional and looks like it would fit within the universe/story being told. Simple aspects of scale can be garnered by the use of a placeholder object, e.g. figures, transport and objects such as the size of bolt holes, windows, tracks and ladders.

Local geology means you can incorporate the hangar within a cliff side or hill top (see **Fig.03**) and get a feel of whether such concealment would be believable or not. Simple suggestion of surface materials, e.g. metal, wood & plastic (etc.), can be suggested to appear solid, fragile or able to withstand a direct heavy assault. Best of all, most of this can be performed with simple tools, like a pen and paper – or digitally.

In production design, it is also quite useful to be able to separate the various elements to show a cutaway design, to describe its functionality further. In **Fig.04**, the hangar design established in **Fig.03** is further described to show that it has the ability to have a lift system that could perhaps lead towards additional underground

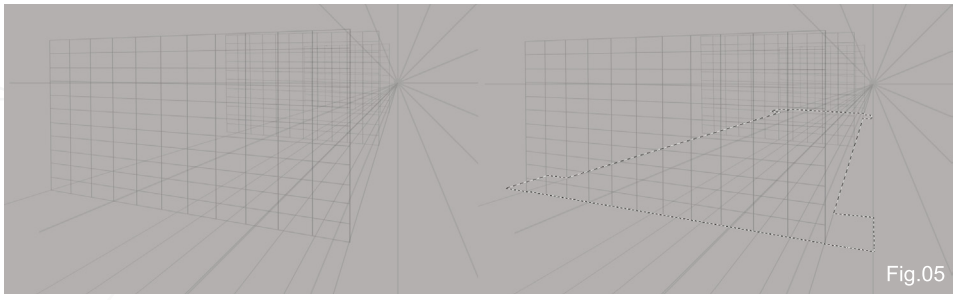
Fig.05

storage. Other aspects, such as life support systems, ventilation and piping can be described. Furthermore, the incorporation of various aspects such as hydraulic powered hangar doors can be explained further, and how the hangar is reinforced externally and internally.

III: Hangar Design Production

The Digital Method

These days, the generation of such sets can be rapidly built using “block models”, produced in any 3D programme. Such block models are simple geometrical representations that take into account the perspective and scale of large shapes and forms of objects relative to one another. The offside of this is the required familiarisation with any 3D programme, ranging from freeware such as Blender 3D, to Google SketchUp Pro, to industry standards such as Maya and 3d Studio Max.

For the purposes of this tutorial, however, we will be using Photoshop to produce a similar process primarily using the line tool and perspective as our main tools.

Perspective Grid

The success of this methodology requires absolute correct and accurate perspective being set up initially. In **Fig.05**, a simple one-point perspective is set to the right (with an implied hidden second point perspective mirrored on the left). A cattle grid of squares is locked out in perspective, vanishing into the horizon.

The next step involves masking out a base using the lasso selection tool (L). The following aspects are relatively straightforward. As long as the bounding aspects of the initially established perspective are adhered to, the realisation is a matter of designing within this three-quarter perspective grid using the line tool.

In **Fig.06**, we outline a simple six-point approach from start to finish:

- Using the established perspective grid, you can plan out an angular-shaped hangar. Try to think in a modular fashion, and incorporate that into building a modular ceiling support

- The next aspects to consider are some side ceiling slats, to allow natural lighting to filter through. Additional foreground elements, such as an outrigger support for the hangar doors, are considered

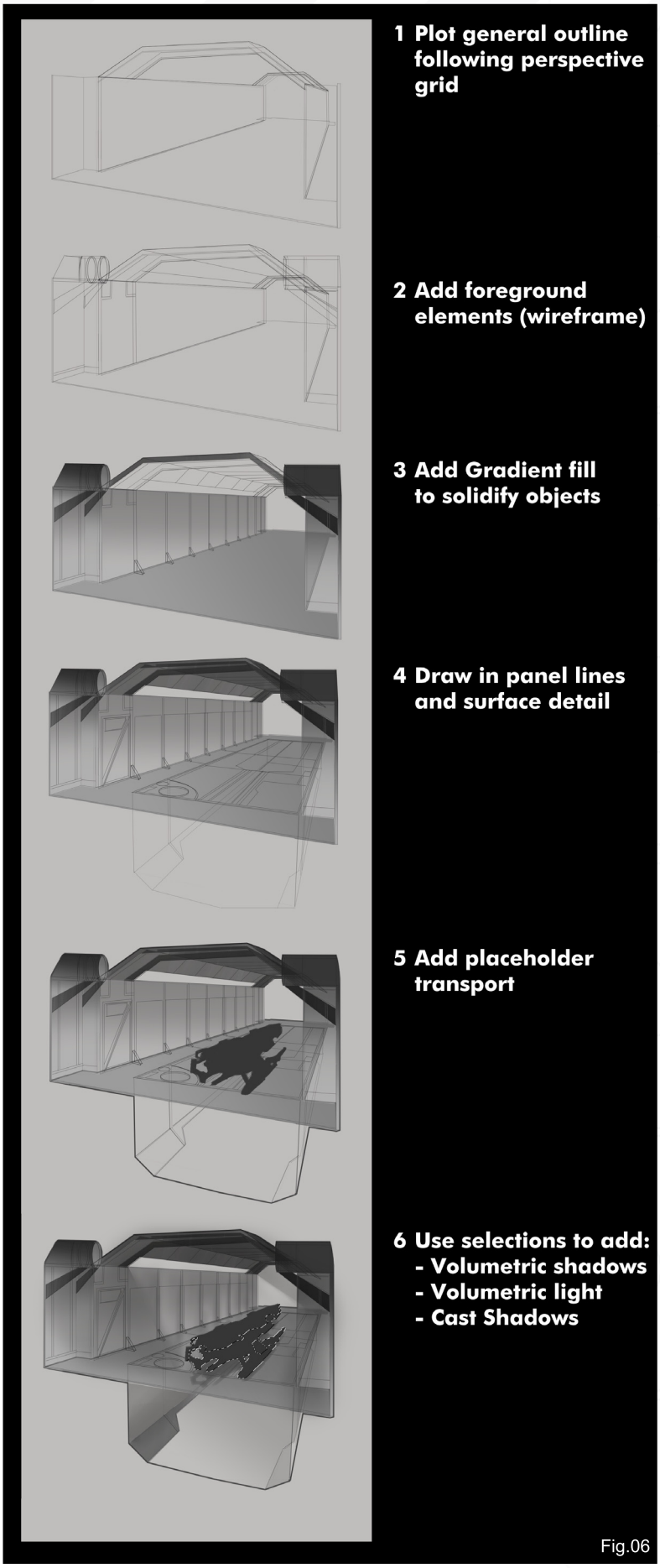

Fig.06

• Once the main details are added, use the gradient tool to lightly give your wireframe construction some solidity and suggestion of surface material

• Adhering within the perspective, you can lathe in further panel lines and details

• To add an underground storage, a lower line drawing is added. To further reinforce the scale, the shape of a futuristic transport is also added. Try not to spend too long thinking about how this transport may look; it merely needs to function as a placeholder and be in the right proportion/perspective to suggest scale – that is all

• Finally, additional touches such as lighting, cast shadows and ambient occlusion can be added onto various layers

Your product is now relatively ready to be shown as a basic idea to the producer, at this stage. If time remains, you may choose to apply a basic colour pass, or even take it into a painting or illustration.

IV: Hangar Design Production

The Marker Method

Once the initial idea for the hanger set is designed, you may chose to work it up as a marker and pen study/design. Markers and pens afford another dimension of the rapid generation of ideas, and the tactile feel allows artists to think the design through without the abstraction and distraction of a more digital workflow. However, some artists are more comfortable using a purely traditional or purely digital workflow, and at the end of the day, whatever works most efficiently for you is the best methodology for you – and you alone.

In **Fig.07**, an adaptation of the initial sketch produced in **Fig.02** is utilised and extrapolated into a more sci-fi feel – i.e. more angularity is employed. In addition, the idea is to produce a rough idea to explore the suitability and functionality of the hangar design. As such, a clean finish is not required. The whole purpose is exploration of ideas, rapidly and efficiently.

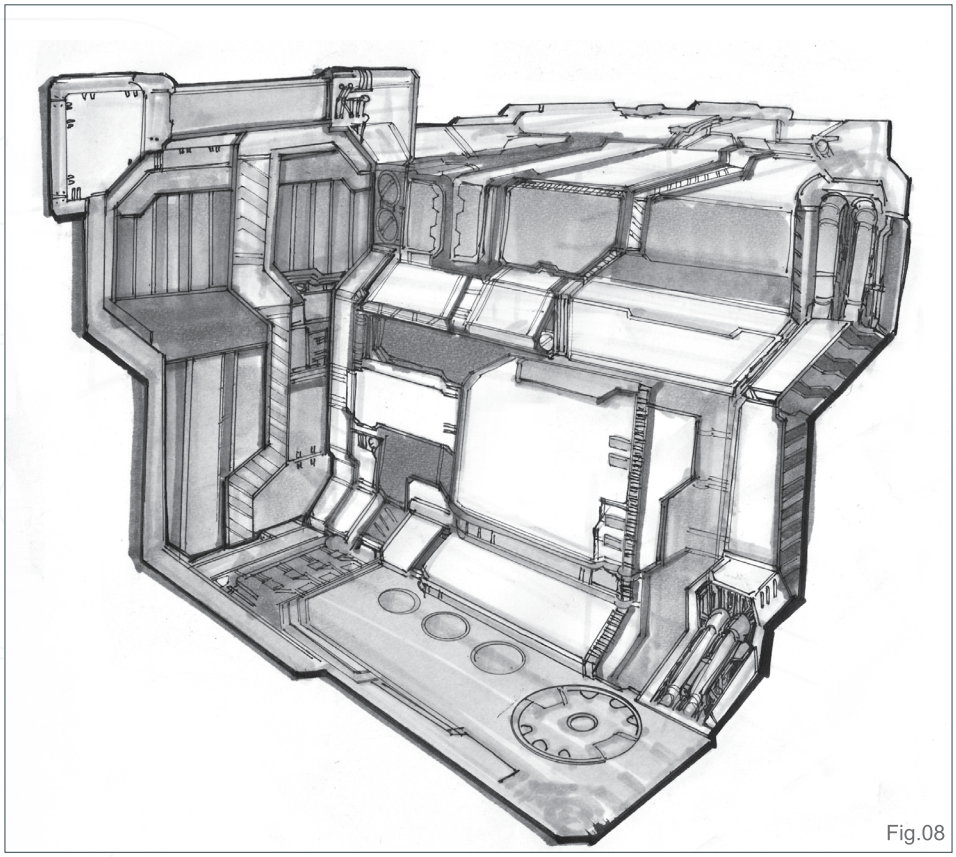

Fig.08

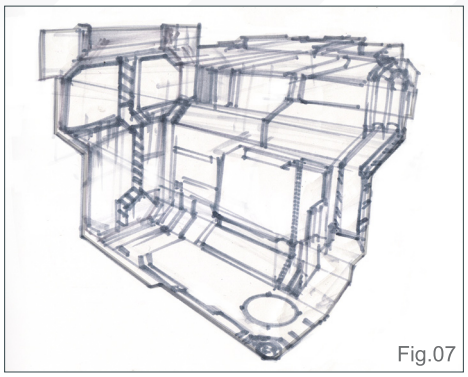

Fig.07

Using this method, various aspects can be explored, such as:

• Hangar doors – have angular, 45-degree corners
• Extrusion – each object has a level of extrusion to lend to the depth and form
• Repeating angular shapes – to reinforce the style and feel
• Design elements – ladders, sinkholes, blast pressure sealed doors, reinforced control towers and windows are included to provide this hangar the ability to store a spacecraft, or a variety of space/water-based transport

In **Fig.08**, the overall forms have the same colour gradation to suggest large surfaces or similar materials. This allows for smaller forms, such as pipes, doors and caution markings, to pop forward. If time remains, the use of a white pen can be used to add specular and highlights. Once you've shown the producer, if the idea is approved, you can then use this initial rough marker sketch to redraw it to produce a cleaner, more professional finish.

V: The Hangar Design

Illustrated

Now that you are familiarised with the variety of methods used for production design, we can explore the industry methods of producing a mood piece for production purposes.

Organising your Digital Workflow

For the purposes of an illustrated mood piece, some basic organisation of layers can be helpful. More often than not, artists choose to save multiple PSD copies, e.g. version 1, 2,

3, 4, etc., and these can cumulatively grow in size, but provide future security if you do need to go back to an earlier piece that had a missing layer or alpha channel that your later images lack. Whereas, other artists have really amazing organisational skills and good habits, with the naming of each layer organised into layered groups.

A suggested organised layer workflow could be as follows:

1. Group – Junk (hidden)
2. Group – Perspective grid (hidden)
3. Group – Post processing II: particle effects
4. Group – Post processing I: colour changes
5. Group – Final details
6. Group – Lights
7. Group – Foreground elements
8. Group – Objects
9. Group – Background
10. Background

Note: In Photoshop, you can group a bunch of layers into a folder and give these folders a specifically assigned name. This allows for easy reviewing of various elements.

Inevitably, there comes a point where an image is primarily 60-80% complete and can be painted flattened, as you fancy.

Painting from Dark to Light

For an environmental design with a fixed design, it is often easier to start with a greyscale-to-coloured approach Primarily, this is to ensure the design elements adhere closely to any concept you have worked up prior.

In **Fig.09**, the greyscale images start from a darkened canvas. The workflow and reasoning is thus:

- **Initial Exposure** – Imagine you are a room without any lighting. By painting in the first strokes of light, you establish your light sources and lightest parts
- **General Forms** – With the established light sources, you can further expand and work out the general shapes and structures
- **Perspective Correction** – Although most images can be painted initially by eyeballing the shapes, inevitably it can be useful to plot in a perspective grid, to provide corrections to lines that you thought were parallel but actually have broken geometry/perspective

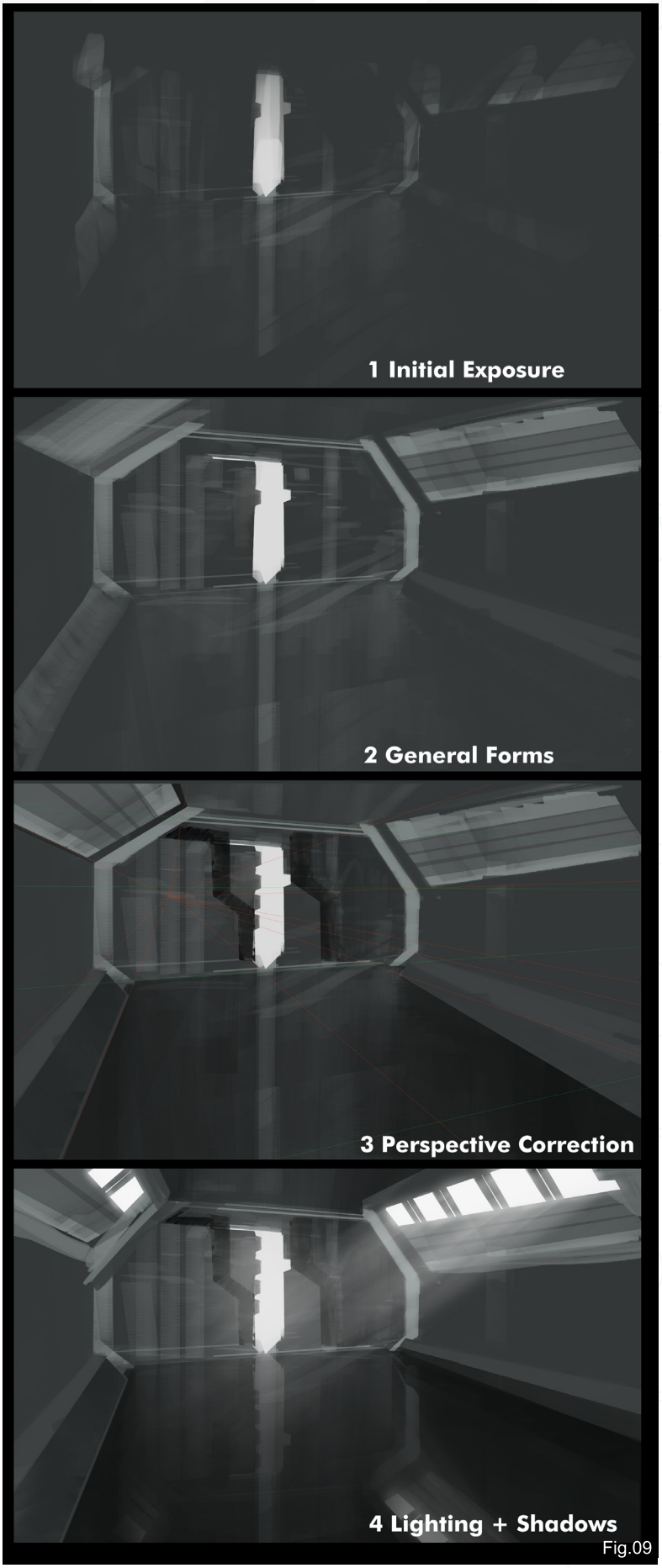

Fig.09

• **Lighting and Shadows** – Further elements of external lighting and general shadows can be added. In our illustration, the hangar is partially submerged with water, and thus acts as a natural mirror

Now that your initial hangar structure is built, the challenge comes in providing adequate lighting and object interest. In our hangar illustration, I had an idea of a futuristic space vessel that could be docked in water, on land or in space – and thus has natural buoyancy. I imagined a fairly large gunship or vessel that has 40-60 odd crew members.

The Dangers of Ad-Hoc Transport Designs

In **Fig.10**, this set explores different transport iterations. Unlike our previous tutorials, the object interest was built from shapes and forms, and retrofitted with a functional look and ad-hoc feel.

• **Initial Design** – I felt a semi-angular and sleek-shaped transport with a vertical external command tower would be a nice direction

• **Exploration** – Various ideas to explore a docking platform of sorts was looked into. However, the shapes were perhaps too complicated, busy and distracting overall. So the design is killed here

• **Revised design** – Perhaps a space battleship can lend towards a more epic feel? I have to thus go back into an earlier PSD and retrofit the hangar to look bigger, and redesign an ad-hoc space battleship

• **Alternative Direction** – Sometimes when exploring ideas, the silliest thing comes to mind. To paraphrase the lightsaber type duels between Dark Helmet and Lone Star of Spaceballs fame (infamy), “My Schwartz is longer than yours...”

Note: I included this WIP step (4) because it reflects the truth that concept artists tend to be creative in a variety of ways – to the extent of making fun of their own paintings. Not everyone gets it right the first time, and the main thing is to exorcise you lesser designs, until it feels right.

On the Right Track

Right, so settling on a more definitive transport design for object interest, we settle on the space battleship as the direction to pursue **Fig.11**. The overall forms are bulked up further, and some

Fig.10

care is spent on the volumetric God rays (on a separate Lighten layer).

The next aspect is to perhaps think of building some scaffolding and walkways to populate within this scene. In **Fig.12**, a simple mixture of custom scaffolding and patterns are painted in Photoshop on a new image. Using these shapes, the remainder of the scene is populated with scaffolding, walkways and bounced light to suggest reflective metal. In addition, some human figures are also added to provide a sense of being within the scene, and scale.


Fig.11

Greyscale to Colour

The transition from greyscale to colour is inevitable (**Fig.13**). At some point in this process, every artist has to add colour and make the image work, and a whole variety of existing and new methods exist to make that transition. The main thing to keep in mind is a definitive colour palette, and trying to make it work with the scene.

In **Fig.14**, I settle on the colour of the water – a light, iridescent green – as part of a sea dock/ hangar combination. With green as the main colour, this leaves two possible main choices:

- Adjacent colours of yellow and blue
- A complimentary red

I opt for the former, and include a basic colour pass. The image inevitably goes through the "ugly duckling" phase where colours appear washed out, and forms not as strong as they should be. The main thing to keep in mind is

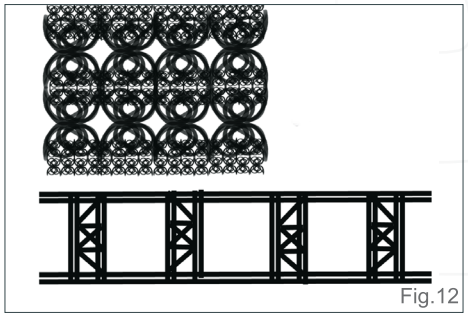
Fig.12

that everything is remediable. And if stuck in this situation, try to work through it methodically and figure out what is required to make the image work.

You should ask yourself: Is it:

- The overall forms?
- A lack of definitive value?
- A lack of focal contrast?
- Conflicting compositional elements?
- A non-ideal colour combination?

In **Fig.15**, these problems are addressed by primarily:

- Strengthening the shapes and forms
- Using cleaner selection edges
- Including ambient and bounced light
- Using layered objects
- Adding bounced caustics from the water, to provide an under lit surface to the object interest

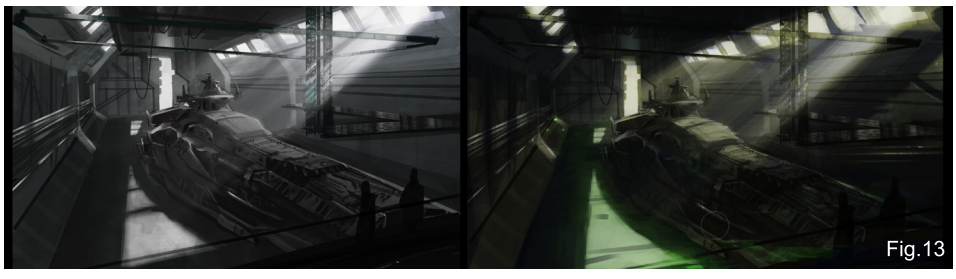
Fig.13

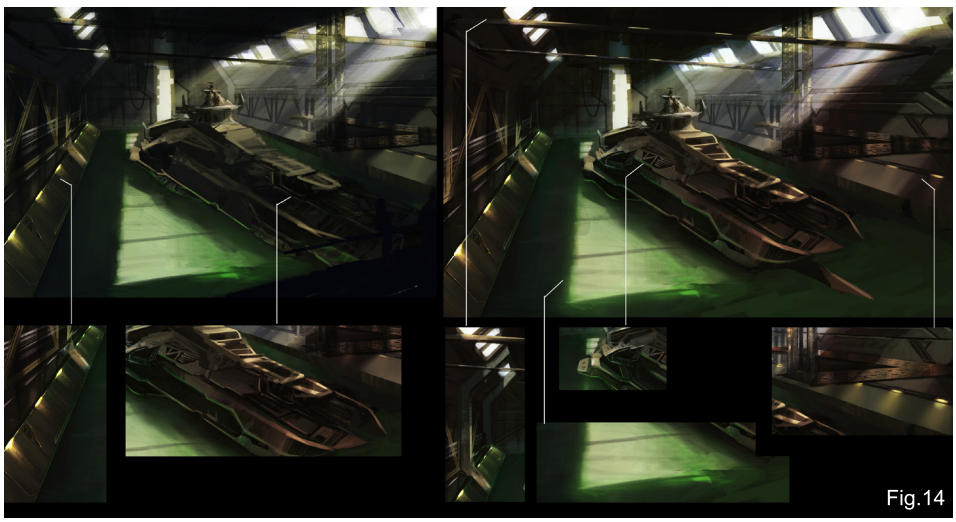
Fig.14

The next aspect (**Fig.16**) is to add further focal detail and tone back various aspects of the image so that they do not all compete in detail:

Things that were considered:

- **Atmospheric perspective –** Objects in the distance should appear further away and contrariwise for objects in the foreground

- **Construction –** The use of blue lights and sparks from local construction workers can help give the sense of this large vessel and subject interest

- **Lighting –** Bringing back the parallel God rays helped to sit the large space battleship into the image
- **Perspective –** Rechecking that all the elements fit the initial perspective grid

- **Specularity –** The lit vertical supports were masked out using the pattern established earlier and the right desaturated coloured light was used to show it being in the mid-ground
- **Light and Shadows –** Re-establishing that the cast shadows from the various structures followed the forms accordingly, to provide a more solid sense of structure

The mood piece is now almost ready for presentation. To bring it more into focal detail, the main horizontal axis of the transport is worked on and the foreground elements are removed temporarily to work on the background and main transport. Red signage and large LED type structures are installed to provide relief to the primary yellow-white of the overall structure (**Fig.17**).


