yags

Yet Another Game System

SciFi Tech

Galactic Empires of the Future

Free as in Freedom

GPL

SciFi Tech Equipment

> *It is change, continuing change, inevitable change, that is the dominant factor in society today. No sensible decision can be made any longer without taking into account not only the world as it is, but the world as it will be.*
>
> *-- Isaac Asimov*

This is the future of Hollywood Science Fiction. Actually, it's not quite that bad, but the *SciFi* label is used to describe a future more suited to action and adventure amongst interstellar communities, than to one embedded in a virtual reality simulation running in a Matrioshka Brain. Laser guns and space ships if you like, rather than hard science fiction.

Yags measures the technology available to a campaign with technology levels (TLs), where the modern era around the start of the 21st millennium is TL 8. For the technology of the 20th century, see *Yags High Tech*, and other articles will cover earlier periods. TL 9 and above are in the realms of the future, so is purely fictional.

Everything here is suited to *SciFi* style campaigns, with faster than light travel, ridiculous energy production and weird new forms of matter. It may be suitable for campaigns built around *Traveller*, *Babylon 5* or the *Foundation* series, though isn't particularly suited to settings such as those of *Revalation Space* by Alastair Reynolds or *Queendom of Sol* by Wil McCarthy. It's aimed at the harder end of Hollywood SciFi, rather than the type of futures portrayed in modern SF books. If you want a harder, grittier future than *Ultra Tech* will be designed to cover this, following a branch of future technology where computational power is not restricted by storytelling requirements.

The big requirement here is that the future is still about people. Computer technology is limited so that humanity doesn't vanish up its own singularity, thereby preventing the ability to have high adventure in interstellar communities.

Future History

> *The only way to find the limits of the possible is by going beyond them to the impossible.*
>
> *-- Arthur C Clarke*

The Near Future (TL 9)

This covers the technology that becomes available over the rest of the 21st century, from about 2020 to 2100. Computers continue to improve, genetics and medical science make some great leaps but the biggest change is in energy storage, which is needed to power the smart devices of the future.

Guns still fire bullets, mostly with the help of chemical explosions. Travel to orbit becomes cheaper and easier, but space travel across the solar system is still hard. Ion drives and nuclear rockets are generally used.

The Whole Planet (TL 10)

By TL 10 we can consume the whole energy resources of a planet, with a combination of fission, fusion, solar and other power sources. Interplanetary travel becomes easy, but the limits of computational technology are being approached. By the end of TL 10, the first FTL drives are developed. Bodily organs can be grown on demand in vats, as can food.

Guns fire bullets, often propelled by EM gauss effects. Laser weapons are common in specialist cases. Nuclear powered plasma drives are the typical means of space travel.

To The Stars (TL 11)

Star travel becomes reliable as the technology improves, but it is still slow. Computer technology is approaching a stasis, but medical science is removing the need for cybernetics, allowing limb re-growth and some limited anti-agathics.

Gauss and laser weapons tend to be equally common, and materials tech starts to improve body armour. In space, lasers and particle beams dominate.

Fundamental Forces (TL 12)

Star travel becomes faster, and cheaper. Manipulation of the weak force allows for nuclear damper technology, and new forms of matter can be created. Medical technology has improved to the point where most things are survivable if you can get to a hospitable in time. Cybernetics seems like a passing fad, since organic replacements can be just as good.

Guns can be laser or gauss, but a few heavy plasma weapons are becoming viable. When large amounts of power is required, anti-matter is the way to go.

Walking in the Sky (TL 13)

The creation of repulsors and tractor beams pave the way for flying cars, though true anti-gravity is still unattainable. Interstellar travel is cheap and readily available, and much industry is now placed in orbit.

(TL 14)

Conquering Gravity (TL 15)

Inertial dampers, including artificial gravity.

Masters of Force (TL 16)

Disintegrators.

Armoury

> *The more efficient a reaction drive, the more effective a weapon it makes.*
>
> *-- The Kzinti Lesson, Larry Niven*

The number of options available to those who want to kill or harm others tend to proliferate as technology advances. We have moved from requiring strength of arm as a measure of killing power, to the equaliser of chemical powered kinetic and explosive weapons. Experiments with more exotic ways of killing people, which started in TL 8, finally reach fruition in TL 9 and beyond.