Fig.16


Fig.18

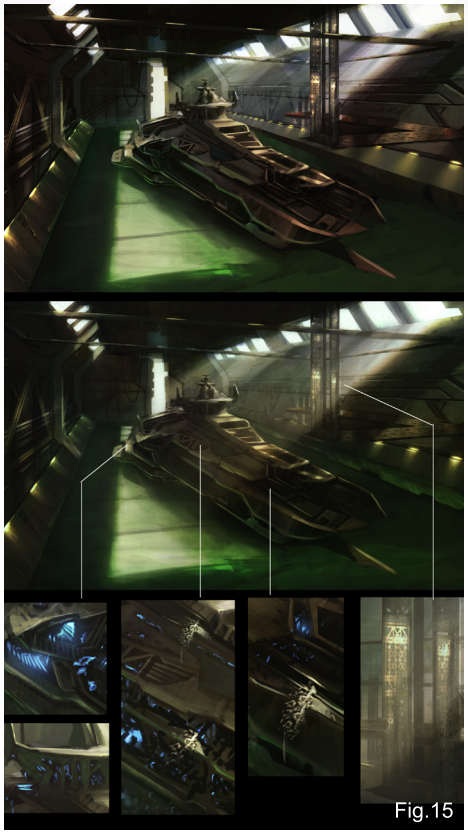
Fig.15


Fig.17

Finishing Touches

To complete the image (Fig.18), the re-installation of the foreground catwalk is reintroduced. Using a careful masking of the pattern texture built earlier, the foreground catwalk is rebuilt and lit accordingly to appear 3-dimensional.

In addition, I relocated the placeholder figure to the far left, and decided on a more recognisable navy uniform feel to situate the viewer into the mood piece. As a final twist, I go back in and change the overall colour palette to a red-green complimentary, instead.

Optionally, you can choose to re-colour or relight the whole image to explore different colour

(warm, cold, monochromic) and lighting (darker, greyer) situations.

Conclusion

Well, that's the first environmental related sci-fi tutorial that we have covered. In these final tutorials, the aim is to share all the studio, production and troubleshooting approaches used for professional work. I liken the concept design process as a visual design and troubleshooting exercise – nothing glamorous or fancy, just good, progressive ideation.

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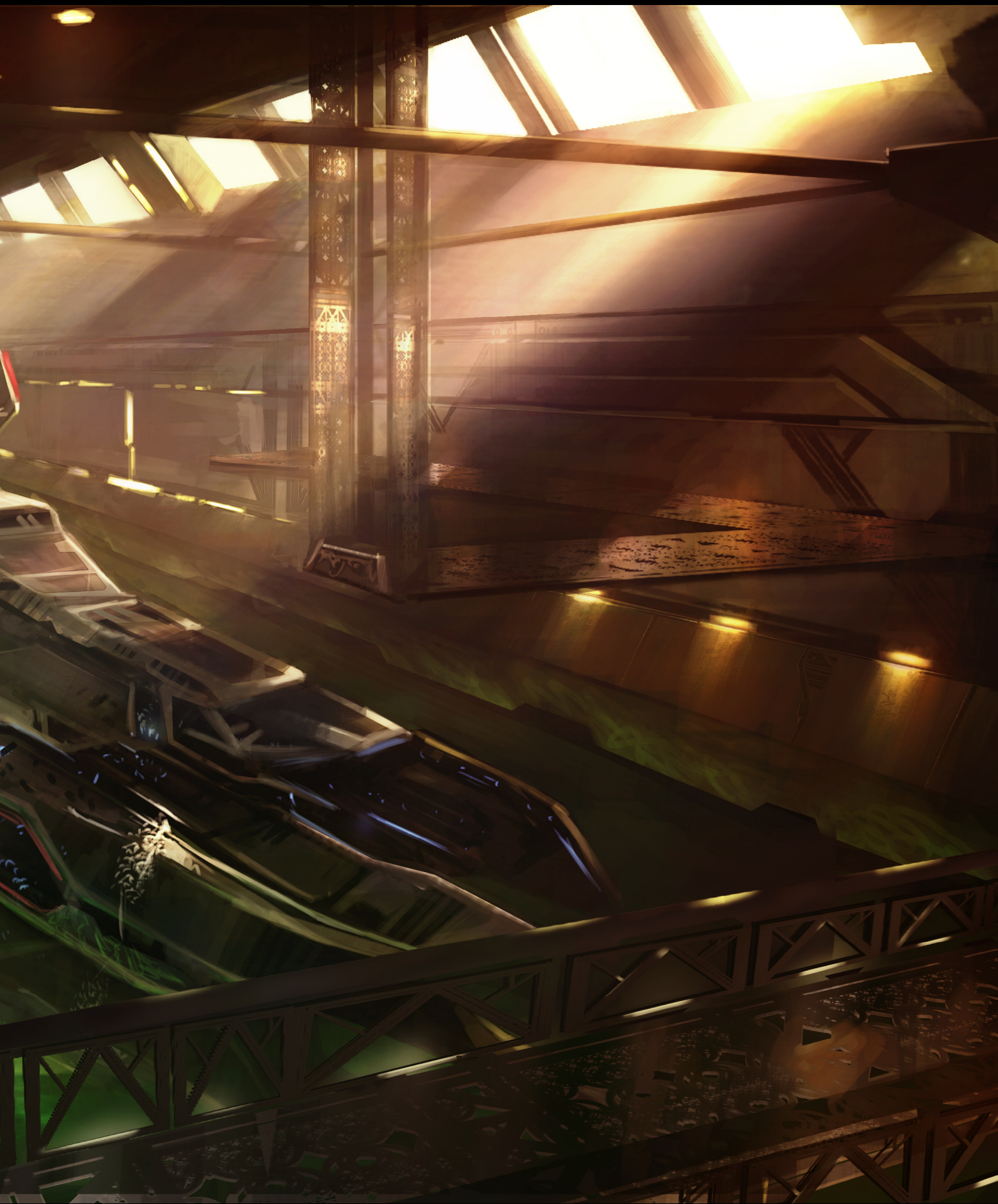


Chapter 10

SPACE BATTLE

SPACE PAINTING
CHAPTER 10: SPACE BATTLE

Created In: Photoshop

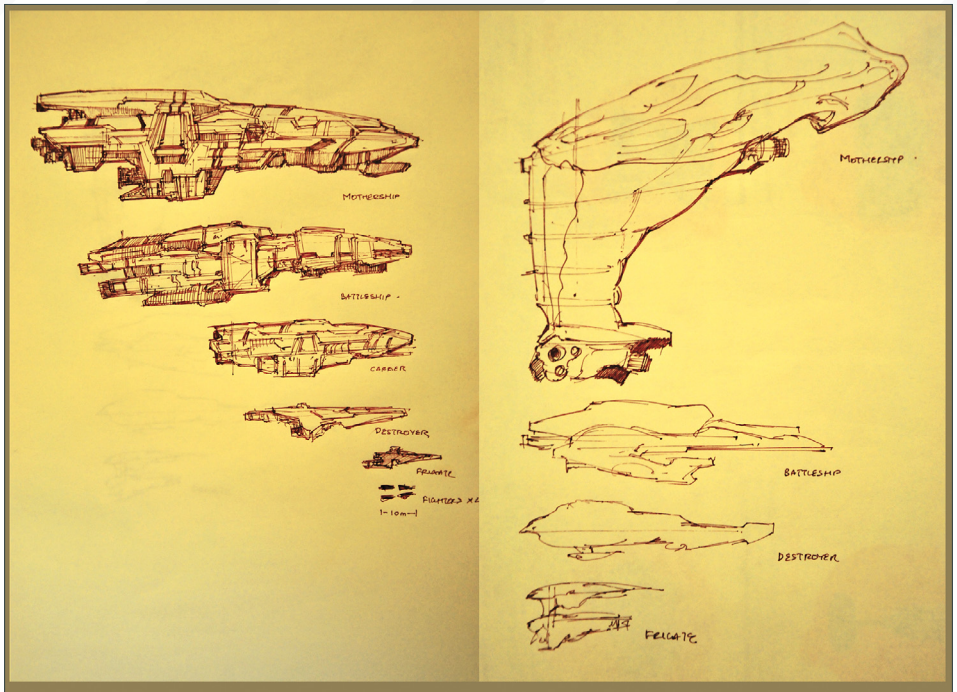
Overview

In chapter ten of this space series, I would like to share how a typical freelance artist, or studio, may go about producing key scenes for use within the pre-production process of a game or movie. Cue a space battle as a chance to create some creative mayhem and exciting visuals.

Throughout the series, we have focused on the more practical aspects of design, generating ideas and troubleshooting your way through a brief, visually. In contrast, we will now focus more on the production side of art; producing concepts, iterations and visuals that can be used to create assets for use within a matte painting, virtual 3D set or game environment.

I: Assembling the Props

Throughout this series we have worked on a variety of fighters, capital ships, stations and shapes. Now is the opportunity to be selective and bring them all back in within a compositional context. And just to keep things rich and original, let's have an opposing force that looks and feels more organic and alien-like in its design language and aesthetic (**Fig.01**). For this scene, our main purpose is to produce a set of key moments in an epic space fleet battle, followed by producing a composite shot to show how a singular key battle moment may be illustrated as the "money shot".



OPPOSING FORCES Fig.01

Opposing Forces – Line Up

A good starting point would be to line up the various capital ship and ship profiles side by side, so that you can visualize the core silhouettes of both forces (**see Fig.01**). On the far left, Team Alpha is defined by a symmetrical, semi-industrialised, angular look that is characterised by chunky and elongated forms along the longitudinal axis. In contrast, the far right Team Zeta is defined by a more organic geometric shape, coupled with elements of an asymmetrical nature that borrow from shapes such as a trident, scythe, and a two-to-three pronged fork.

The next step is to extrapolate these ship profiles into something more volumetric. Personally, it seems easiest to extrapolate to a three-quarter perspective view of either the front- or rear-side angle (**Fig.02 & Fig.03**). In addition, it's also useful to block these designs out into a black and white silhouette to check them for readability.

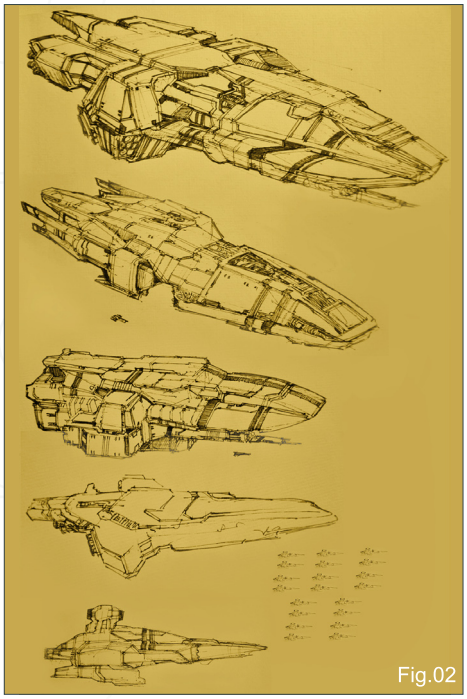


Fig.02

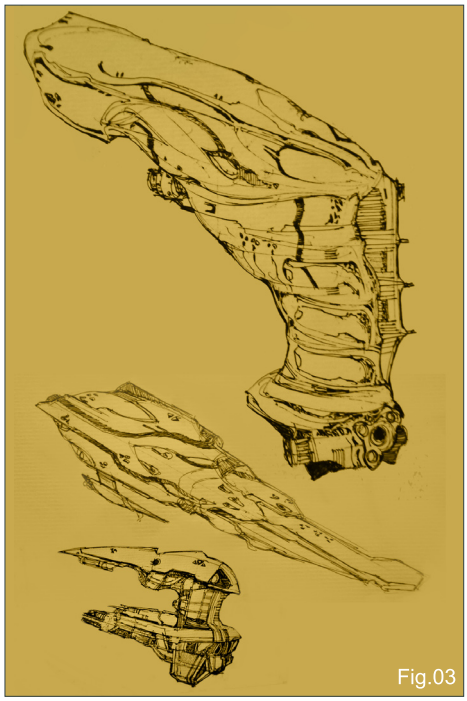


Fig.03

One thing that may be surprising is that after adding details and panelling, the overall forms do not work out as well as you might have expected. Take a look at **Fig.04,** which features a side-by-side comparison of both opposing teams. Team Zeta consists of very defined shapes and reads reasonably well, in particular the Mother ship (top right) and Frigate (bottom right). In comparison, Team Alpha has very similar shapes. In fact, if there was no relative comparison of size then one would be hard pressed to distinguish a battleship from a normal pea shooter. So what does that mean? Does it mean the design is flawed? Does it mean the ships require more definition or defining characteristics? Or does it mean the ships require a return to the drawing board?

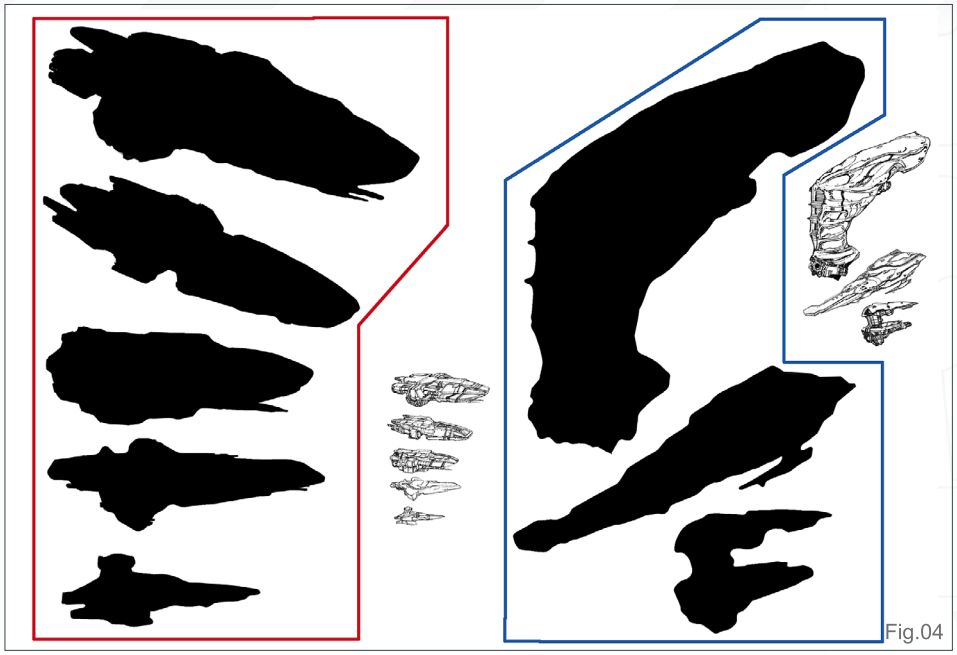


Fig.04

All of these issues, or variants thereof, are important issues to consider for the would-be concept designer of futuristic spaceships in the entertainment industry. A typical scenario could be that after weeks of iterations, each ship design is locked down and approved. Subsequently, for some unknown reason, let's say these designs get given to 3D modellers and texture artists, and (God forbid) it progresses even further up the food chain to the maquette (scale model) modellers for use in a miniature set. Then the big day arrives and it's time to film the miniatures (or pre-visualisation). You have assembled all of these props and assets together, and perhaps have even planned a special effects shoot, but ... it just doesn't work. All the ships look similar, with only a few distinguishing shapes and objects standing out. And that is the crux of it all.

To be able to work out all the main issues of a key frame scene that does not amount to a full illustration, has sufficient visual information to convey the scene, and does not lose any of the ambiguity of a "speed paint", the goal is again to develop a rigorous and straightforward

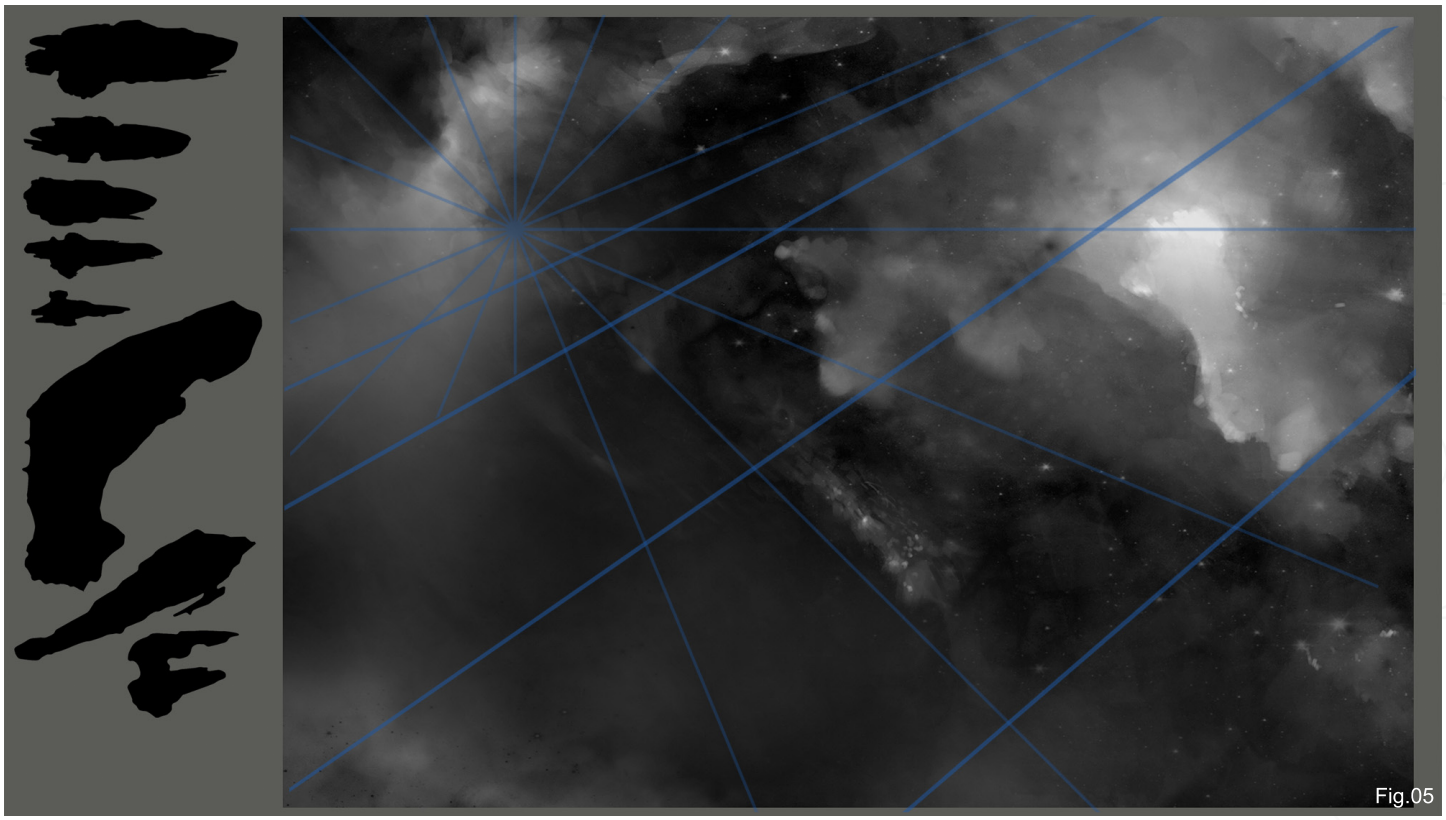


Fig.05

Fig.06

methodology that allows one to explore all the key tenets of the required scene, whilst still being fairly efficient in execution.

Opposing Forces – Team Alpha

For Team Alpha, we will gather a range of capital ships and a single personal fighter (**see Fig.02**). In the three-quarter view, the designs that seem to work well are the second (from the top) capital ship and the last two shapes at the bottom. What is really surprising is that while the top two ships have the most design, thought and functionally, their outlines may not work very well, whereas the ship with the least panel lines or design (fourth from the top) works quite well as a distinctive shape (**Fig.04**).

Opposing Forces – Team Zeta

In comparison, the requirements for Team Zeta (see Fig.03) meant producing a more distinctive (i.e. visually different) design. This invariably led to an elegant, vertically unusual, elongated design. Partially organic and smooth in comparison (this sometimes translates to alien looking*), it was a matter of lines and functionality working well (luck), from the first draft (that did not require too many further iterations). However, of all the designs for Team Zeta, only the top and bottom forms echoed well with one another. The other forms were too similar to Team Alpha (the reasoning was thus: these elongated vessels would hide cleverly concealed arrays of weaponry that would open up, akin to the petals of a flower), and for the purposes of this workshop, they were curtailed to oblivion.

**Any design language deviating radically from known historical or current day objects/transport/ functions may be perceived as "alien looking" in nature. Even when a distinctive design becomes iconic and enters popular culture, it may be that until the general public is able to see, interact and physically use the new device, abode or transport, anything too radically different will appear alien looking. For example, if you were to rewind the clock back 100 years and tell people that one day every household would be able to have a small receiver device that showed moving pictures on a screen, you would be rightly laughed at and accused of being delusional. Go back 500-600 years and the world view would be so radically different that such current day appliances would have had most folk hanged or burnt as a demonic heretic for even entertaining such thoughts! To conclude, what this slightly more academic discussion means to simply state is this: 70:30. By that I mean that if you want to keep the designs within the realms of believability and the accepted world view, try to keep your design 70 percent rooted in existing design, and leave 30 percent to the realms of the creative imagination.*

II: Key Scene Moments

The next crucial step is the process of idea generation. It is said that imagination - the ability to create worlds, to make real matter from mind and will - is the power of the Gods. As visual communicators of things that don't exist and things that become birthed into the current reality, artists have to uphold that responsibility. This step is a cross applicable methodology, ideal for all manner of creative generation, and arguably the most important element within the production of any storyboard, illustration or conceptual design (that is if you want to produce

a believable, functional, working scene that doesn't just consist of made-up shapes that fall apart on closer scrutiny).

From my own experimentation, I line up all the approved design forms in one corner of the digital canvas – similar to generating a paper cut-out of various approved designs and forms – and then literally scatter them across the chosen canvas (**Fig.05**).


Fig.07

Drawing a Line in the Sand

The next aspect is to generate a backdrop. In this instance, I have re-used elements of backdrops produced in **Space Painting Tutorial Series: II – Transport: Part 8 – Space Stations (Issue #038)** and started working in greyscale. This allows us a rapid base from which to paint upon, and by the end of this workshop the canvas will have changed many times, to suit the final shots.

Next we make the choice of an arbitrary horizon and perspective (**see Fig.05**). As I often try to say, there is no up, down, left or right in space. Therefore accurate space painting can be both chaotic and a bit sterile. Nevertheless, it is our duty to make it exciting, and to choose the right frame, aspect ratio and appropriate crop to make the shot work.

Establishing Shots

Using this basic canvas, I would recommend producing a grid of six to eight panels of equal aspect ratio. In this instance, we use the widescreen aspect ratio to conform to modern filmic conventions (smaller aspect ratios such as 16:9 or 4:3 can be simply a cropped view; it is therefore easier to work wide and crop in small for each respective format). Try to work loose and fairly rapidly, spending an average of 20 – 30 minutes on each panel, working in the general forms and approximate shapes, and focusing primarily on mood, lighting and readability.