Guns and Things

The standard weapon if TL 9+ is the gun, and initially most will be similar to those that were common in TL 7 and 8.

Ls: Laser weapon. Unaffected by wind, though may suffer in fog and thick atmospheres. Does not loose attack bonus or suffer fumble increases at medium or long range. Counts as a firearm for defence and damage rolls.

Pa: Particle weapon. Similar to lasers, with a few differences which will be described later.

Pl: Plasma weapon. Fires bolts of superheated plasma which burns through a target explosively. Doesn't count as a firearm against armour, but does for defence rolls.

So: Sonic weapon, ignores all armour but very short ranged. It's base damage is halved at medium range and quartered at long range (instead of the normal damage modifiers).

Some of the weapon types are described in detail below.

Exotic Weapon Types

As arms companies search desperately for the next 'killer' weapon technology, it becomes apparent that one of the most efficient ways of killing someone is to through a small bit of heavy metal at them very quickly. This is as true in TL 16 as it was in TL 6.

However, more exotic technologies do have their uses, and after all, this is meant to be *SciFi*.

Gauss

Gauss weapons do not have a special weapon type, and are considered identical to standard firearms for combat purposes. They work by accelerating a charged metal slug with an electromagnetic pulse rather than by using a chemical explosion.

They can be more accurate than chemical based slug throwers, and in theory can have higher muzzle velocities once power densities of the weapon's battery reaches a suitable point, but are otherwise similar to previous weapon designs.

Lasers

Laser weapons are generally the first departure away from propelling a slug of metal towards the target. As a 'direct-energy' weapon, a laser directly converts energy into killing power. Though this isn't as efficient as it may sound, laser beams have definite advantages.

Lasers are very accurate. On the scale most gun fights are fought, lasers are unaffected by wind and gravity. They do not lose their attack bonus at medium and long range, and neither do they suffer increased fumble chance. Laser weapons also tend to have a very high *increment* attribute.

The *medium* and *long* will be double and triple the *short* range of the weapon. The beam does not stop at *long* range however, and will continue beyond this. Each multiple of *short* range beyond *long* doubles the damage penalty however. So damage is at -5 at *medium* range, -10 at *long* range, -20 up to x4 *short*, -40 up to x5 *short* etc.

Lasers also have the ability to shoot through standard glass without affecting either the beam or the glass. However, they are affected by moisture, and ranges are at least halved in mist or fog, and quartered in heavy rain. Reduce range by 10 underwater.

In a thin atmosphere, double all ranges, and in a vacuum triple all ranges.

TL9: The Near Future

The future has already arrived. It's just not evenly distributed yet.

-- William Gibson

The progression of technology through the 21st century has been one of iterative improvements over what has gone before. There's little which is completely unexpected, though changes to society would not have been expected in early TL 8.

A TL 9 Culture

Everybody is part of the network, and everything is in the cloud. Social networks link everybody to everyone else, and your reputation and friends are governed by your standing on these social networks. Privacy crumbles under the onslaught of location based services, advertising and automated status updates. As new generations are born into this world, and find the idea of sharing your life, thoughts and loves with everybody else perfectly natural, keeping a lid on commentary becomes impossible.

Part of this new world is aided by the invention of superior new energy storage technologies, so even the most power hungry smart phones can last a week between recharges. Consistency between power sockets and network links also becomes necessary, and possible once requirements begin to stabilise.

On a larger scale, there is a greater use of energy sources such as solar, wind and tidal power as a more flexible and distributed power grid is developed. Fossil fuels are still heavily used, though high performance electric cars begin to become practical with better batteries. Towards the end of TL 9, fusion power starts to come online, though most power stations are proof of concept designs serving small towns.

In space, new forms of drive technology based around plasma and ion designs come into use. There is limited colonisation of the solar system, and industrial, medical and tourist use of orbital facilities.

Genetic engineering becomes the norm on a large scale, greatly improving the availability of food. Genetic disorders can be cured prior to birth and for the wealthy life expectancy rises consistently above 100. Cybernetics improves, with lost limbs and other organs being replaced by artificial devices as good as, if not better than, the original thing.

Weapons

The killing ability of man portable weapons plateaus during late TL8 and early TL9. The lack of progress in personal armour means there isn't a necessity for weapons to become more deadly. Instead, they are lighter, more reliable and somewhat cleverer.

Most small arms switch to case-less ammunition, with some larger rifles moving to gauss or even laser. For the most part, the good old chemical powered slug thrower is still the most efficient in terms of weight, cost and effectiveness.

Armour becomes a bit lighter and a bit more effective, but not by much. Richer nations can afford powered hard shell armour towards the end of TL9, but since they're also the ones making the newer weapons and they're only going up against lightly armoured opponents there isn't a drive to modify small arms to be effective against such targets.

Smart weapons, capable of automatically calculating the range to a target, and setting explosive timers themselves do become common. Networked battlefields, combining light artillery, drones and net-enabled combat troopers can bring effective fire down on an enemy position quickly and technically without human intervention.

A19 Assualt Rifle

Caseless 7mm assault rifle.
Legality: 3; **TL:** 9; **Mass:** 3.4kg ; **Cost:** $350
Load: 4; **Str:** 4; **Reach:** 2; **Atk:** +10; **Dmg:** 20
Increment: 30m; **Range bands:** 400m / 1000m / 2.5km
Capacity: 36; **RoF:** 50; **Recoil:** -4
Fi Au SA TA Lo-1

Assault rifle designed to use caseless ammunition. It uses a larger round to provide better effectiveness against body armour, plus has the option of an under slung grenade launcher with 3x40mm grenades. An automatic range finder can adjust the sights to improve targeting of standard fire, plus auto-detonation of the grenades.

It has single shot, full auto and 3-round burst modes, the latter of which is sometimes the only option in some models.

B2022 Battle Rifle

Caseless 7mm battle rifle.
Legality: 3; **TL:** 9; **Mass:** 4.5kg ; **Cost:** $650
Load: 4; **Str:** 5; **Reach:** 3; **Atk:** +11; **Dmg:** 23
Increment: 40m; **Range bands:** 800m / 1.6km / 4km
Capacity: 30; **RoF:** 10; **Recoil:** -4
Fi SA TA Lo-1

A rifle designed for longer range engagements than what the more compact assault rifles are used for. It is limited to semi-automatic and 3-round burst fire, since fully automatic fire at greater ranges isn't viewed as being useful.

Barrett X-2

15mm gauss sniper rifle.
Legality: 1; **TL:** 9; **Mass:** 16kg ; **Cost:** $15,000
Load: 16; **Str:** 5; **Reach:** 4; **Atk:** +11; **Dmg:** 19
Increment: 60m; **Range bands:** 2km / 3.5km / 5.2km
Capacity: 10; **RoF:** 3; **Recoil:** -10
Fi SA Lo-2 Vc

This is a heavy rifle which fires a solid metal slug using an electromagnetic impulse. Such gauss weapons start to become available towards the end of TL9, and are found in specialist roles such as snipers rifles, where the smooth acceleration of the round, and lack of explosive gases, provides greater accuracy.

Close Assualt Shotgun

An automatic shotgun designed for close assualt.
TL: 9; **Mass:** 4kg ; **Cost:** $570
Load: 4; **Str:** 4; **Reach:** 2; **Atk:** +15; **Dmg:** 27
Increment: 10m; **Range bands:** 15m / 50m / 80m
Capacity: 10; **RoF:** 5; **Recoil:** -3
Li Fi SA Lo-2 Co-18

Short barrelled shotgun with a 10 round magazine and designed to fire shot filled rounds. It can also used fletchette rounds which halve medium and long ranges, and changes the weapon type to Co-17 due to the extra spread. This is designed to minimise collateral damage.

Exage 7mm

A heavy 7mm automatic pistol.
Legality: 3; **TL:** 9; **Mass:** 750g ; **Cost:** $300
Load: 0.5; **Str:** 2; **Reach:** 0; **Atk:** +5; **Dmg:** 14
Increment: 15m; **Range bands:** 75m / 150m / 300m
Capacity: 10; **RoF:** 5; **Recoil:** -3
Fi SA Lo-1

A well known brand of automatic pistol that is available pretty much everywhere, due its low cost and ease of manufacture. There are many knock-off variants, though most differences are superficial.

Higher tech versions may have built in laser scopes and round selectors to allow multiple ammunition types. A high capacity magazine (20 rounds) is also available.