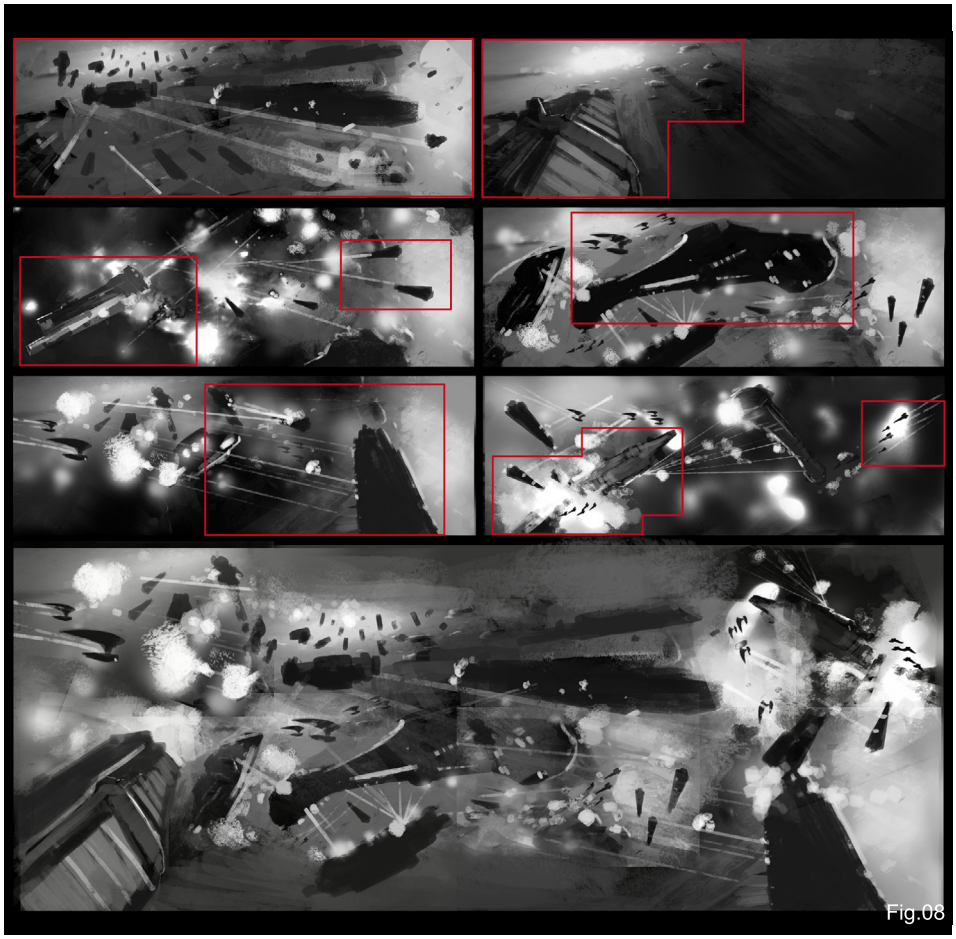


Fig.08

An analysis of the various shots, from top left to bottom right, are as follows (**Fig.06**):

- **Shot 1:** A great compositional shot with various similar shapes heading progressively in the same direction, and good use of light particles to lead the eye towards the artificial vanishing point/horizon
- **Shot 2:** This shot is more suitable for a wide shot, featuring a giant battleship heading into battle in the distance
- **Shot 3:** This shows the chaos of a battle in action – no real composition or defined viewpoint
- **Shot 4:** An alternative shot displaying the really large vessel of Team Zeta being attacked/attacking
- **Shot 5:** A good secondary shot showcasing an exchange of fire from a battleship about to be attacked
- **Shot 6:** Similar to Shot 5, but featuring another battleship being destroyed instead

Ultimately, I prefer the first shot as our key visual scene. The thing is, while your first concept or first stab may sometimes be the best, it is not until you have worked out alternative shots that you can adequately make an informed decision.

Initial Compositing

Using the key visual thumb in Shot 1 (**see Fig.06**), the next task is to assemble all the various props into one chaotic mess (**Fig.07**). Yes, that's right. We want to recreate the chaos of a battle in space, similar to the various sky and naval battles of World War I and World War II. Albeit with more un-organised chaos, because frankly as much as I love the composition and simple direction of Shot 1, you would be hard pressed to find a battle executed in such a regimented fashion. Shot 1, in critical analysis, is almost too orderly and this ultimately translates into a very sedate, almost calm scene (**see Fig.07**). While you could use this shot as the opening of a space/naval battle, if you have one singular painting to represent the chapter and a key role of this act, it should be more engaging. Aim to thrust the viewer right into the action. This can normally be achieved by having a camera viewpoint set up just behind or over the shoulder of any transport your camera is focusing on. So that's it; Shot 1 must go now, unfortunately.

Fig.09

With reference to **Fig.08**, we take all the best elements of the six panels (noted by the various areas selected in red), and consolidate them into one miraculous, organised, chaotic mess. This involves some degree of overlay painting and re-painting to produce some sort of coherent mess. Notice that Shot 1 provides the main backbone around which a more complicated battle scene is shaped.

Exploring Alternative Shots

Lastly, this is a good juncture to explore various alternative shots that could be obtained by cropping and zooming in on various aspects of your cinematic set piece illustration (**Fig.09**). The good news is that you can always produce a good composition with the right shot and the right crop. Just ensure your canvas is wide enough and of sufficient resolution to handle this. The current piece is now approximately 4500 pixels wide and thus fully adaptable to any crop size.

Fig.10

III: The Money Shot

Now that the process of idea generation has been explored, we can get down to the nitty-gritty of producing the "money shot".

Proof of Concept

The entertainment industry works roughly like this: a production director, game team or writer has a great idea for the next great big movie, animation or game product. Be it a new IP (intellectual property), establishing a successful continuing sequel or an individual pitch to various investors, publishers or venture

capitalist, it is all about producing a convincing pitch. Let's say your team has produced a rock-solid pitch with great ideas, a good script, and strong actor line up/game play, and have also discussed with relevant interested parties about your upcoming film/product. The thing that gets the product a green light is producing a) Proof of Concept (a.k.a. pre-production/line 0, whereby you can be relatively creative without the restraints of a script/game idea), and b) Key Scene Visuals (late pre-production/line 1, whereby some rules are set in stone and you need to explore the more exciting elements of your game/movie). If you're successful at getting over the first hurdle, then the next few stages are roughly the elements of production.

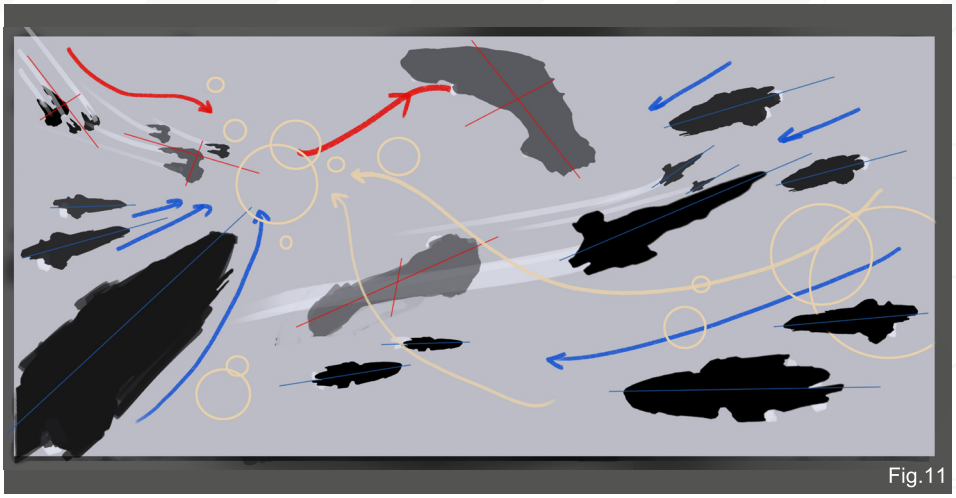


Fig.11

Production in games means passing through a rigorous set of chapterly and quarterly deadlines that show the progress of the game in production and ensure that the objectives agreed to in your company/team's contract with the developer, publisher or investors are being achieved.

Production in movies means getting your initial proof of concept into production, and being on site to produce concepts, line art and further key visual scenes for each segment/act of your movie so that sets are made, props are built, and the whole film is produced on time and within budget.


Fig.12

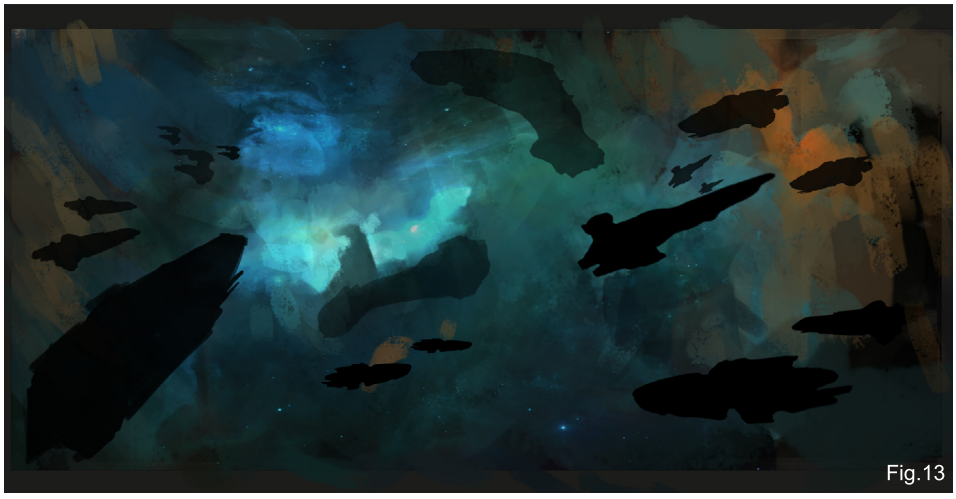


Fig.13

The Composite Shot

With reference to **Fig.10**, the amalgamated greyscale shot incorporates all the various elements, shapes and forms. It all looks relatively confusing and is without any visual focus. The explosions are all relatively of the same luminosity and all the forms are of the same black, silhouetted, placeholder ships. So let's take a step back now and simplify.

Fig.11 shows a better sense of organised chaos, whereby various ships are actually grouped together in relative positions. Grouping a set of similar ships in a formation can allow the viewer to have a perceived perspective:

- **Yellow:** Denotes various explosions and the overall (planned) visual direction of the composition
- **Blue:** Groups of Team Alpha ships with their own respective axes and grouped vanishing points
- **Red:** Groups of Team Zeta ships heading in an opposing direction

Greyscale to Colour

Now begins the trickier bit: converting a greyscale value image into full Technicolor. While it's both hard and challenging to make a greyscale image look good in colour, it's not impossible. A greyscale image converted to

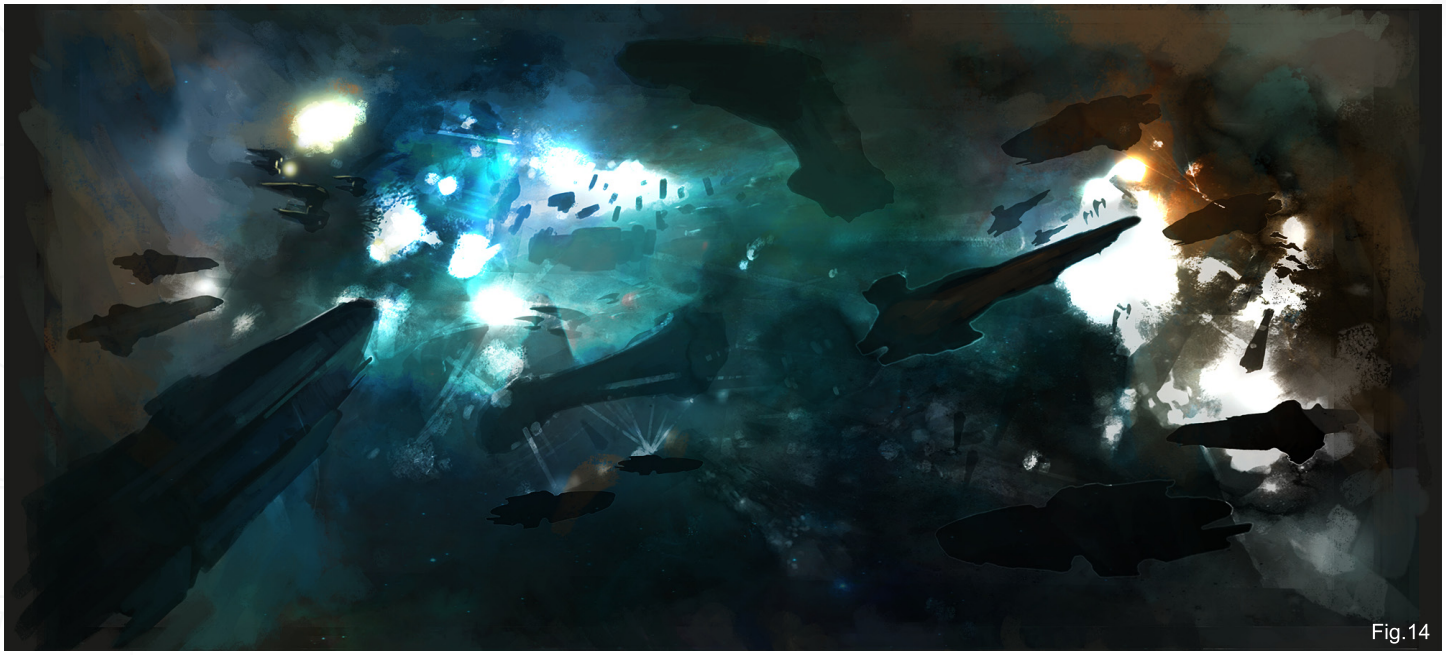


Fig.14

colour always has that overly-saturated, overly-dark feel, and these issues can be compensated for by some degree of “to-ing and fro-ing”.

The fact is that it will probably take a certain amount of experimentation, or someone showing you how it works for them, before you come up with an acceptable working method. In space, this can work with limited success, although I do find that painting in colour from the word go has a more painterly/illustrative finish. On reflection, it could be that there is insufficient random noise/hue/saturation when we try to add our own colours onto a greyscale base.

So let’s have a look at some different methods of successful conversion:

- Overlay an old photo/texture painted image on a low opacity (3-5%)
- Photoshop > Select > Colour Range method (feel free to do some self exploration to achieve this method)
- Establish a monochromic colour (e.g. Hue/Saturation set on Colourise) and add thin washes of complementary or adjacent colour
- Straightforward over-painting

In this workshop we will opt for the last option: the simple, straightforward method (**Fig.12**).

On a new layer (100% opacity, normal) you can simply paint to establish various colours and complementaries, which then generate a vague and pleasant-looking set of hard-edged (coloured) clouds. These can represent various nebulas or slightly coloured gas clouds (**see Fig.12**). However, it’s important to remember something that’s been mentioned in previous chapters of this tutorial: one can often find space vehicles within gas clouds. This tends to denote that one is flying on the periphery or within a nebula, which ultimately implies that either your vehicle is capable of escaping/nullifying the dense gravitational and strong forces of the universe, or is purely fictional.

The next step is to slowly reintroduce the cut-out shapes of various groups of ships that recede into the distance and to ascertain readability (**Fig.13**). In addition, we can take the time to develop our backdrop further, and we can afford to blend far distant objects and clouds into a homogeneous tone.

Following this comes the trickier bit: introducing all of the mid-ground to background explosions and elements. A simple method is to set your image on luminosity and lower the opacity (**Fig.14**). You’ll find that this introduces many elements of noise and mess; unfortunately this is just a necessary evil and any undesirable elements simply need to be painted out.
The painting may appear ugly at this stage, but this is a natural part of the process and it’s simply a matter of ordering the chaos to improve things. Glaze objects in the distance with a light (pseudo) atmospheric perspective (reasoned as a light dusting of space dust) to gently separate the mid-ground and background elements.
In addition, you can further blend and darken explosions in the distance into the background to achieve a more homogenised background.

Correction & Detailing

The next few aspects will vary according to the skill of the artist. Seasoned artists can achieve suggestive detail with calculated strokes (made to look deceptively simple due to their impressive understanding of the basics). Alternatively, other artists can achieve a similar result with some step-wise methodology, practise, determination, the correction of strokes and the establishment of the basics (composition, lighting, perspective, colour, contrast, separation of objects, use of rim lights, bounced lights, ambient and directional lights, and so on).

Veering back onto topic, it is a matter of starting to add some rudimentary details to our

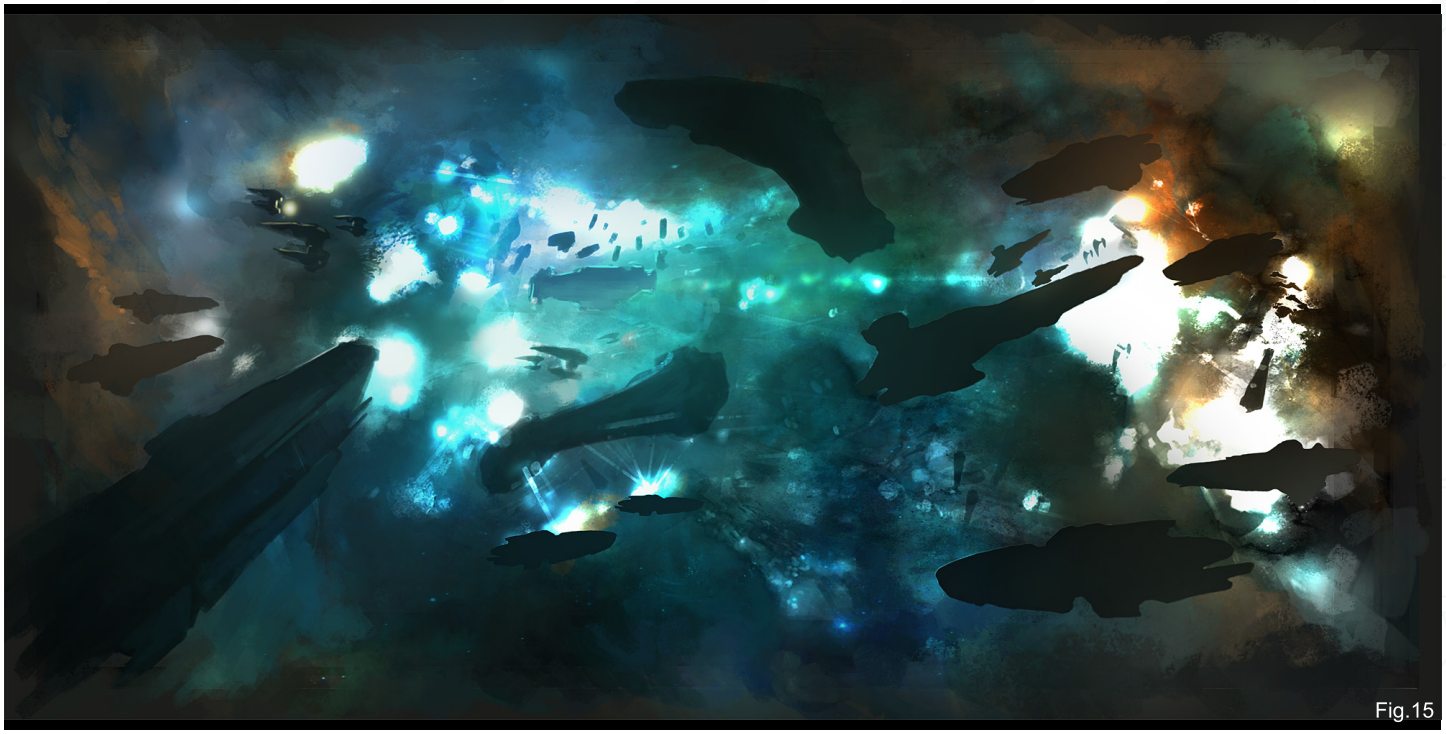


Fig.15

foreground objects (**Fig.15**). Panel lines and sheets of metal can achieve an even sheen by painting parallel strokes according to their relative planes. In the top-right segment there is a feeling of empty, useless space, and so perhaps another explosion could be added to generate further interest. I am mindful that the eye is led towards the far distant light (top third left), and that adding another closer, brighter light source may distract compositionally. The explosions is therefore rapidly converted into various ships coming out of hyperspace and being attacked and/or surrounded. Some even display the first signs of an explosive shockwave of contained gasses, debris and hot plasma (**Fig.16**).

Cropping into part of the image now, the initial thumb in Shot 1 (see **Fig.07**) is re-explored in a crude manner, replete with trails of lights and cannons being fired (**Fig.17**).

Level 2

Now that the initial elements have been worked up, there is the opportunity to add that extra level of realism and a second level of detailing. In my own vocabulary, I break the colouring and detailing of an image into Level 1 (30%) and Level 2 (70%). A very high quality visual may even necessitate further effort, texturing and super-fine tweaking which would amount to a third level: Level 3 (90% complete). I usually find that when left to one's own device, most images tend to be considered finished at a Level 2 of detail/composition and lighting. Achieving a near-finished, super-level of detail is often only

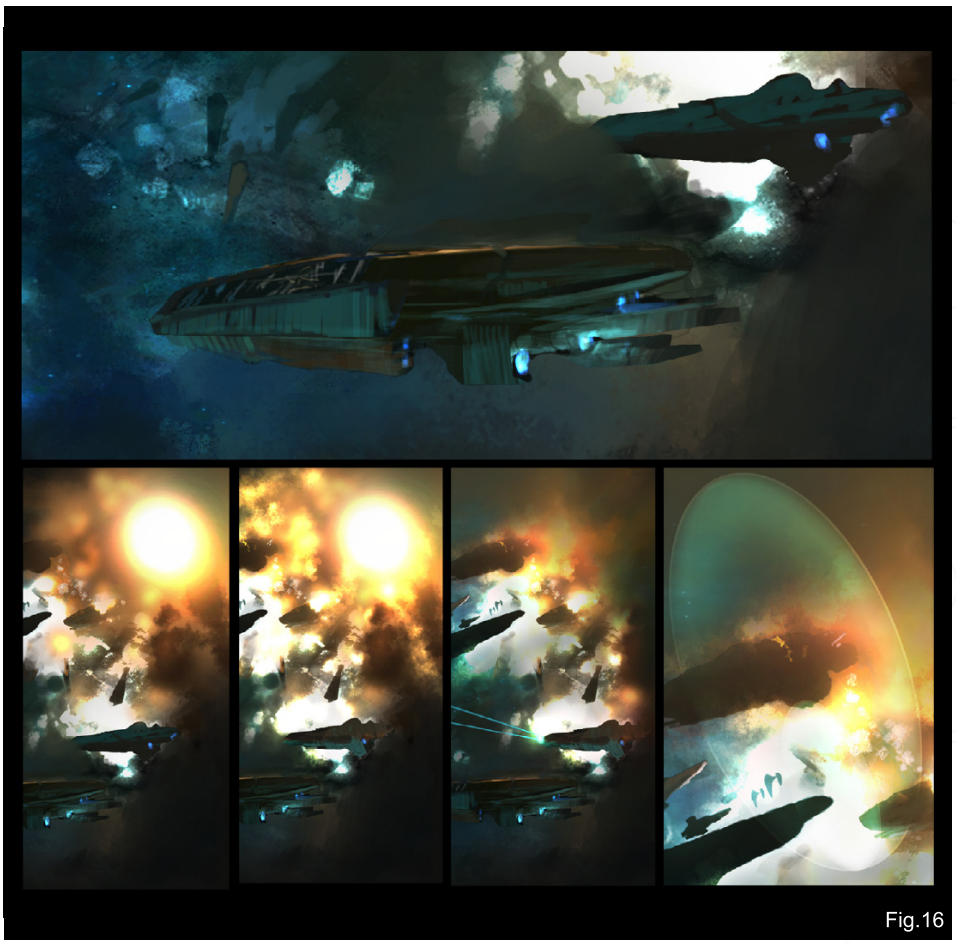


Fig.16

achieved with constant feedback and correction, such as when working with a client, or on a piece being considered for portfolio/illustrative cover/art gallery purposes.

For the purpose of this workshop, we are only interested in achieving a Level 2 finish. This is mainly because of relative real-world time constraints; you often do not have more than one or two days maximum to work on a large, complex piece. So let's have a look at the overall composite illustration (**Fig.18**).

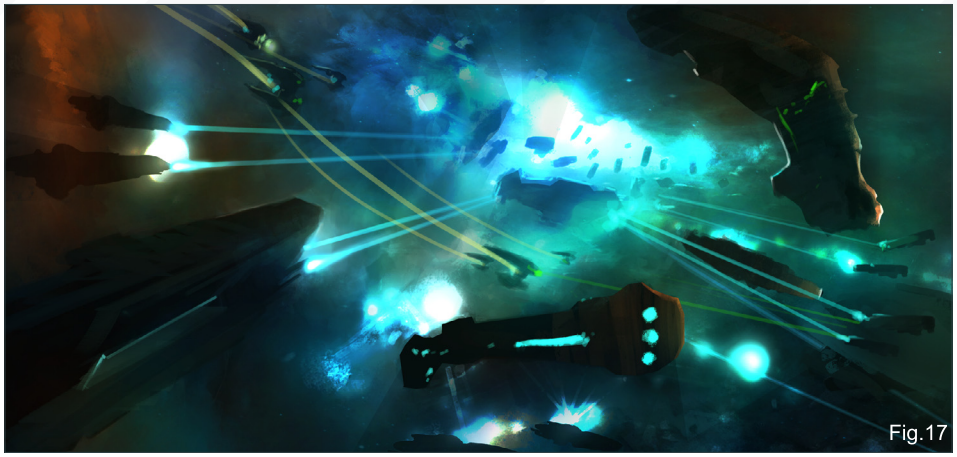


Fig.17

Most of the placeholder objects have their shapes defined by relative rim lights, based on the ambient and direct lighting. The top right segment shows a well defined shockwave; the lower right segment shows a battleship being attacked by the larger organic Zeta Team, and its shields being activated. Note that the Alpha group utilises solid laser beams that arc from one defined point to another, whereas the Zeta group utilises greenish proton torpedo-like shots that are more powerful but are fewer across the illustration. What we hope to get across is the immense strength of the Zeta group – it necessitates only a large, solid mother ship and relatively fewer, well-armoured ships/frigates.

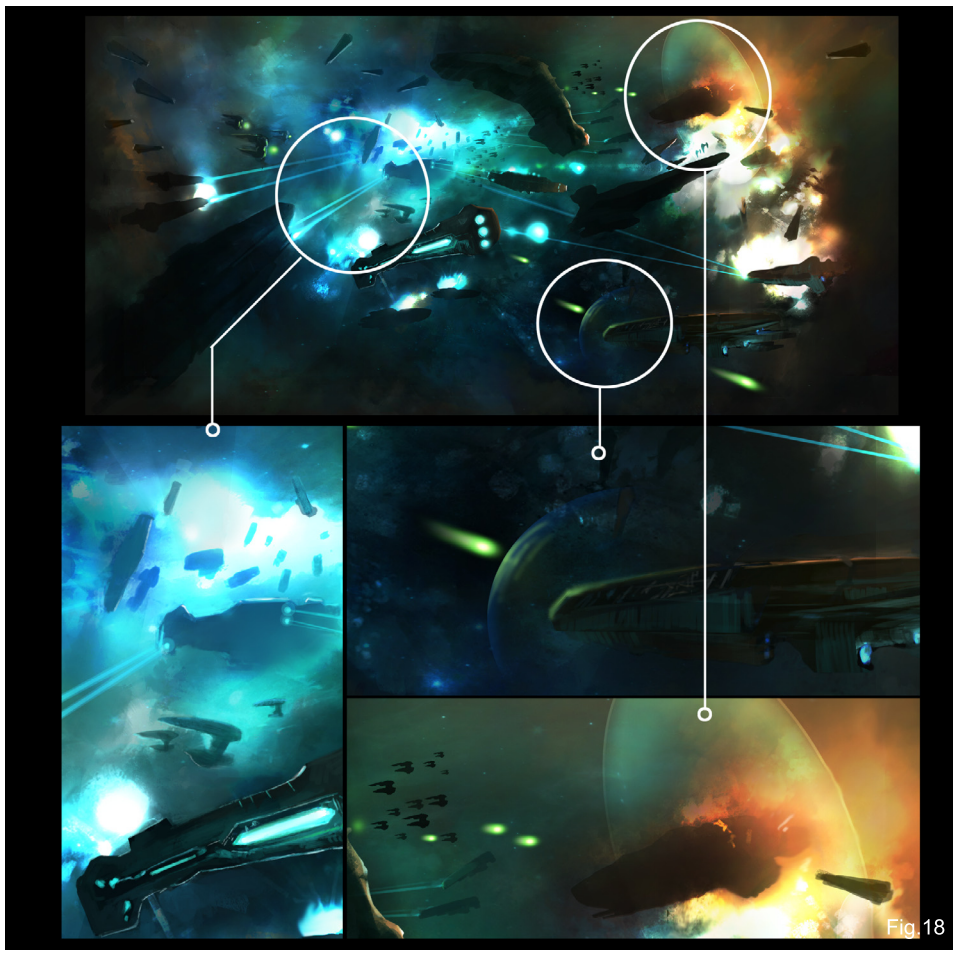


Fig.18

Some further close-ups now show us the rough details of the use of local directional lighting to colourise the foreground elements (**Fig.19**). In the top segment, the Alpha fighter utilises a warmer colour on its lower aspect, whilst the upper portions are cast in relative relief, thus producing an under-lit finish. Whereas, the

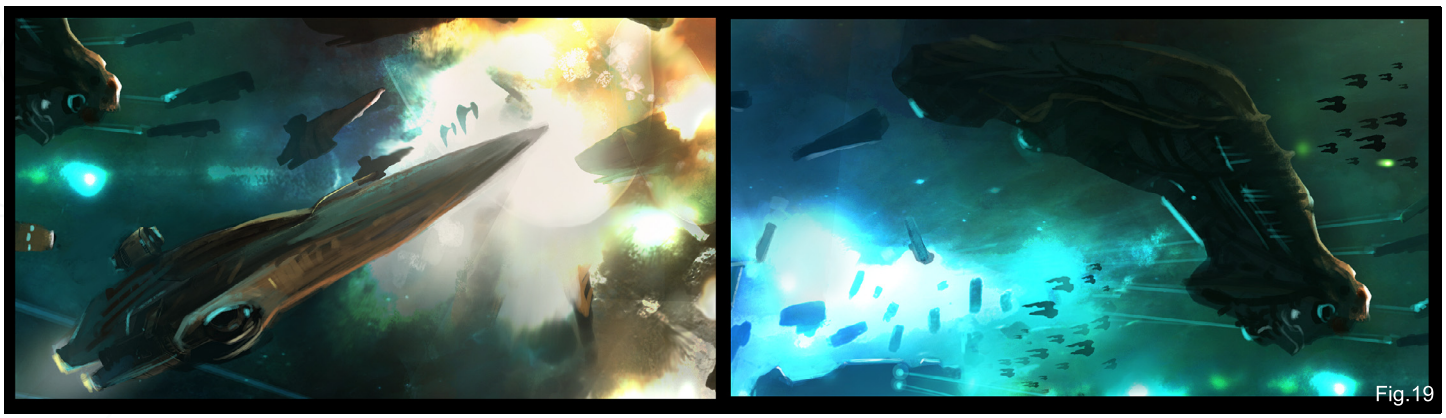


Fig.19


Fig.20

main Zeta mother ship uses a more muted and narrow band of values that are close to the mid-to-background colours. These will help to seat the object into the mid-ground.

Finally, the subtle use of volumetric cast shadows can just add that additional element of realism. We finish off with a few additional corrections and blend it all into one final giant (organised) chaotic clash of light, colour and space vessels attacking and counter attacking one another, with various groups having their own personal dog fights (**Fig.20**).

Alas, we have not yet finished. This is because we have forgotten to tell the basic story behind our image!

IV: A Story without Words

The final aspects of a Level 2 detail (going into Level 3) would be what I liken to post-processing. This means the majority of the painting in this image is complete, and from here on it's just a matter of fiddling and fudging with various cropping angles, filters, contrasts, and colour/lighting adjustments.

Now, there are various ways of setting up a good composition. One can be naturally gifted or take the pains to construct good elements of composition from the get go, or alternatively you can think like a photographer. Imagine, you have a standard 35mm (F1.4) fixed lens and you are asked to take a few good snapshots of this space battle scene. Now, assume that exposure, ISO and speed are not an issue, and that the only issue you have is to take a good shot. Utilising your basic selection tool, or crop tool in Photoshop, rotate your selection and take virtual snapshots of compositions you desire (**Fig.21**). Sounds like common sense, and

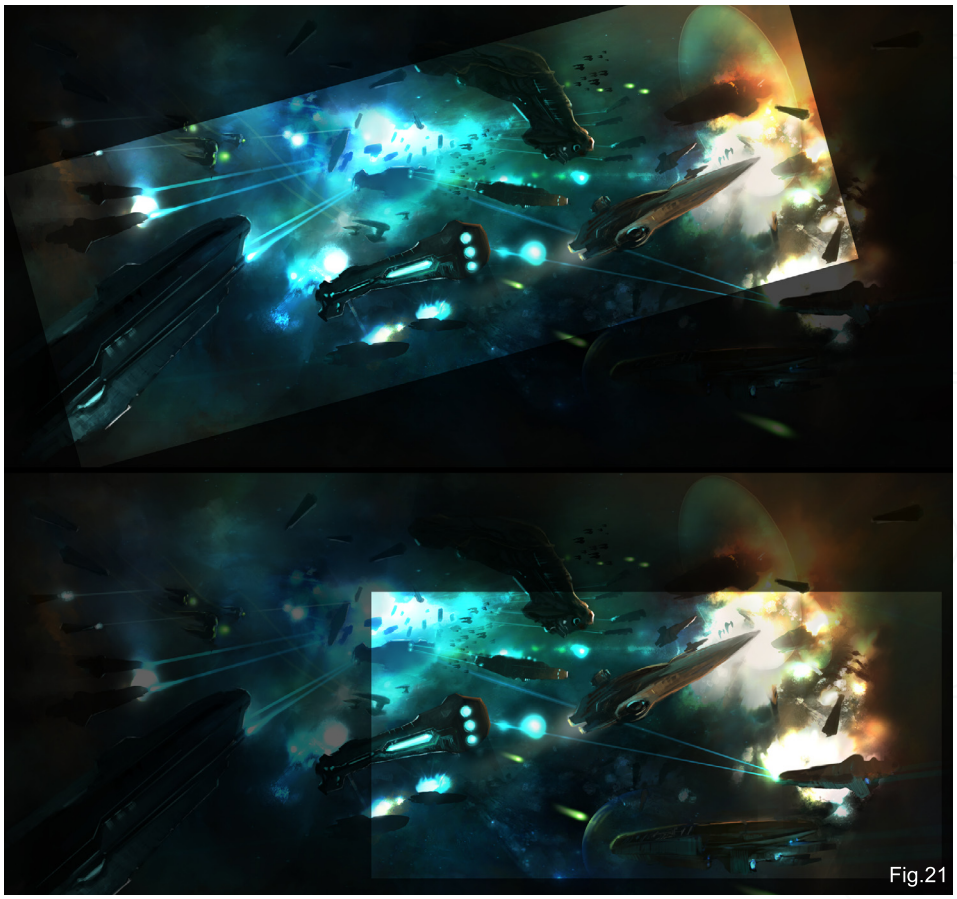


Fig.21

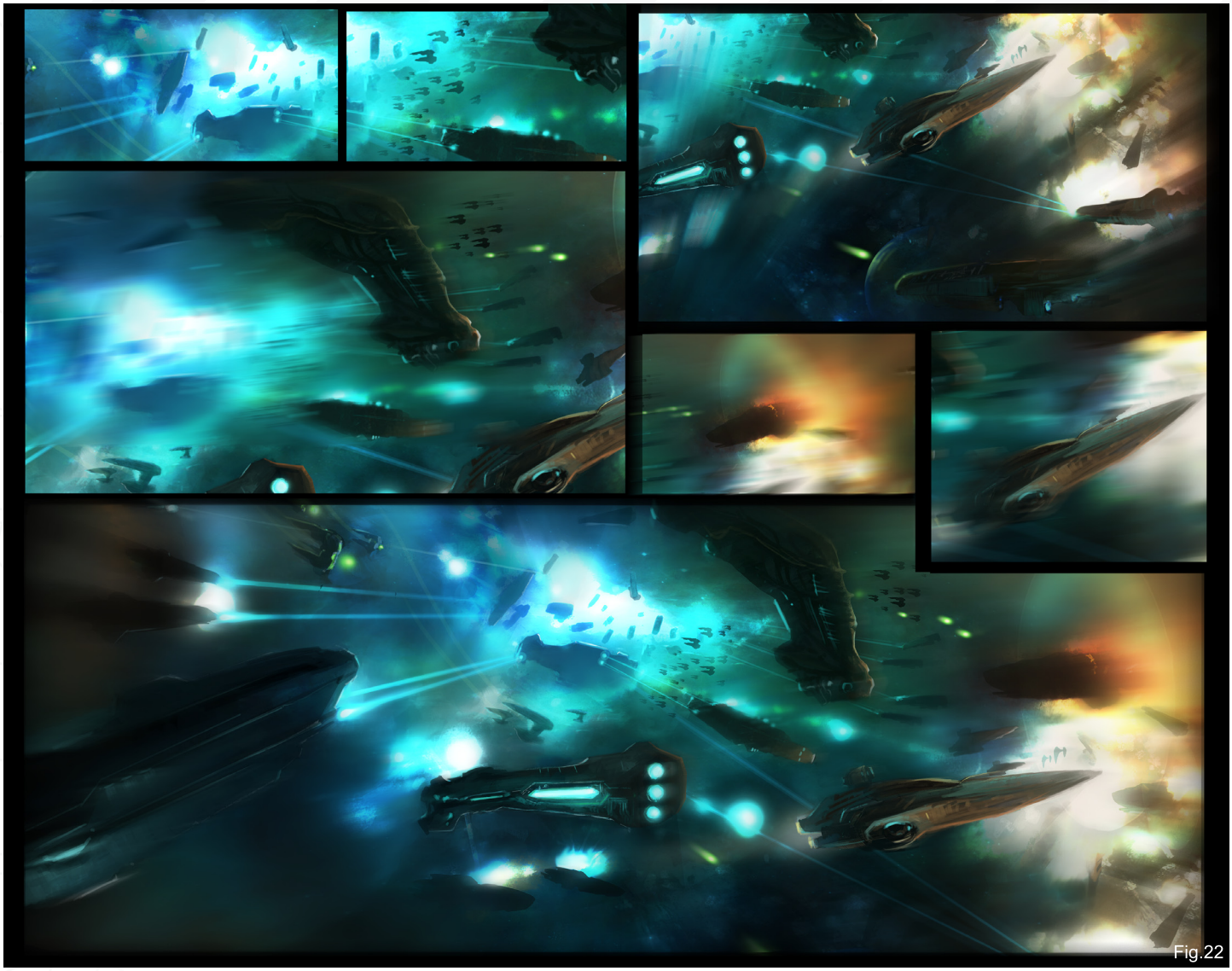


Fig.22

clearly does not sound like high level artistry! And that is the beauty of it: it's simple and under-used.

The reason why I choose a 35mm fixed lens (you can use a wide angle or panoramic fixed format lens) is because, as a photographer, one has to either move forward or backwards to get the right composition. This means you have to develop a good eye for subject matter and composition, without resorting to automated features or tricks. Seriously, I would recommend a cheap camera/camera phone to every artist so that you can take snapshots wherever you go and practise the art of composition (and lighting/colour/subject matter/perspective). This will subconsciously translate across into your art in many ways. And thus, you can take various selections and generate a simple storyboard out of these selections at will.

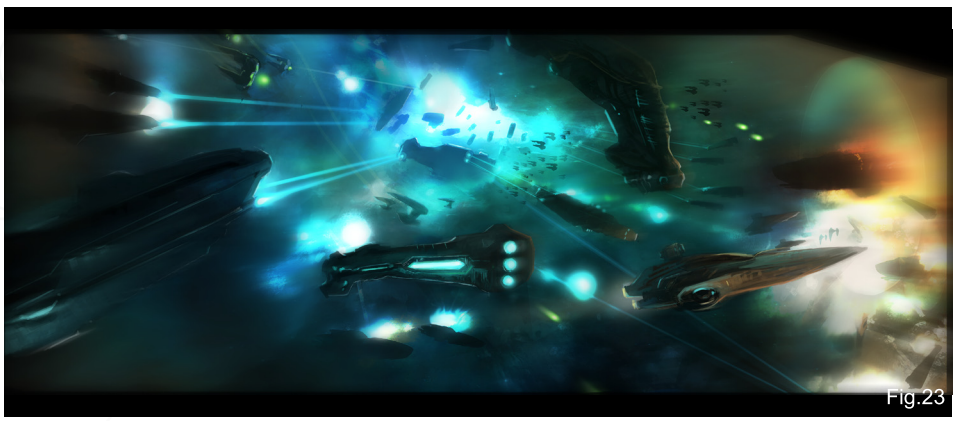


Fig.23

Have a look at **Fig.22** as a basic storyboard. The storyboard/panels can be read generally from left to right, top to bottom, in any fashion. And in essence, it should tell the basic story of a space battle. The really clever thing is the simple and effective use of motion blur and radial zoom (blur). By making duplicates of your selections you can replicate fast shots by tracking your focal object (the background is blurred in the direction of your camera's relative speed and velocity) or by panning out further to

take a wide shot. Take care to erase/paint-out blurred areas to bring back various objects of visual interest into focus.

Personally, my ideal shot would be embodied by the panel in **Fig.23**, which has echoes of the Shot 1 thumb (**see Fig.07**), but now with elements of motion and blur. Suddenly your illustration is transformed from a static, clear, focused image into something that comes alive and becomes more filmic. Do note that motion blur should not be used as a crutch and should never replace a decent understanding of the basics, but it's certainly useful to help sell the idea of action.

Conclusion

This workshop hopefully demonstrates one methodology that you can experiment with in your day-to-day workflow. There are lots of other workflows out there; from constantly interesting ones, to totally counter intuitive workflows that surprise and may be unsuitable for some artists, but are perfectly fitting to others. Thinking cross-laterally, you can also apply similar optimisation and thought generation workflows in other related genres, e.g. character and creature

design, landscape and cinematic set pieces, and so on.

In conclusion, the main things to get out of this short article are:

- Find the right shot
- Ensure the forms read
- Apply sufficient visual contrast
- Be prepared to apply judicious artistic license versus your own core values, if the scene warrants it
- Optimise your workflow

As ever, thank you for the constant feedback and interest in these tutorials. They are hopefully small insights into the personal and commercial methodologies developed to suit our studio's (**Opus Artz Ltd**) day to day operations, and perhaps, partly, a pathway to guide you on your own personal quest.

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Chapter 11

MINING THE ASTEROID FIELDS

SPACE PAINTING
CHAPTER 11: MINING THE ASTEROID FIELDS

Created Using Traditional Tools:

Pilot G-Tec C4 0.4, 0.25; Letraset Pantone: Cool grey 1, 3, 5, 7; Letraset Promarkers: Ice grey 1, 2, 3, 4; Copic layout markers: 1, 3, 5, 7; Copic wide markers: 3, 7; Prismacolor markers: cool grey 30%, 50%, 70%; Letraset bleed proof marker pad A4; Xerox - 100g/m squared A4 Colotech +

Digital Tools:

Adobe Photoshop

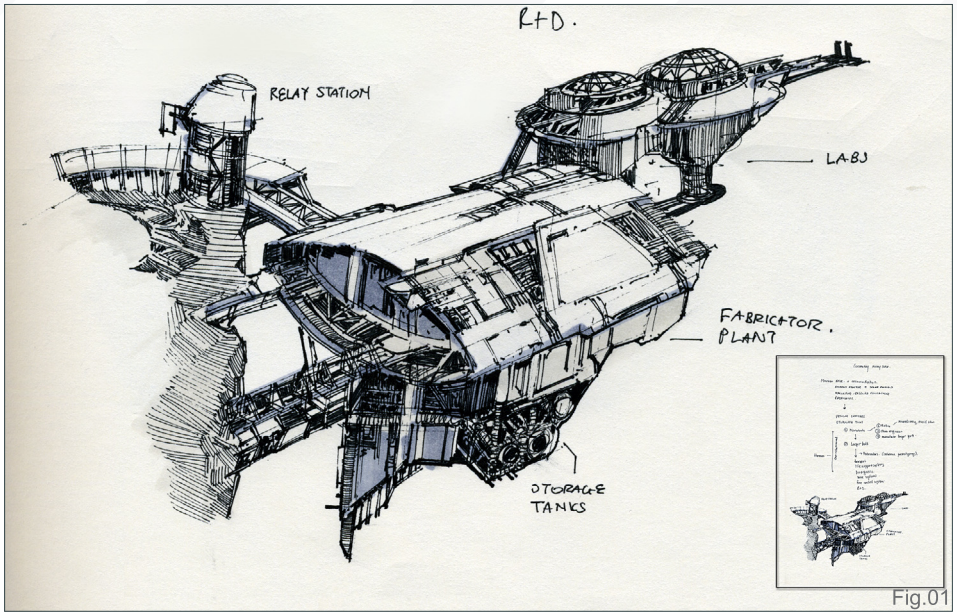


Fig.01

Introduction

We have finally reached the penultimate chapter in our space painting series. We have traversed various methods of contemporary and futuristic space habitation, looked at the construction of space vessels, and even had an in-depth view of the chaos of a space battle. In this chapter, let's examine the aspects of a more civilian nature.

Overview: Vision of the Everyday Future

Let's imagine a few hundred years from now, when mankind will have achieved the collective willpower and growth to band together in the universal spirit of exploration, and start down the journey of travelling to the nearby stars. Throughout the everyday life of this seemingly unlimited vastness of unexplored space, this represents the new Wild Wild West; living life on the space frontier.

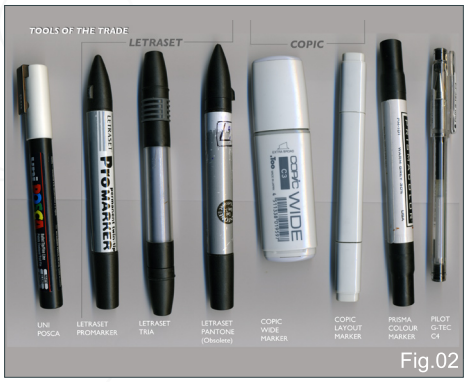


Fig.02

Let us look at our future brethren and imagine what everyday life could be, such as the mining of an asteroid field. And using that backdrop, discuss the issue of asset generation, i.e. the behind the scenes methodology of idea generation and the production of set designs that could be applied on a movie set/virtual 3D effects/game environment.

I: Imagining the Mundane

In this penultimate chapter, my thoughts are to steer us perhaps on a more retro science fiction route. This means exploring good old science fiction shapes; chunky and bold facets/planes mixed with extrusions of semi exposed pipes, cabling and gold foil. Translated into game/movie speak: the visual direction is retro sci-fi, with hints of *Space: 1999* and flairs of Syd Mead and Joe Johnston (**Fig.01**).

Paper Pixels

Coincidentally, this genre lends itself well to more conservative tools, such as the Renaissance PDA (i.e. pen/pencil/markers/ink washes and a sketchpad). This brings to the fore a current battle, if you will, about the transition and argument for/against the use of traditional versus digital methods of communication. On one hand, the movie and gaming industries have digital pipelines in place that would lead one to conclude, perhaps, that it is simplest to have a purely paperless setup and production. On the other hand, there is something tactile and almost primeval about writing, drawing and reading from paper.

Indeed, one could argue that the preparatory aspects of initial ideas and pre-production lends itself well to the more traditionalist methods of creation. One could brainstorm and generate a whole universe on the back of a paper napkin, from the crudest gesticulation to an intricately rendered mothball. There is something to be said about the use of paper...

One could hypothesise that one day there will be advanced facsimile methods of recreating digital alternatives to traditional tools, that a paper alternative could be recreated using clever nanites (armies of nanobots) and augmented reality (virtual reality imaging onto portable personal optical devices) applications. Indeed, humankind could advance so far as to one day look back and perceive the use and application of paper as a rare commodity or antiquity, and yet ... there is something alluring about reading a book anywhere, everywhere, with batteries not included.

Retro Reconstruct

There is a saying, “Courses for horses”, or “There are no rules. Only tools”, as Glen Vilppu is one to say. In my mind, I tend to amalgamate it all as “Tools for fools”.

Without quite getting into the debate of which digital software or best broomstick to use for such space art materials, I can only highly recommend the right tool for the right job. Sometimes this means learning new techniques, applying different media or a cross application of tools, and sometimes it’s applying yourself using the best skills that you currently have at your disposal to get the job done. It does not need to be the best sliced wedding cake in the universe, or even an impeccably baked tart with a crispy underside that is neither too hard like concrete or soggy overall. More importantly, it is about knowing your limitations and ability to deliver for the job at hand.

And thus, we arrive back at tools. Retro tools, namely the pen, paper and the ink wash. I love still being able to wield the pen and paper when it comes to sketching down a draft idea. The pen is such an unforgiving medium in normal circumstances (impossible for producing clean character faces and features without a deft, experienced hand); however, if harnessed appropriately, provides benefits primarily being:

- They are permanent (and fast staining)
- They apply well with alcohol-based markers

Retro Tools

The objective here is to introduce traditional tools, marker types and uses. With reference to **Fig.02**, there are a range of weapons for the retro minded, starting from the left to right:

Water Based Markers

- **Uni POSCA** – water based poster markers; work well on porous surfaces such as wood, cork and polystyrene

Alcohol Based Markers

- **Letraset Markers** – there are three ranges: originally Letraset Pantone (featured three different nibs and refillable inks, now obsolete), and subsequently evolved into the novice/beginner range; Promarkers (cheap, cheerful and great) and the Tria marker range (expensive, require refill cartridges, and fall apart ... all the time)
- **Copic Marker** – Japanese standard flag bearer; comes in normal size (Copic Layout: fat nib/thin nib), wide size (Copic Wide: singular fat nib) or Copic Ciao (beginner range: fat nib/brush nib)
- **Prismacolor Markers** – great dual nib marker range, only available from the US (or on export), affordable and features a great set of cool greys

Pen

- **Pilot G-Tec C4 Pen** – ranges from 0.4 (0.2mm) down to 0.25 (0.1mm) and provides some of the best fine tips for use in illustration. The colours favoured for traditional sketching or illustration are black and brown

Paper (What is not apparent is the type of papers used, which are namely):

- **Marker proof paper** e.g. Letraset
- **Colour copier paper** e.g. Xerox Colotech+

If you are located in the US, Canada and Asia, the chances are your local markers are: Prismacolor markers (predominantly) or the Letraset markers. If you are located in Central Europe and Japan, your local markers will be: Letraset (predominantly) and Copic markers.

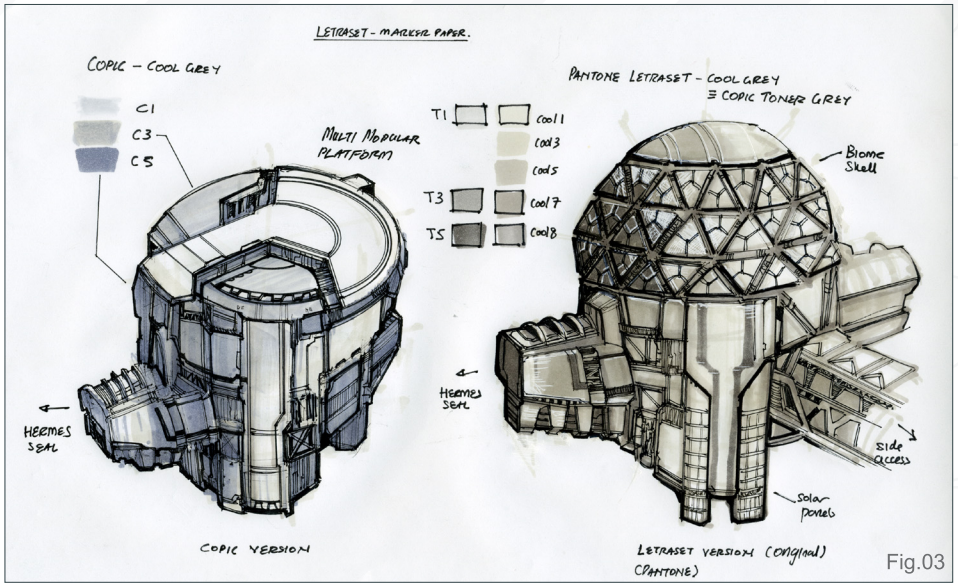


Fig.03

Space Biomes: Marker vs. Marker Test

When comparing the leading markers against one another:

- **Prismacolors and Copic** – feature comparable cool grey sets
- **Letraset** – the old pantone series is comparable to Copic toner greys, and are warmer overall
- **Letraset Promarkers** – the hidden champion of the series; aimed at beginners, it is affordable and works very well. No refill, however. For a comparable grey value to the Prismacolors/Copics, use the ice grey range

Let’s test these markers out by designing a set of retro sci-fi biomes modules. These would realistically represent horticultural living spaces to grow trees, plants, and life within space. A great example of such an enclosure is embodied by the Eden Project (Cornwall, UK), or the large enclosures such as Kew Gardens, London.

In a direct comparison (**Fig.03**) we can view the effect of using Copics vs. Letrasets cool greys. Notice how warm the Letraset default

cool greys are in comparison to the Copics. With various experiments, we have found that these Letraset greys are equivalent to the Copic toner grey range. In addition, using marker paper (A4 Letraset) combined with markers provides a richer range of values, and soaks up less marker than conventional A4 paper. However, it also tends to leave semi-opaque residues and brings out a sharp contrast in the inks on the markers (especially if one were heavy handed).

The solution to this is to upgrade to modern technology. Colour copier paper, designed for colour laser jets/ink has a much smoother surface and retains marker ink brilliantly. Our next image sequence features the cheaper Letraset ice grey markers, but note how much more brilliantly the grey values and ink lines are retained…

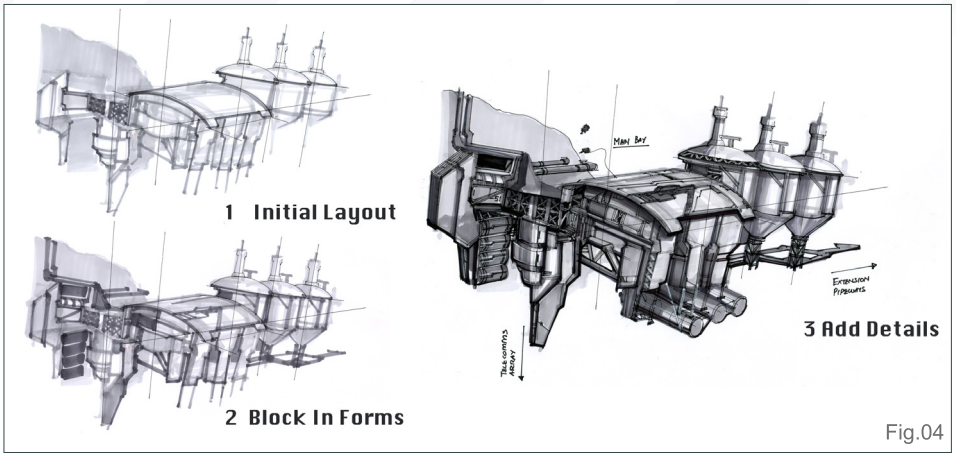


Fig.04

II: Living Amongst Asteroids

The next aspect is to visualise a future life amongst asteroids. What very few people know is that asteroids are an amazing resource of raw materials, rare metals and water. Therefore they are an ideal place for mining, exploration and a way station to the stars.

The second part of this workshop concentrates on two aspects: firstly the construction of a base of operations, and secondly, based around developing a mining rig, or in this instance a hero transport (instead of characters) as the aspect of mining and coring asteroids will be akin to using deep sea submersibles for work underwater, except in this instance we have the harsh temperature and pressure extremes of space.

Interplanetary/intergalactic space is a dangerous environment filled primarily with gas, dust, cosmic rays, small meteors, and (non-perfect) natural vacuum, matter, dark matter, EM radiation, and so forth. As such, even with futuristic protection suits, advancement would probably not be able to account for the random small meteorite or debris that may escape local tracking sensors and devices, and may be akin to a high velocity projectile tearing through one's deep space protection suit. It would be far better to navigate space within a personal deep space environmental vehicle, that is small enough to manoeuvre in confined spaces, but robust enough to withstand the rigours of outer space, barring planetary re-entry.

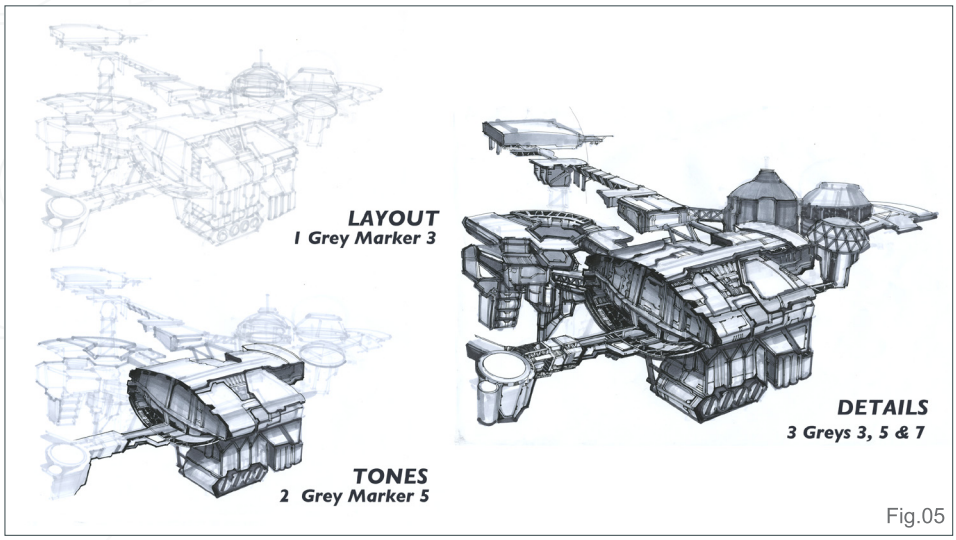


Fig.05

Constructing a Base of Operations

The objective here is to construct a deep space base/way station using industrial design principles. The initial construction of a base will require consideration of the following:

Main Base (as seen in **Fig.01**)

- Basic housing
- Life support system
- Power generation
- Propulsion
- Resource storage
- Analysis and utilisation
- All purpose tool shed

Once a purpose-built base is installed/hauled into position, these bases should be adequately self sufficient to harvest and manufacture their own equipment from local resources. As such, the base would require:

- **Prefabrication and manufacturing module**
- **Manufacturing** – transport, tools, robotics, nanobots, gene sequencer, wiring, and various modules according to local blueprints
- **Biomes** – local growth and sustainability of local food and produce, generation, purification and entrapment of beneficial gasses, primarily components of air (oxygen, nitrogen +/- carbon dioxide)
- **Transport hangar module** – storage, repair and launch of local mining rigs and protective deterrents

- **Weapons and defence module**
- **Advanced life support systems**
- **Energy storage and generators** – including
  advanced solar panels, mirrors and local propulsive/non-propulsive reactors

Asteroid Shell – Prototype Base

To produce a preliminary base, let's explore this as a marker design using colour copier paper and Letraset ice grey markers (affordable enough to use once). The main premise of this sketch is a prototype base attached to a large asteroid that is being hollowed out and fit for purpose. The beauty of using a large enough asteroid to manufacture and install a base in is the ability to use it as a natural shield against the elements.

In the 1960s, Roy Scarfo and Dandridge Cole conceived the use of a hollowed out asteroid as an asteroid shell. Using a nuke melter or plasma cutter, you could hollow out a base of operations that could be fitted with an inflatable liner and some airlocks to recreate living and breathable environments. The initial issue is the fallout of radiation from nuclear based tools, and the interiors leftover would appear glossy and smooth. A surface depth of 3-4 metres is sufficient to eliminate most (90%) of cosmic rays and thus is a sustainable and long standing option for the future. For now, the global and economic financial issues to investigate and manufacture such technology for asteroids is perhaps a non-option, but nevertheless the ability to do so is not too farfetched a thought. Only the means of doing so in a repetitive and sustainable manner are the remaining obstacles preventing humankind from living a space life.

Using a simple three-step approach, we can build the base as follows (**Fig.04**):

- **Initial layout** – Plot perspective lines and layout; try not to apply much tone in this step, it is primarily to apply proportions and serve as a guide
- **Block In forms** – Lathe in your general design features: base, hangar, a set of cylindrical biomes and connectors
- **Add Details** – Pen in your designs, apply thicker line-weight in areas of ambient occlusion (shadows)

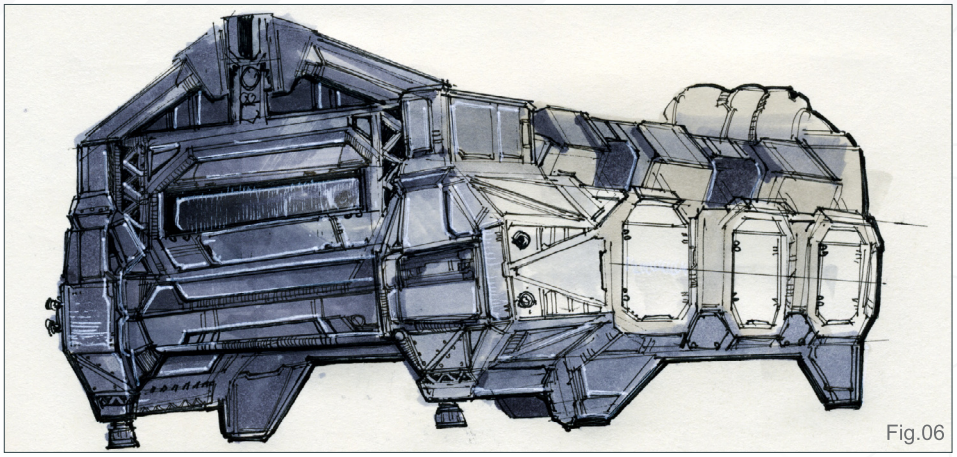


Fig.06

Asteroid Shell – Advanced Use

The next aspect is to expand this base to provide a full set of operations (**Fig.05**). Using the same three-point method, this is an opportunity to refine the overall design.

Utilising the initial vision detailed in the sketch in **Fig.01**, let's expand the base to incorporate a full complement of modules: base, life support, biomes, alternative power supply, manufacturing and transport hangar, multiple docking ports ... the list is endless.

Alternatively, you may approach the design of an environmental set piece as follows:

- Layout
- Tones
- Details

Such a method requires rapid use of markers over a 15-20 minute period because markers dry a lighter tone than when wet; due to the alcohol base the ink will evaporate to stain into its set form. To provide a smooth transition you may utilise blender solutions, which are varying degrees of almost medical grade ethanol. 70% proof ethanol is normally used in hand gels for sanitation, and ethanol procured in the local pharmacy is almost 99% proof ethanol (not for human consumption), and can be used as a nice alternative if you don't have any blender solution at hand. Essentially, the marker blender releases ethanol that allows a lighter stain of marker to be released, and thus may be nice to use if one wants to produce a gradual effect or blend smoothly between two tones, e.g. 30% and 50% grey.

Mining as a Resource

In the future, the ability to harness asteroids will be a key step in humankind's expansion and deep thrust into the nearby galaxies. As previously mentioned, asteroids are abundantly available resources full of massive amounts of useful metals and minerals, including carbon, iron, nickel, platinum band metals, and gold. In addition, they contain considerable water that can be used for a variety of purposes: human consumption, energy and propulsion systems. And therefore, as mentioned earlier, it is essential to develop robust deep space exploratory vehicles for which to explore, mine, harvest and retrieve. (For further information about asteroids as a resource, you may like to check out this resource: *Space Resources* by John and Ruth Lewis, from Columbia Press.)

For this tutorial, we are suddenly taking a turn towards prop set design from markers to digital and rapid colour pass for use in production.

Vernier Mining Rig

The objective here is to explore traditional marker and digital design using industrial design

principles. For the design of a Deep Space Exploratory Vehicle (DSEV) - Vernier Rig – I want to explore a “sexy brick”, in essence.

The design concept is to make a functional and retro looking transport and upgrade it with all the modern industrial design common sensibilities. The initial draft (**Fig.06**) is fairly rectangular, oblong and squat; perfectly ugly but functional. Tiny manoeuvring thrusters are slotted all around to provide maximum manoeuvrability for its purposes; however, it is hard to gauge how such a vehicle would appear from other angles.

In addition, a smaller DS-ROV (Deep Space Mini Remote Operated Vehicle) is also sketched out, in case the eventuality requires a smaller craft to explore and retrieve core rock samples (**Fig.07**). It was initially designed as the core DSEV rig; however, on various iterations its profile and mechanics fit a smaller scaled device, such as a ROV of current day standards.

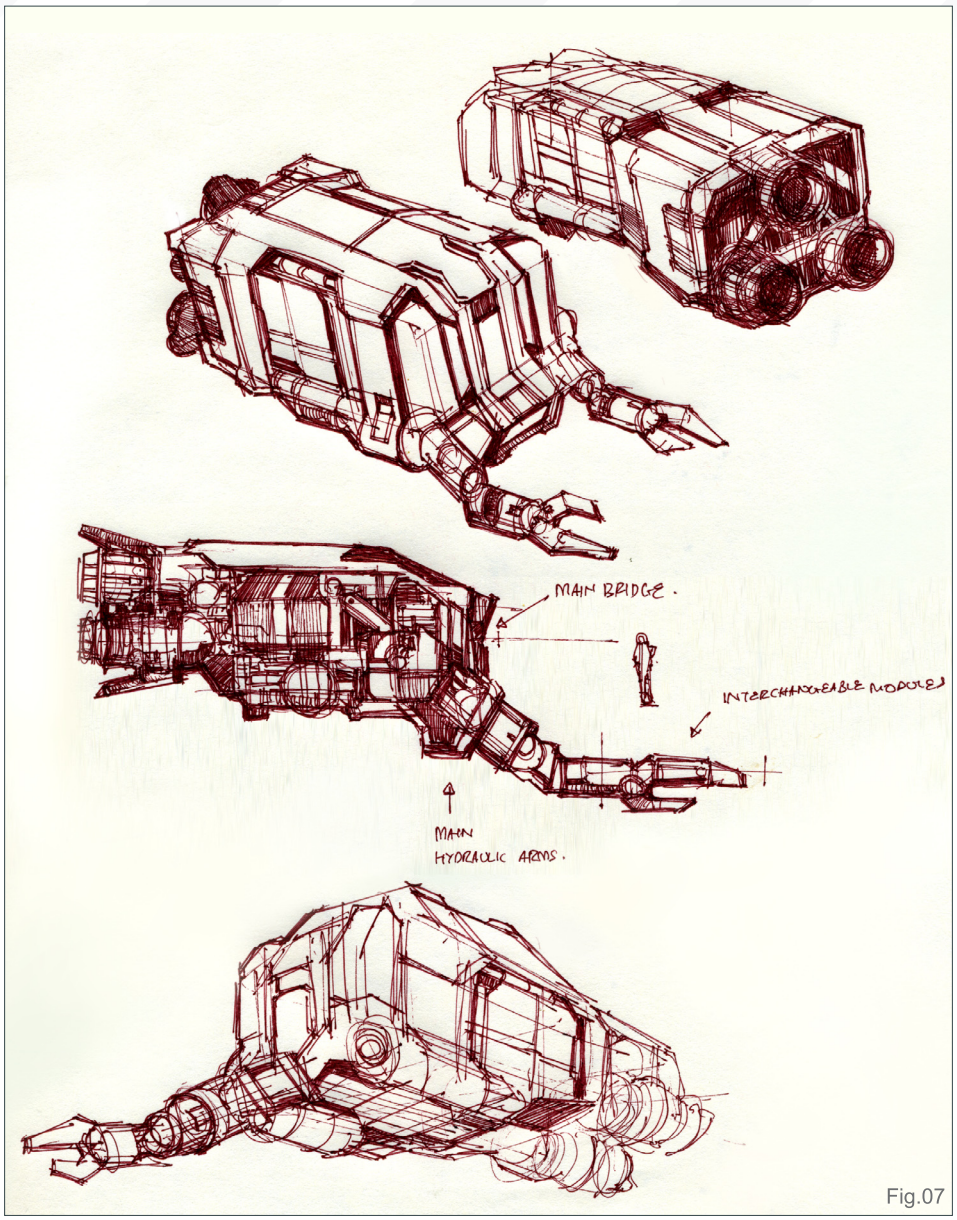


Fig.07

Building the Vernier

The Vernier is explored next from a different profile angle. Upon its second iteration, the squat rectangular shape is retained; however further additional elements are added, such as modular cargo side pods, ventral and dorsal airlocks and a large gold reflective bubble cockpit situated right at the front.

In **Fig.08**, the methodology is simplified into a three stage process and finished with further details and tightening. Hopefully, it is relatively straightforward and self explanatory, but just as a recap:

- **Initial Draft** – The silhouette is drafted; if the overall form reads well, it will read at a large or small scale
- **Key Design Features** – The trio of semi rectangular side-cargo pods are the distinguishing feature of the Vernier, and help break up the overall squat form
- **Tone & Value** – Shadows and tones according to its relative planes are applied
- **Details & Contrast** – I liken this to

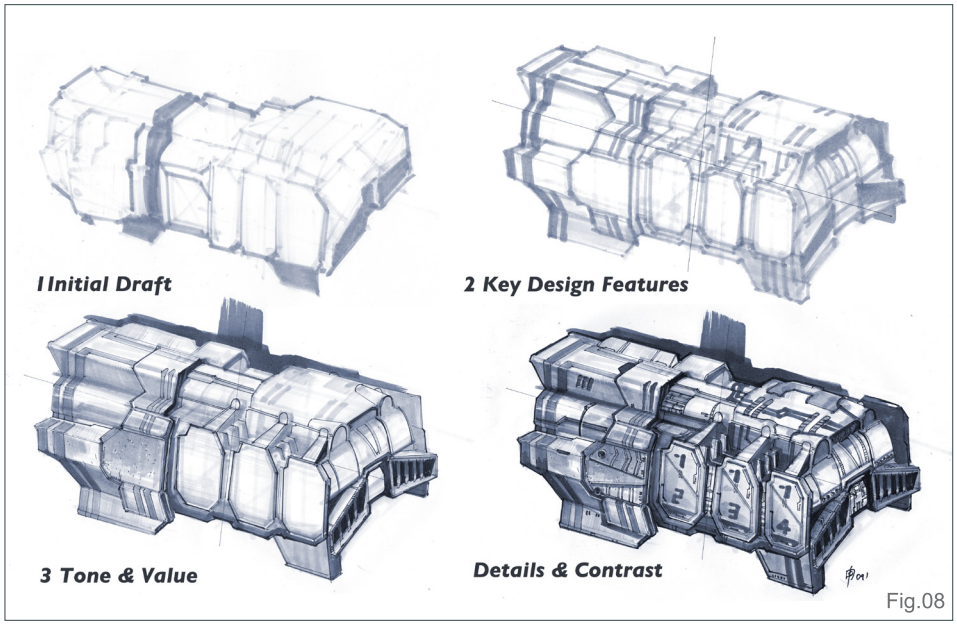


Fig.08

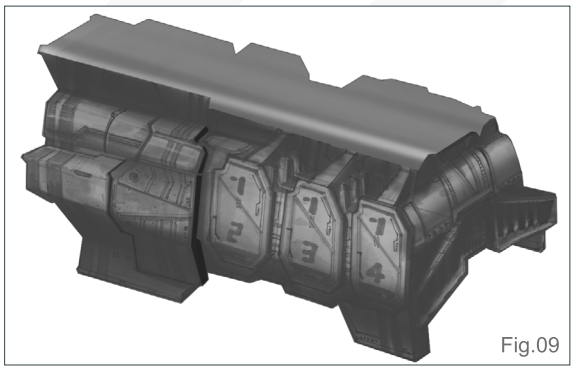


Fig.09

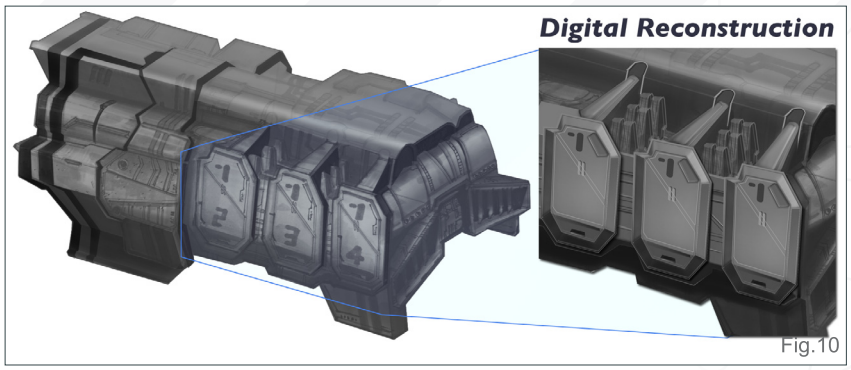


Fig.10

tightening the screws; tiny details, design features and vents are applied

Digital Marker Technique – Selection Hell!

The next aspect is to explore using more digital tools – namely the production of a digital marker concept. The essential secret (if there are secrets) to this technique is an initial clean line draftsmanship, followed by selections. Multiple, multiple and multiple selections and gradients – that is the byword of industrial card design. In addition, for every edge there should be a bevel, a line, an ambient occlusion (shadow) and a highlight. This ultimately translates to: pain!

In theory and practice, one could optimise the process quite easily via a system of recorded actions, to produce selectable objects and selections at a single touch of a button. However, for the purposes of this workshop, only the Lasso, Fill Gradient and Airbrush are utilised for the entire process.

For this process we want to essentially break the original design (see **Fig.08**) down into key facets. There are primarily three key faces and two angled planes. So, armed with the Polygonal Lasso tool, let's rapidly take you through the process (minus the pain). From start to finish, this process of selections took a good ten hours of fudging – non-stop. In comparison, painting it digitally took two hours!

However, it is the type of finish and effect that is desired which is important, and thus it is vital to at least appreciate how to use various techniques to accomplish different levels of finish and decide on the method that suits you best. Tools for fools, remember!

In **Fig.09**, the upper facets are selected and an event gradient is applied to all planes facing the light. Next up is the production of the more complicated but repeatable cargo side pods (**Fig.10**). Because it is a complicated shape, this segment alone took a good hour to lathe, plan, plot, tone, and value. Once it was completed, however, it was a matter of grouping its various components together and applying subtle drop shadows, and multiplication to produce a faux 3D effect.

Some hours later...

All the major facets have been plotted, selected and the respective Gradient Fill applied. The design looks respectable (**Fig.11**) and multiple key design features have been added to the whole space transport. Unfortunately, there

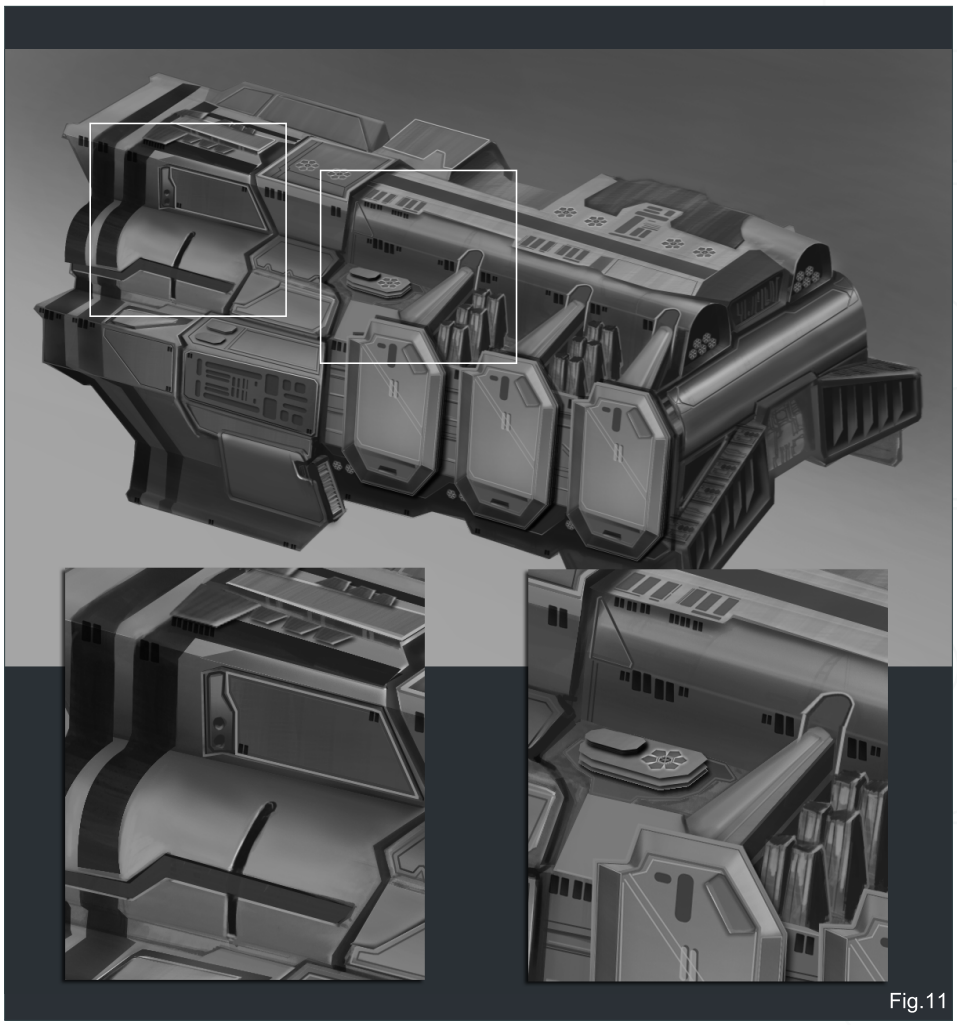


Fig.11

is nothing mysterious or special about this process, just mindless selections and gradient fills for each facet or curve. And the generation of a bevel, shadow and appropriate highlight. Lastly is the generation of a simple cast shadow (**Fig.12**), which involves plotting the way forms interact with the directional light source. Using the Line tool it is relatively straightforward to cast a direct shadow. In this instance, we use a top-down direction to plot the cast shadow. Cast shadows are effective in providing readability and three-dimensionality of any drawn two-dimensional object.

Digital Marker Technique – Painting it simply!

For the simpler option of painting the vehicle, an understanding of form will help immensely in the rendition of the various facets and surfaces. For this methodology, I would highly recommend painting still life objects (from your local surroundings). You will be amazed at how rapidly and powerfully you can apply these studies and knowledge to your digital/traditional painting. Alternatively, you may choose to use 3D software or traditional sculpting of figures and objects to understand forms better (**Fig.13**).

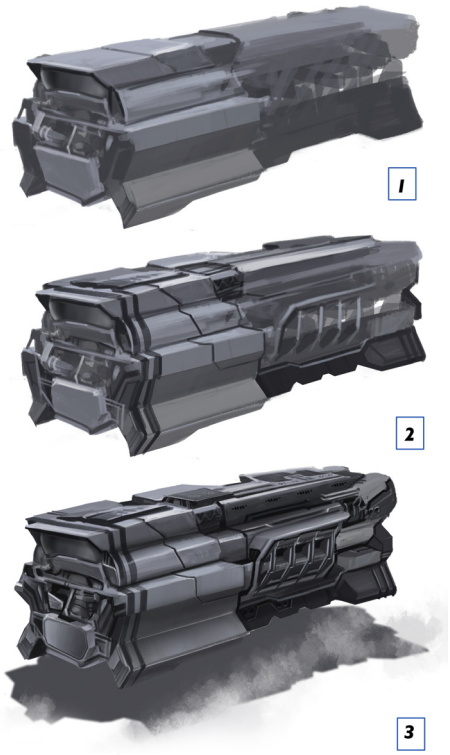


Fig.13

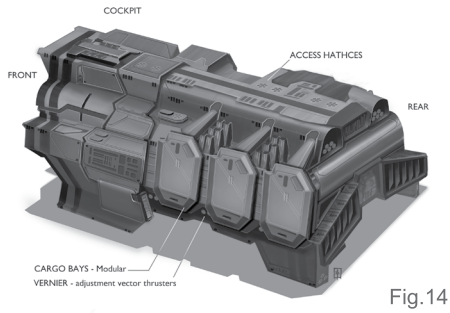
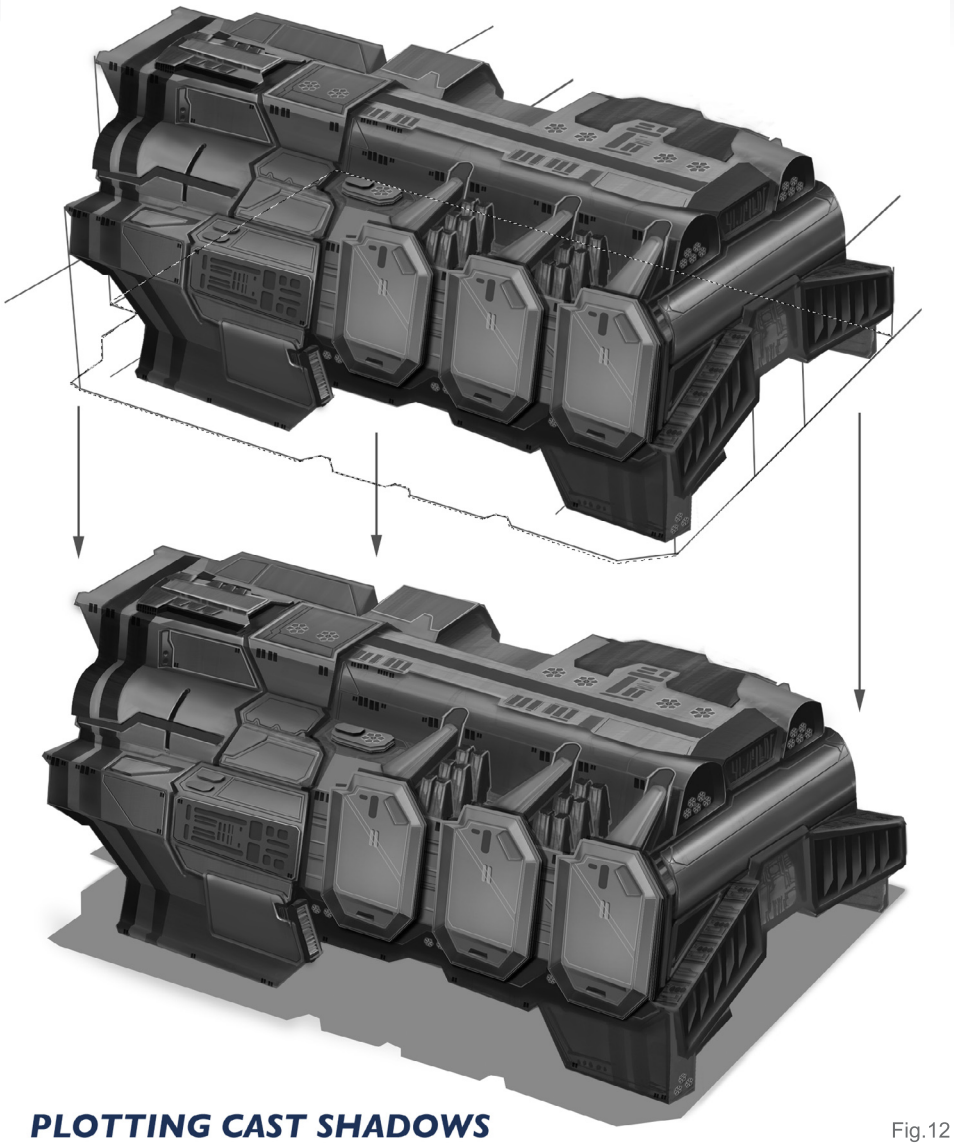


Fig.14

Again, we utilise a simple three-step process towards this that I can summarise as **(Fig.14)**:

- **Block in** – block out a relative form using the broadest brushes possible (on a new layer) and do not worry about details or being tight
- **Sculpt out** – much like trimming away excess clay, mould your transport into a more defined shape
- **Detail in** – using a finer brush, add all the focal details and subtle bounced light you think may be inherent



PLOTTING CAST SHADOWS

Fig.12

Colour Pass

This process is very straightforward. Honestly, if the values are relatively narrow, the transition to colour can be quite rapid and mocked up. Total time spent here was 20 minutes.

Now, firstly you have to understand that there is a natural frustration when adding colour to a greyscale image. In an environment, it may appear almost impossible or at odds. However, for a transport of character, a flattish or nondescript background is often sufficient towards producing a relatively pleasing effect.

In our process, shown in **Fig.15**, we start by colouring our stripes first (utilise the Colour layer option). Stripes are important as they help lead towards seeing a three-dimensional form. Next we apply a base colour. For space transports a creamy white base is an excellent starting point. This is primarily because cream white is a great way to pick up local ambient colour. For example, a white alabaster marble cast sphere placed above ground under a blue sky will have bluish hues above, and warmish bounced light below.

Once you have established a weak – almost anaemic – base colour, you should subtly add saturated colours and colour your background. The secret to making a greyscale image work, or a greyscale object work, is its surrounding colour. In this instance, we apply a saturated orange background, and this seats the whole image together. It is appropriate at this stage to flatten the whole image and tighten up over the image with a brief lick of paint to unify both object and background together (**Fig.16**).

III: Shaping a Future

Now that we have all our separate props built, we can cast them much like actors on a stage. In this instance a stage filled with asteroids rich with resources for harvesting, and a way station for humanity in the depths of space.

Stepping Stones

The objective here is to move from retro to digital. We bring it all together as an illustration/ production set design. Now that we have taken the effort to produce the various components, the next step is to see how it stands up within an illustration or a virtual set. Before that though,


Fig.16

Fig.15

let's take a small detour and discuss colour palettes and value ranges (**Fig.17**).

In the colour palette (see **Fig 17**), there are three ranges shown. These cover warm, cold and saturated. Upon analysis of most retro paintings or master paintings, a narrow palette of colour tends to be used, such as Palette 2 or Palette 1.5 in **Fig.17**. Whereas in contrast, the more stylistic or illustrative images depicted in the mid 1950s and 1960s tend to have more vibrant, saturated range of colours.

Notice on the far left there are approximate values of these colours in greyscale, which amount to either a wider range of values (saturated palette) or a narrow range of values (cool/warm palette shown above). For our purposes, we will use the selected range of cool colour palettes for the final aspect of this workshop.

Fig.17

Illustrating an Asteroid Base within an Asteroid Belt

In this illustration, we will consciously not have any luminous star nearby. Instead, we will use various bands of nebula cores and spiral galaxies to offset and provide lighting for the mining base (**Fig.18**). I find it useful to lock the colour palette off in a small corner to the top right, and move it about as needed.

In this instance, let's opt for a narrow green blue colour palette and simply start the process by blocking in a monochromic swirl of gas clouds. Next is the important task of blending in the various strokes to produce subtle midtones. Ensure you don't blend too much to allow for some of the original marks to show through, as these will help produce happy accidents and abstract shapes.

Subsequently, we rough in the approximate shape of the mining base, attached to a partially cored large asteroid. Lastly, we can bring these abstract shapes into a more solid form, which I term "solidfication". This allows you to determine the contrast between hard surfaces and various objects.

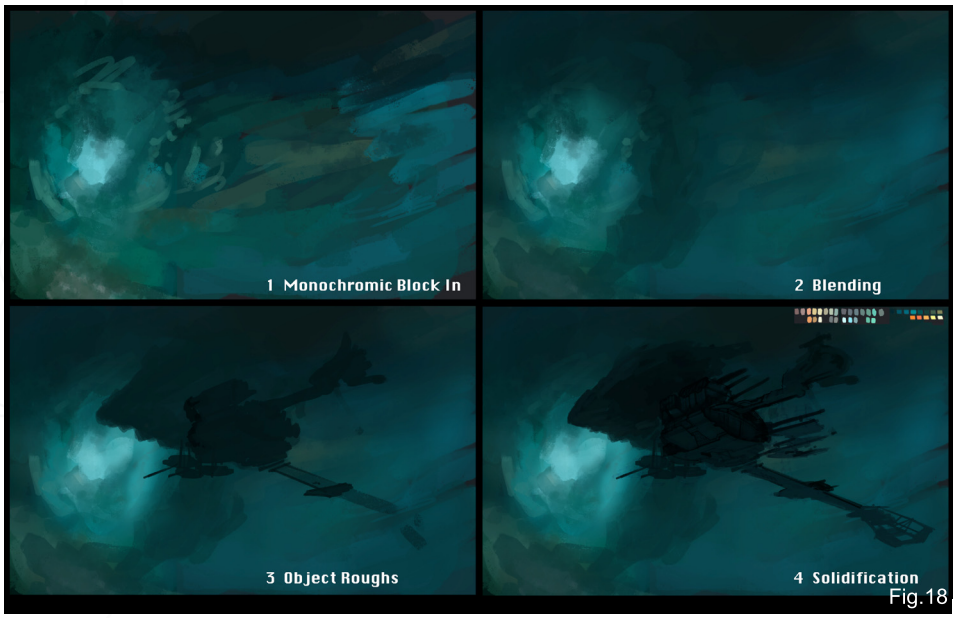


Fig.18

In terms of composition, I felt it important to provide a sense of floating in deep space, and decided to invert and place upside down the top aspect of the base – and perhaps have various mining rigs docking and leaving the base.

Asteroid Field

Next is the plotting of an asteroid and debris field (**Fig.19**). I imagine that the area surrounding the large asteroid shell would be more devoid of asteroids and have been harvested to produce more harvester rigs and base modules. Keep in mind that various asteroids will come in all shapes, orientations and sizes. However, it does stand to reason that the further away they are, the smaller they may appear.

So using a semi circular design, the various asteroids are plotted in by hand by their multitudes and are repeated via various processes of multiplication until we have the

impression that of floating in a field of rocks and debris. Much like flotsam and jetsam at sea. Do ensure that the facets facing the primary light source are lit, and those facing away retain their base tone. To provide a really volumetric feel, you can later plot multiple cast shadows to good effect. Just ensure not to go overboard!


Fig.19

Props in an Asteroid Field

Thankfully, we have spent sufficient effort and time in generating a well designed DSEV rig for use in deep space, and these can be inserted into the scene relatively easily (**Fig.20**).

For a close up view of how such integration can be used, let's look at **Fig.21**. The carefully selected vehicle is inserted twice: one set on Luminosity (this allows the rig to attain a homogenised colour with the backdrop), and the second set to Multiply (with opacity adjusted) in order to ensure that not too many details are shown, in comparison with the overall image.


Fig.20

To keep the whole illustration tidy, I have structured the various layers into three simple groups (**Fig.22**):

- **Palette**
- **Group 1 – Transport**
- **Group 2 – Asteroid Field**
- **Group 3 – Asteroid Mining Base**
- **Background**

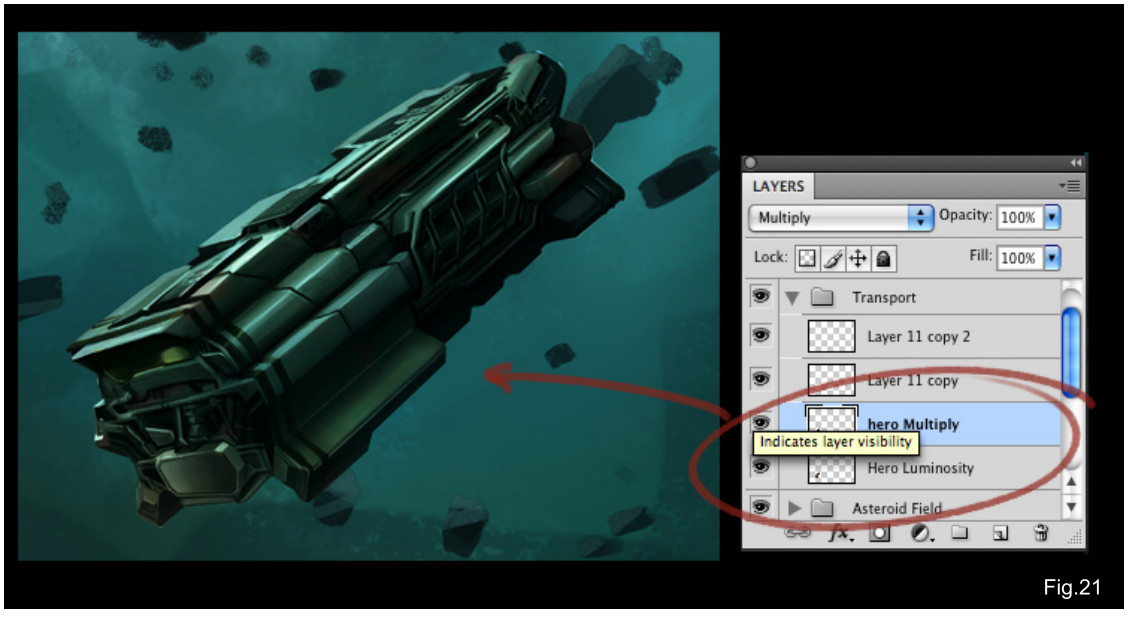


Fig.21

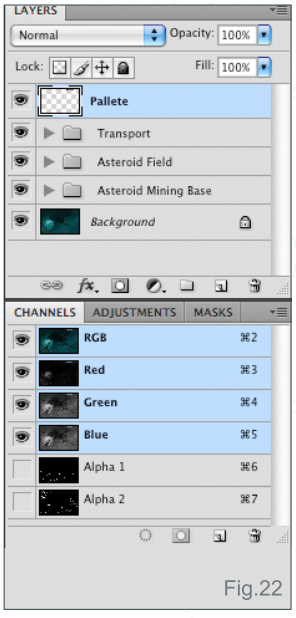


Fig.22

The next aspect is to block in all the highlights and shadows of the lit and under lit surfaces of the base (**Fig.23**). As long as you keep within the established palette, this should be a relatively rapid affair. In this instance, you may choose to put your fully designed station set on Overlay/Multiply onto the illustration. In contrast, however, I have chosen to merely Overlay the initial layout sketch, which is far cleaner and devoid of the finer details that won't be apparent to the viewer at such a distance anyway. The advantage of this is twofold:

- The detailed worked-up model allows the visual database to selectively add any key features without obscuration, and allows you to paint facets without getting bogged down with the lovely details
- A clean layout allows one to paint in merely facets and therefore simulate/replicate the feeling of how it may appear in space, but actually only provide simplified key data using various tones/values to denote a facet/plane respectively

Fig.23

Post-Processing

The final aspects of any illustration are to add some focal details, slight colour adjustments, glows, and final rechecks to ensure the composition and subject matter will appeal to and draw in the viewer (Fig.24). More importantly, please check that you have started and converted your image to a larger pixel resolution, as there is nothing more disheartening than having spent all that time painting and establishing a brilliant painting only to realise you have painted an image that, when printed, is only visibly clear on a pinhead.

Conclusion

Thank you for joining us on our far flung space quest from the outer reaches of other worlds, and the regions of the nearby planets in the solar system. We have discussed the more commonalities of exploration of outer space, living in intergalactic space, and extrapolated as far as the establishment of colonies and realms of mankind within the far distant future. In addition, I hope I have been able to provide and share useful production workflows and solutions as a modern day artist, that are versatile in any media, steeped in the foundations of traditional truisms, basics of art, and applicable within the modern and traditional media.

What may or may not have been apparent was that in this workshop, we have integrated multiple processes of production set design and prop design, and tied it all together to produce an illustration or mood piece for production. It is surely a more laborious process but the end result hopefully speaks for itself as a solid, coherent design illustration.

In our final chapter, we are going to re-examine mankind on their quest for the stars by imagining them adrift on countless star ships and establishing far flung colonies across space. We will draw upon the spirit of various space visionaries and come full circle in mankind's continued quest to explore, seek new life and discover the mysteries of the universe. See you next chapter!

Dr Chee Ming Wong

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Fig.24

Chapter 12

SPACE COLONIES

SPACE PAINTING
CHAPTER 12: SPACE COLONIES

Created In: Photoshop


Fig.01

Introduction

Welcome, dear friends, to the final chapter of our chapter-long exploration of science- fiction and outer space travel, both within and without the vast tapestry of our Milky Way. We are at last at our journey's end, and looking back over the chapters it has indeed been quite a journey, both artistically as well as in the richness of life experience; distilling and consolidating space research, knowledge and art techniques into one memorable whole. Starting from the birth of the stars and hurtling forth through nebulous clouds and the barrenness of desolate planets, we explored the far flung reaches of mankind's journey into the last great frontiers of space. For our final act though, let's reach back to a time when mankind has decided to actively reach for the stars, and in the first step to greatness, mankind has decided to build the first space colony, known as the International Space Island Station One (ISIS-1).

I: Colony Construction

To build a colony that can truly sustain the long-term habitation of a new breed of mankind in space, there are a few fundamental challenges. In essence, mankind needs to address the issues of:

- Radiation
- Lack of gravity
- Reproduction and fertility
- Sourcing building materials
- Sourcing sustainable and consumable resources

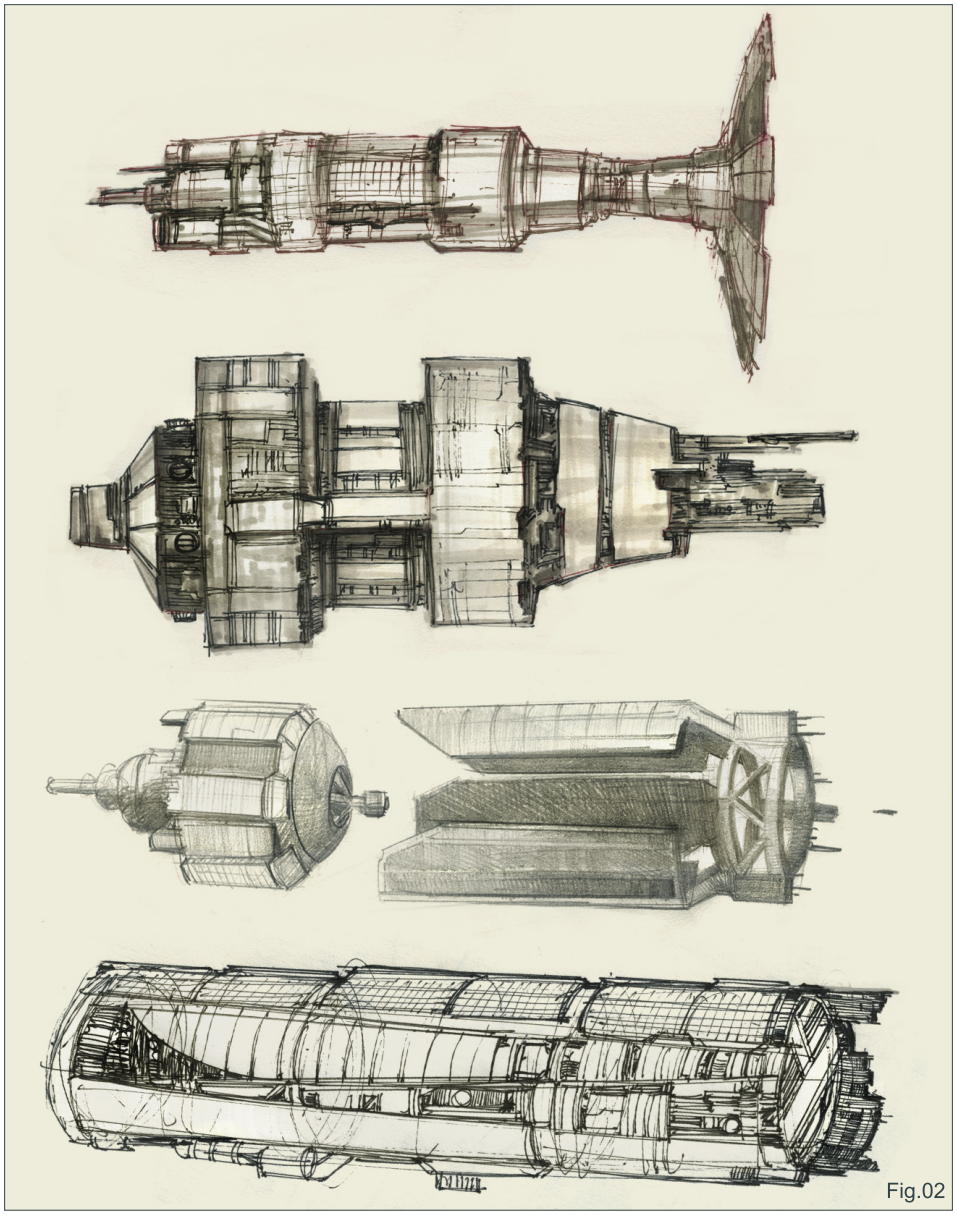


Fig.02

For a vision of the future today, exploration of Closed Ecological Life Support Systems (CELSS), or biospheres, started from the 1965 Russian BIOS-3 pioneers, when algae was used to recycle the air breathed by humans in a closed facility in Krasnoyarsk, Siberia. Subsequently, various projects such as NASA Human CELSS Experiments, Biosphere 2, Nauvik and the Eden Project explore the range of habitation within various enclosures that all help in our understanding of the building and habitation of orbital space settlements, and therefore future planetary habitation (**Fig.01**).

Colony Designs

The designs produced for this workshop are based on a combination of large cylindrical colonies, paired with twin torus-shaped habitats that are built to counter rotate one another to

produce artificial gravity and reduce any wobble along the central cylindrical axis (**Fig.02**).

Artificial gravity can be generated via centrifugal forces with gravity being stronger on the periphery of the wheel-shaped habitat. This allows for the use of zero gravity within the central zone, which is useful for the placement of:

- A space port
- Manufacturing sectors
- Hydroponics
- Research and development labs

In our initial schematics (see **Fig.02**), the external wheel-shaped (torus) habitats are not included but can be placed at various diameters at any point along its central axis. Locating these tori within the centre may tend to cause wobble on either end of the central axis, whereas on the end of each cylinder tends to cause a larger wobble on the opposing end. It is therefore vital to attach an equal and opposite rotating force – to counter the centrifugal force – at any one point.

In addition, various design aesthetics (see **Fig.02**) are explored for the central axis colony designs. These range from delicate and welded parts to more solidly constructed elements, giving the appearance that the various forms have been built from a singular slab of mass. These schematics allow us to logically visualise how the circular habitat would attach to this central hub.

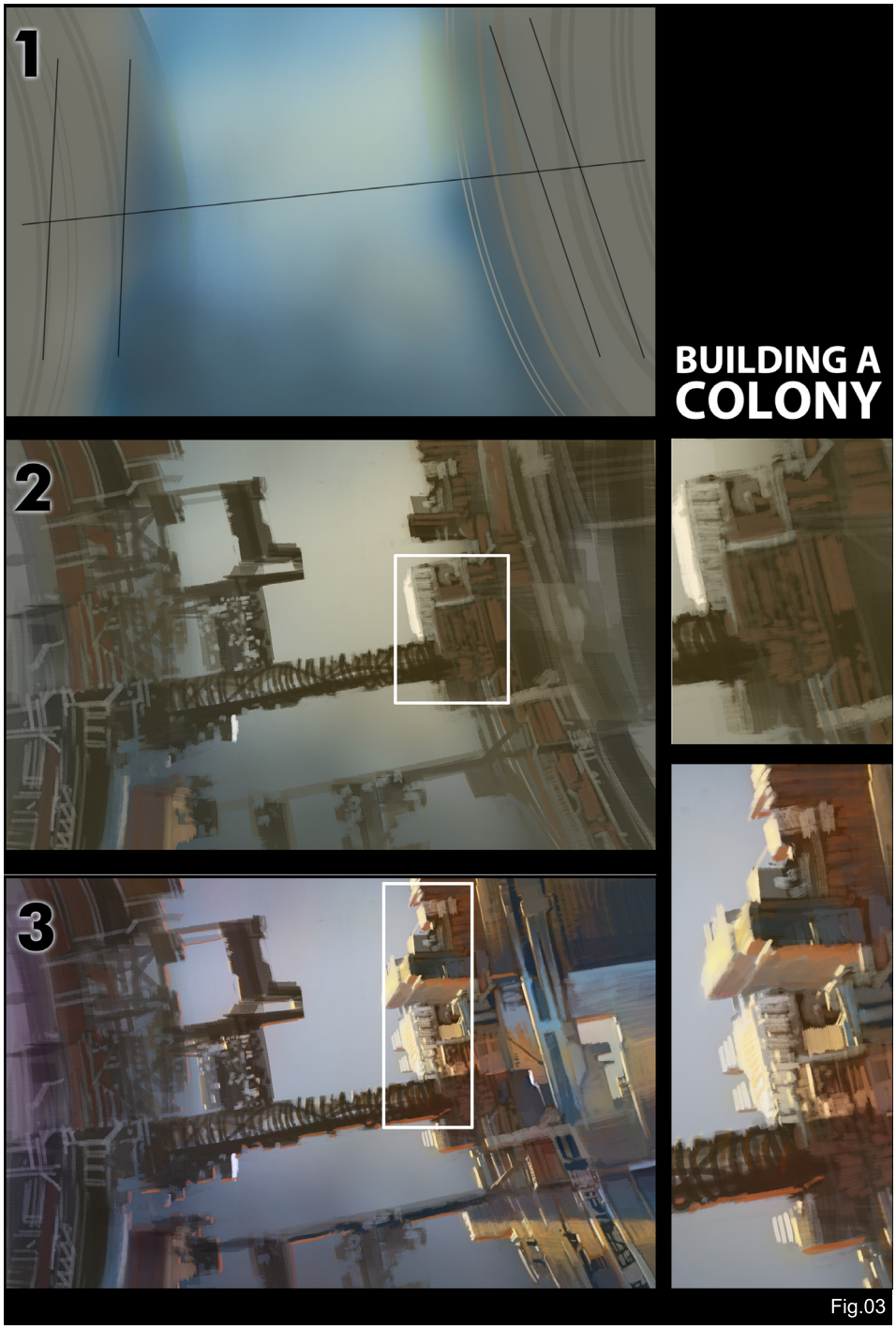


Fig.03

Patchwork Colony

We can now visualise how the gigantic toroidal ring may be assembled around the central axis (**Fig.03**). Often, due to the scalar issues involving such gigantic masses, the whole super structure is rarely visualised without losing some element of detail. The larger an object is, the smaller a feature, such as a bay window, may appear. It is therefore a trade off between detail versus overall shape and form.

Layout

The first steps (see **Fig.03**) involve essentially the layout of the composition, general shapes and forms, whilst establishing the key (main) light (source). These 3 key steps are sufficient to establish up to 70% of any illustration (the rest can be thought of as additional window dressing, sprucing and polishing; i.e. bringing an image into sharper focus).

Initial Layout: Establishing the perspective. The main axis is plotted and a gradient fill (main back light) is established. Initial construction lines allow us to plot and suggest the overall direction.

Block-In (Monochromic): The key forms and shapes are established in this shot. Ensure the overall composition reads as one shape, and that the key lighter and darker panels are established.

Colour Palette (Warm and Cold): The establishing (low contrast) monochromic palette gets a warm and cold treatment. Areas of light are assigned warm colour values, and areas of shadow are assigned cooler tones. A low key light is used to allow for long cast shadows.

To unify the whole illustration – this is where the artistic license comes in – some suggested bounced light from local light sources (orange/red is used in this instance), and a fake bluish sky light (to gel the whole image as if it were within atmospheric conditions) is implemented. This is due to the decision to employ a primary blue-cyan colour, with a naturalistic yellow sunlight complementary colour scheme.

Colour Correction

The next aspect is to explore the overall colour of the composition. In **Fig.04** you can see how the change from a primary blue-purple shadowed area to a cyan-brown-orange combination changes the whole mood and feel of the establishing illustration. Notice that only the far right aspect has this applied. This is due to the initial piece having a uniform colour palette established, and by adding a warmer set of tones on the right tells the viewer that there is an overall contrast to the piece, and suggests a global backlit light source (left).

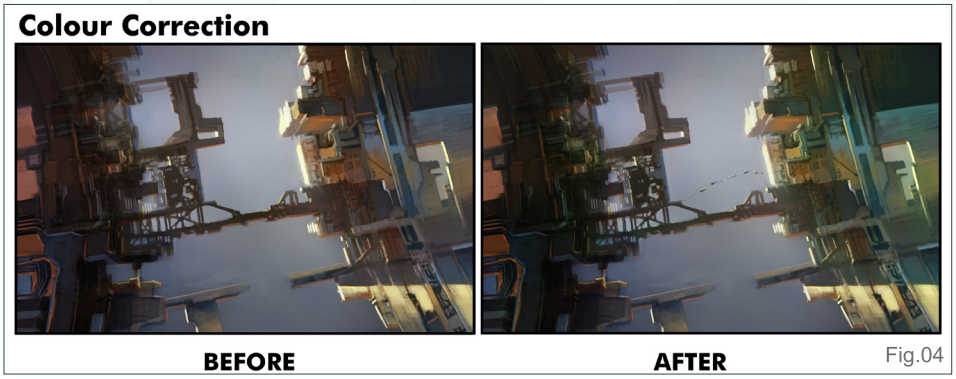


Fig.04

In addition, we have taken the opportunity to add some minor object interest, such as a string of objects traversing from one end of the cylindrical mass to another. These represent a collection of cargo and extension modules to help further extend and build the bridging structures to bring the two cylindrical structures together. Within this step, the suggestions of volumetric cast shadows and light are established as well. We will return and strengthen this aspect later on.

Local Colour & Lighting

Once the right colour palette is established we can tackle the window dressing aspect (**Fig.05**). This segment can bring much life and local hue variation to any image, and therefore cast interesting shadows across various forms and provide the clearer suggestion of abstract shapes and forms in an image. We can employ various methods, such as:

- Use of pin-point lights
- Neon glows (used judiciously)
- Repeating shapes and elements (suggest forms in perspective)
- Strips and bands of light and darker material

Fig.05

Lens Flare

The lens flare was once a key selling feature of early digital art, that eventually suffered from overuse and subsequently died a violent death. However, lens flares are back with a vengeance and in this instance can be justified.

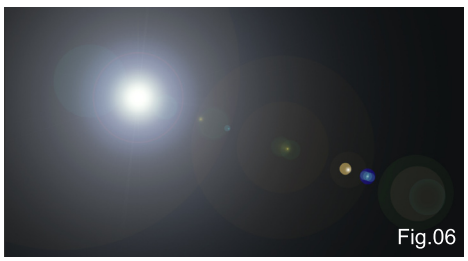


Fig.06

To use the lens flare (**Fig.06**), we make a new layer and fill it with a primarily black colour. Subsequently, a lens flare is plotted on, and using the layer blending options we set it to Overlay or Hard Light, to suggest backlighting.

Bloom & Volumetric Shadow

With the final lighting and colour integrated, the final aspect is to apply volumetric cast shadows and bloom. In this instance, the main light source is hidden in the upper left, and to suggest additional 3-dimensionality we can punch in further holes and prebuilt panels to create interesting plays of light and dark (**Fig.07**). Similarly, appropriate volumetric cast shadows across the large structures help to sell the overall image by suggesting the correct form and readability.


Fig.07

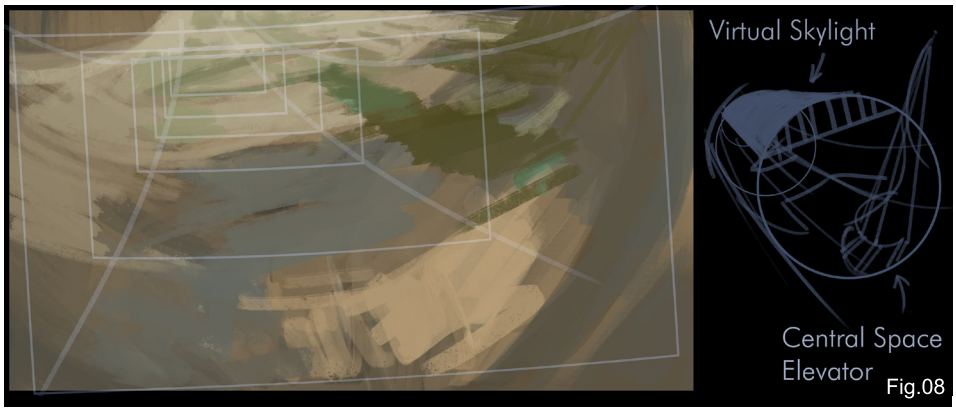


Fig.08

II: Inhabiting the Colony

In this second part of our final workshop, we aim to establish the first colonists living within a small segment of the space colony. The whole habitat ring has yet to be fully built. Over the next few chapters and decades materials secured from strip mining of the local asteroids and surface of the moon go into the generation of space alloys, rare metals, water

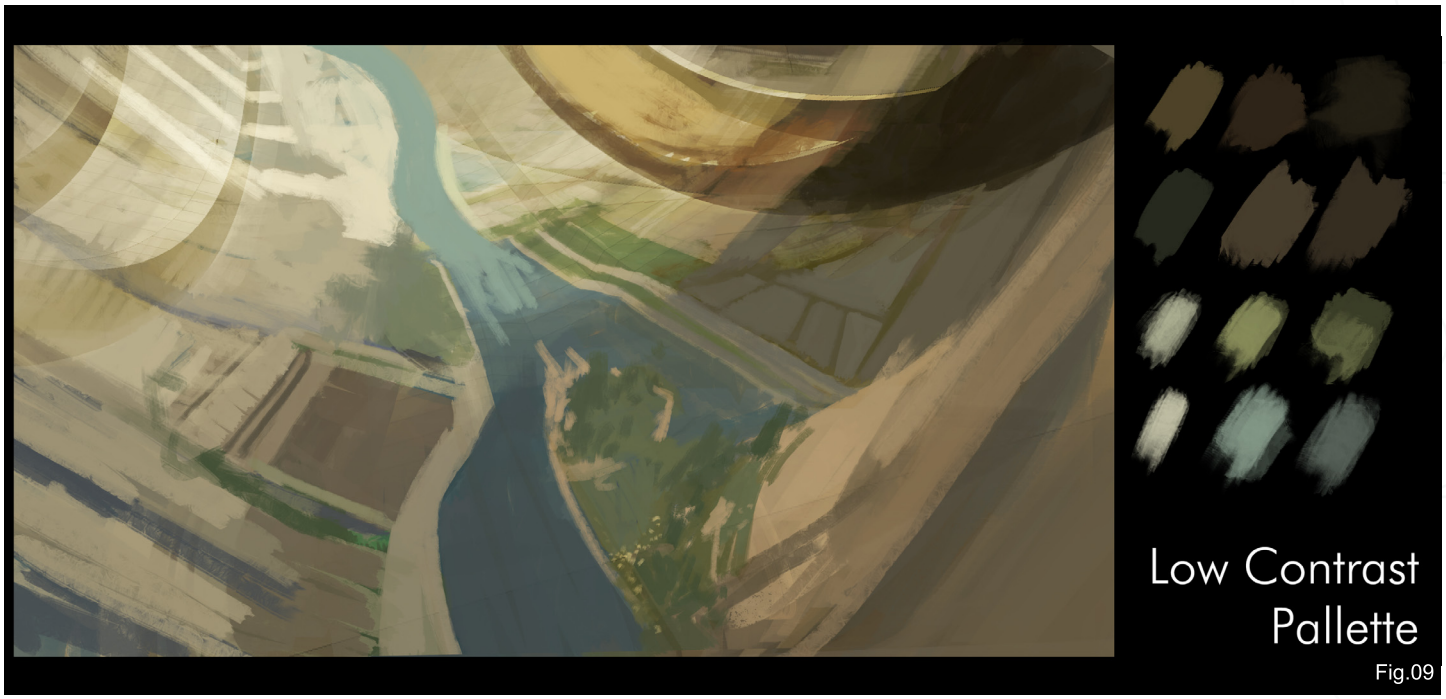


Fig.09

and resources for life in space. Each segment of the vast ring habitat has a thick exterior to provide effective radiation shielding; this is further provided by a thick half-mile layer of soil, concrete and life support systems.
The early colonists are to establish a small space city and farming community to research and develop a self sustaining community in space. The aim is to recreate an artificial land of verdant green plains, lakes and vast waterways that additionally ensure there are sufficient natural CO2 scrubbers, and humidity – therefore a sub atmospheric condition that is suitable for human life, once some basic adjustments are made (akin to living in high altitude).

For the simulation of a 24-hour night and day cycle, a virtual halo sky light strip extends all across the inner side of the torus, with inhabitants never seeing a real horizon during the habitation of ISIS-1.

Farming Colony

The initial canvas involves exploring various compositions for the depiction of such a large colony. The idea involves a high bird's eye view, whereby the viewer is high above from an adjacent sky train leading towards the inner segment Zero-G spaceport (**Fig.08**).

You can either choose to plot a curved perspective in by hand (I use the simple process of receding boxes plotted by hand), or to make your life easier a simple 3D torus block in can be employed.

Palette

The next task is to establish a low contrast palette. In search of the old style of early space illustrators, we will aim to stick to a sky blue, yellow-green surface style of painting (**Fig.09**). The initial forms are not much to look at, and in this instance look like mud! The key is to stick to the plan and carry it out methodically. A meandering central waterway occupies the main aspect of this view, and curls slightly towards the top left. Repeating large shapes of habitat

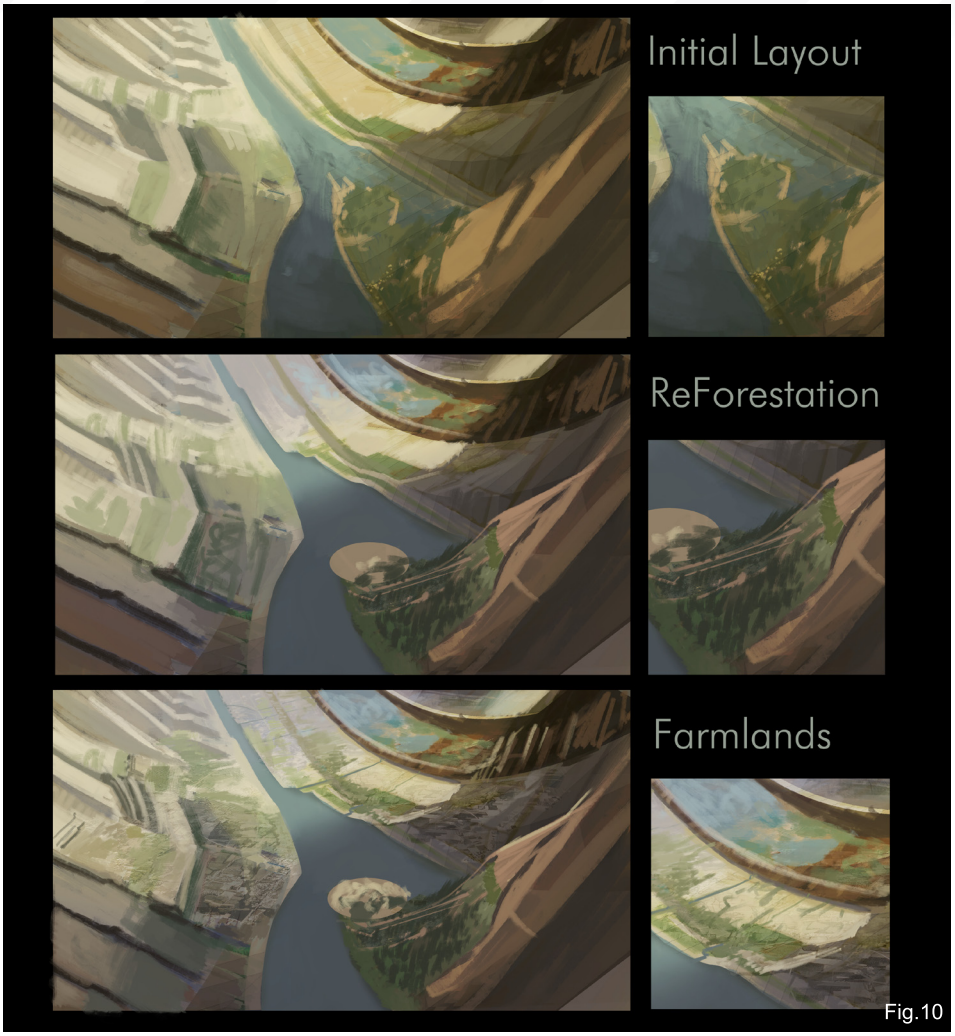


Fig.10

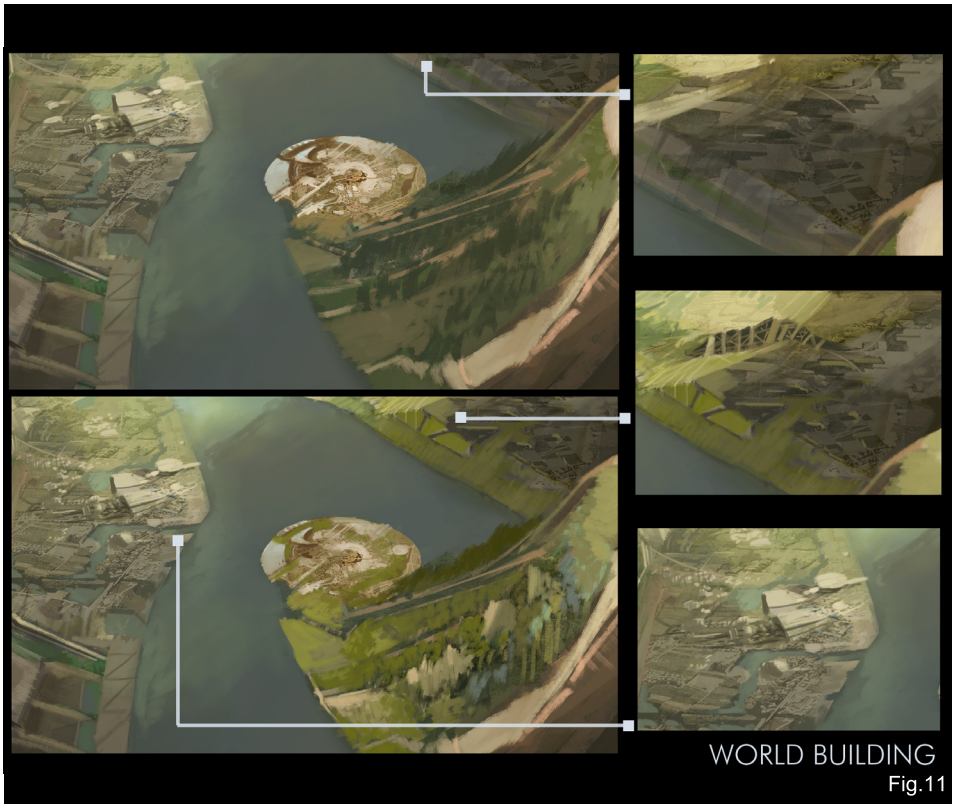


Fig.11

dividers can be seen in parallel on adjacent segments on the periphery of vision.

Central Sky Train Elevator

The next part of the illustration involves some struggle in defining the design and forms of the foreground (**Fig.10**). Essentially, this will be the base of the sky train that will curve and lead upwards into the spaceport (upper right).
The initial layout involves some sort of futuristic tower and materials, which was subsequently reforested with crags, low hills and plains. A central transport hub is initially blocked out, and in addition the suggestion of distant farmlands sloping away into the distance is established.


Fig.12

World Building

Once the general foreground details are established, we can go about and decorate the whole illustration with farmlands, lawns, forests and initial outlying buildings (**Fig.11**). (For inspiration, the various biomes seen in the Eden Project are used as reference – see **Fig.12**). In addition, various docks and waterway resorts are added to suggest various alternate methods of transport in this ring habitat. Fast-forward a few hours, and most of the illustration has been populated with small segments of farmlands, lakes, and waterways. Within each waterway, care is ensured to establish a light, mid and dark side, to suggest depth and translucency (**Fig.13**).

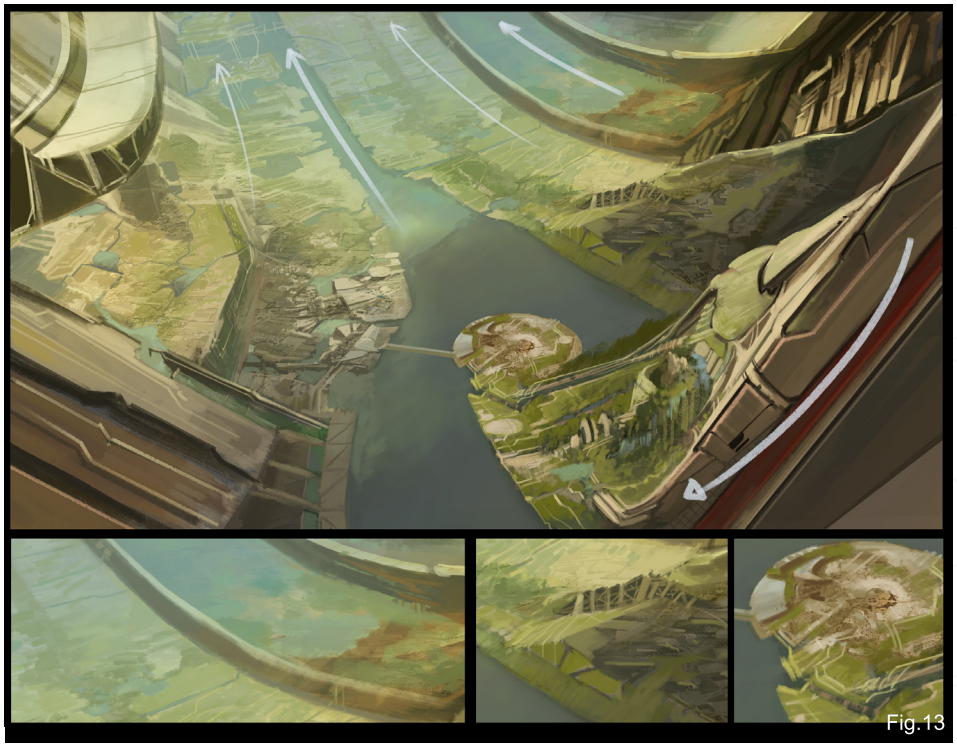


Fig.13

In the far right corner, the initial block forms of a sky train are established, and the overall

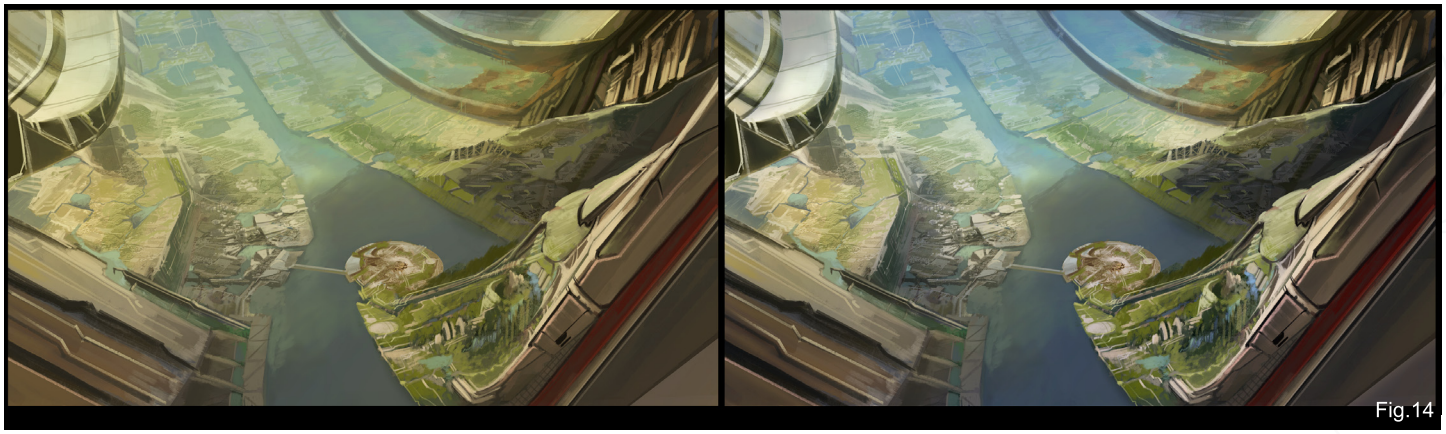


Fig.14

sweeping form of a curved perspective is ensured.

VFX Post-Processing

To complete this illustration, the whole image is saved and flattened, and the final aspects can now be attended to.

A simple Levels adjustment does magic to the overall image (**Fig.14**) – compare the initial green-tinged image (top), and the one with levels adjustment (bottom). We add an additional layer of aerial perspective and a light glaze of desaturated bluish fill light to gel the overall image.

VFX Sky Train

To bring the foreground object (the sky train) into sharper relief, various details require further attention, such as (**Fig.15**):

- Focal detail
- Motion blur (edges)
- Decals
- Thrusters

Once these elements are attended to, the final touches are really just to address various areas of deficit. This tends to happen when you have worked a few hours on an illustration and have become too accustomed to everything. It is useful to take a few minutes out, to walk about and do something else – i.e. give yourself a short break.

Break over! Let's take an objective look at the overall image (**Fig.16**). Looking at the illustration, I feel there are still some gaps to be filled, out with the brush and more lawn and greenery is added over various barren surfaces. Some highlights and reflective details on the sky train are worked over, and the translucent toughened glass cockpit is given some subtle highlights.

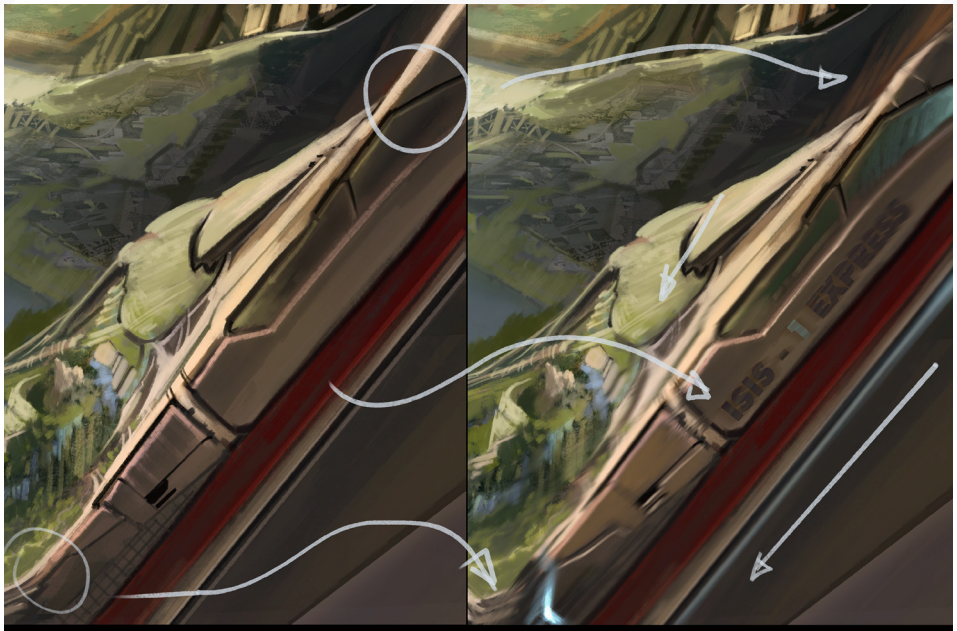


Fig.15


Fig.16

To complete this, our last space painting workshop, the illustration involves some final colour correction. This last stage also includes the addition of aerial perspective, the tidying up of various small details, and the addition of some motion blur via the use of the Smudge and Blur tools (for that personal touch!) on the far edges of the space rail, I ISIS-1 Express (**Fig.17** – Final).

Conclusion

We have now come full circle in our exploration of mankind's continued quest to explore, seek new life and discover the mysteries of the universe. Thank you for taking this journey with me, and may we meet again in the future.

Dr Chee Ming Wong

For more from this artist visit
http://www.opusartz.com
or contact
info@opusartz.com

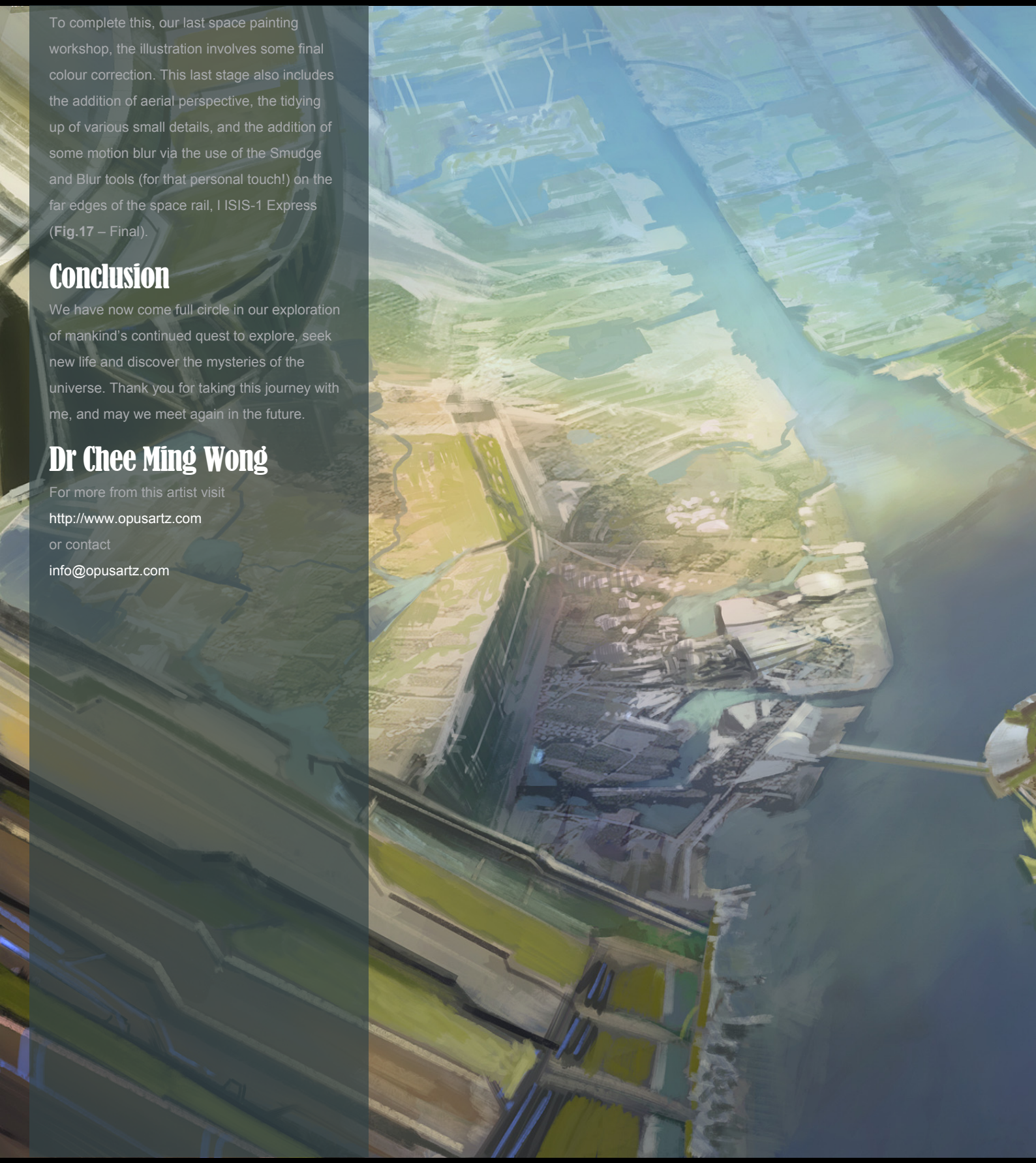


Fig.17

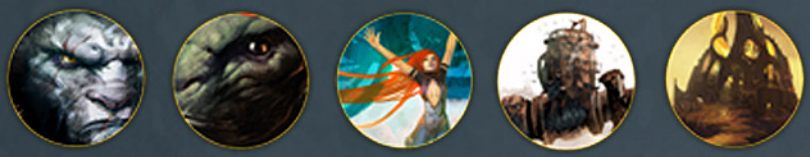
Custom Brushes

Digital Painting Tutorial Series EBook

Introduction:

The Custom Brushes eBook is a 72-page guide on how to create your very own set of custom brushes. We have asked industry professionals from the likes of Carlos Cabrera, Kim Taylor, Melanie Delon, Marc Brunet, Mike Corriero, Richard Tilbury, Brian Recktenwald, Mike Lim (aka Daarken), George Patsouras, Larla Ortiz and Ignacio Bazan Lazcano to create easy-to-follow guides/tutorials on how to create Custom Brushes. As well as giving expert tuition, some of the artists have also supplied their brushes and these can be downloaded at the beginning and end of the tutorials, where available.

This tutorial eBook also includes 84 free downloadable brushes.



The artists featured are:

Mike Corriero,
Richard Tilbury,
Kim Taylor,
Carlos Cabrera,
Melanie Delon,
Marc Brunet,
Karla 'Icon' Ortiz,
Brian Recktenwald,
Daarken (Mike Lim),
George Patsouras &
Ignacio Bazán Lazcano

Downloadable PDF

ELEMENTS

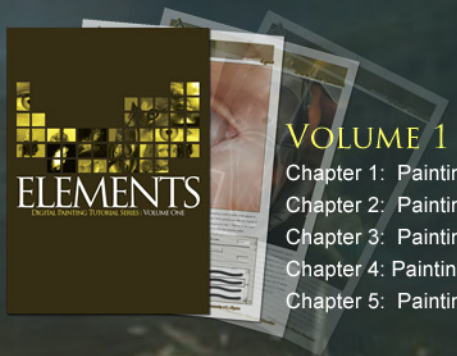
Digital Painting Downloadable Tutorial Series

Introduction

The 'elements' series is a guide to 2D Digital painting and can be followed in most software packages supporting paintbrushes and layers.

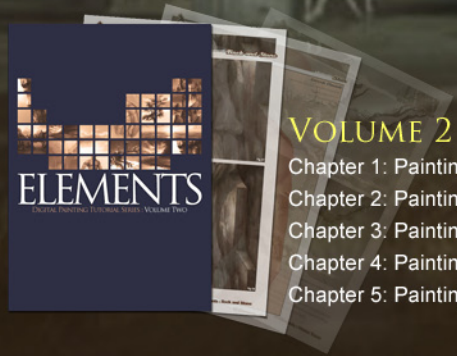
In the first two E-Book volumes, we have choosen some of the most used aspects of digital painting, we cover such topics as painting eyes, fabric, fire & smoke, flesh wounds and fur & hair and asked 2 or 3 professional artists to cover a specific theme or 'element', resulting in 2 or 3 different styles and techniques which can be viewed side by side. With the help of such talented and experienced artist as Benita Winckler, Natascha Roeoesli, Richard Tilbury, Stephanie Loftis, Adonihs and Shane Madden.

Volume 3 of The 'Elements' series follows cartoon and comic artist, Carlos Cabrera, as he takes a basic scene, created by 3DTotal's in-house artist Richard Tilbury, and transforms them into five different weather conditions.



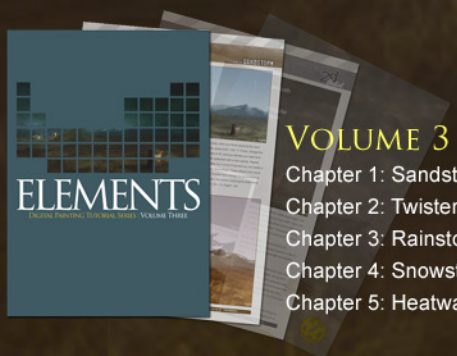
Volume 1

Chapter 1: Painting Eyes
Chapter 2: Painting Fabric
Chapter 3: Painting Fire & Smoke
Chapter 4: Painting Flesh Wounds
Chapter 5: Painting Fur & Hair



Volume 2

Chapter 1: Painting Rock & Stone
Chapter 2: Painting Sky
Chapter 3: Painting Skin
Chapter 4: Painting Trees
Chapter 5: Painting Water



Volume 3

Chapter 1: Sandstorm
Chapter 2: Twister
Chapter 3: Rainstorm
Chapter 4: Snowstorm
Chapter 5: Heatwave

Digital Painting Tutorial EBook

Introduction:

The Painting Armour eBook is a 39-page guide on how to tackle the subject of painting convincing armour. The eBook specialises in creating Medieval, Roman and Samurai armour. We asked industry professional Mike Lim (aka Daarken) to create easy-to-follow guides/tutorials on how to paint these types of armour, and as well giving expert tuition, Mike Lim has also supplied the brushes that he used, which can be downloaded at the beginning and end of the tutorials.

Chapter 01: Medieval
Chapter 02: Roman
Chapter 03: Samurai

painting armour

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Speed Painting

digital painting tutorial series v1 & v2

Introduction

These 90+ page eBooks are a collection of "Speed Painting" tutorials which have been created by some of the top digital painters around today. The idea behind this tutorial series was for the artist to interpret a one-line descriptive brief (provided by us!), create a speed painting from it and then produce a tutorial showing and explaining each stage of production of the artwork. Some of the artists have also kindly created some unique brushes which can also be downloaded at the end of their Speed Painting tutorials. This downloadable PDF eBook can be followed in most 2D software packages that support paintbrushes and layers.

The featured artists are:

Nathaniel West, Daniel Ljunggren, Emrah Elmasli, Mike Corriero, Rich Tilbury, Robin Olausson, Ignacio Bazan Lazcano, Marc Brunet, Nick Oroc, Serg S, Joel Carlo, Levente Peterffy, Mikko Kinnunen, Carlos Cabrera, Paul Davies, Andreas Rocha, Mark Muniz and Fred Augis

Volume 1

Chapter 01: Forest Fire
Chapter 02: Scary animal emerging from a forest
Chapter 03: Ship hit by torpedo
Chapter 04: Tornado moving towards farm
Chapter 05: The room made the explorers feel sick with the thoughts as to what had happened there in years gone by
Chapter 06: City street devastated by war
Chapter 07: Evolution had played its part on these creatures as their world heated up, but the thousands of years of forced hard labor had more impact
Chapter 08: The party entertainers' real twisted identities were very far from their bright, colorful disguises
Chapter 09: The citizens of the flooded city now resided in the tallest buildings connected by makeshift bridges.

Volume 2

Chapter 01: Alien Hot Air balloons
Chapter 02: Steam Powered Mechanical Destroyer
Chapter 03: The Slave Caravan crossed the Desert
Chapter 04: The Beast was poised ready to strike!
Chapter 05: Man-Eating Plants
Chapter 06: The City Centre looked like a Jewel amongst the surroundings
Chapter 07: It was a long way up but they had no choice but to continue climbing
Chapter 08: Once a Thriving City now deserted and taken over by Vegetation
Chapter 09: Robot Scrap Yard

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Matte Painting

Digital Painting Tutorial Ebook Series