GAU-25 Vindicator

30mm Gatling cannon.
Legality: 3; **TL:** 9; **Mass:** 220kg ; **Cost:** 45,000 Cr
Load: 220; **Str:** 8; **Reach:** 5; **Atk:** +12; **Dmg:** 27
Increment: 50m; **Range bands:** 1.2km / 3.6km / 9km
Capacity: 2000; **RoF:** 500; **Recoil:** -20
Hv Fi Au-50 Lo-3 Ex-2 Vc

Similar to its predecessors, the GAU-25 is a gauss based rotary cannon that fires 25mm rounds at over 6000rpm, with a muzzle velocity of well over 1km/s. It is normally vehicle mounted, though is sometimes used on fixed emplacements as anti-air defence.

Typically, the magazine is loaded with a mixture of armour piercing and high explosive rounds for maximum effectiveness against armoured targets.

ILS-2000 Laser Rifle

Heavy laser rifle.
Legality: 1; **TL:** 9; **Mass:** 18kg ; **Cost:** $35,000
Load: 18; **Str:** 5; **Reach:** 4; **Atk:** +13; **Dmg:** 30
Increment: 100m; **Range bands:** 1000m / 2km / 3km
Capacity: 8; **RoF:** 2; **Recoil:** 0
Fi SA Ls Lo-2

The ILS-2000 becomes production ready in late TL 9. It is designed as a sniper's rifle, though has advantages and disadvantages compared to similar solid slug designs. It isn't as powerful as the alternatives, but its accuracy over range is much greater (though effective range isn't as great as standard sniper rifles).

It is heavy, unwieldy, has a low rate of fire and limited capacity. However, it is unaffected by wind and gravity (though moist air can seriously limit range) and can pass through windows unaffected, making it an excellent assassination tool.

It is possible to disable safety features to produce an overpowered shot. RoF drops to 1, but each extra charge used in the shot does +2 damage, with a +1 increase in fumble chance. On a fumble, the weapon burns out and is rendered inoperable (sometimes explosively) rather than firing.

ISW 400

Heavy infantry support rifle.
Legality: 3; **TL:** 9; **Mass:** 5.5kg ; **Cost:** $650
Load: 4; **Str:** 7; **Reach:** 4; **Atk:** +9; **Dmg:** 23
Increment: 40m; **Range bands:** 700m / 2.1km / 6km
Capacity: 300; **RoF:** 50; **Recoil:** -7
Fi Au Lo-3

The ISW 400 is an early to mid TL 9 design which fills the role of a Squad Assault Weapon. It can provide a high rate of automatic fire over a long range, with active cooling systems which enable a sustained rate of fire over a long period. It is designed to be used with either a bipod or tripod, since it is too heavy for most people to use by itself.

The high rate of fire requires a large supply of ammunition, which is not included in the weapon weight.

N19X Assault Rifle

Caseless 5mm assault rifle.
Legality: 3; **TL:** 9; **Mass:** 2.9kg ; **Cost:** $280
Load: 3; **Str:** 4; **Reach:** 2; **Atk:** +9; **Dmg:** 16
Increment: 25m; **Range bands:** 300m / 700m / 2.2km
Capacity: 40; **RoF:** 40; **Recoil:** -3
Fi Au SA TA Lo-1

Light assault rifle firing a smaller round that is still effective against unarmoured targets. It is very light and reliable, and commonly found as the principle weapon of first world armies, as well as in the hands of third world militia.

X54 Hunter Pack
Portable smart missile launcher.
Legality: 2; **TL:** 7; **Mass:** 25kg ; **Cost:** 35,000 Cr
Load: 25; **Str:** 3; **Reach:** 0; **Atk:** 25; **Dmg:** 25
Increment: 500m; **Range bands:** 2km / 4km / 5km
Capacity: 6; **RoF:** 1; **Recoil:** -20
Hv Lo-4 Ex-2 Vc Gu(C/0)

A portable backpack carrying 6 micro-missiles normally equipped with HEX warheads. They link in with the soldier's rifle or HUD to pinpoint the rough location of the enemy, launch themselves on a high angle ballistic trajectory, then use automated smart guidance to pinpoint the exact locations and perform final flight corrections before impacting with the targets.

They are designed to take out targets dug in behind walls or inside buildings. A *Heavy Weapons* skill check

XV-A2 Laser Point Defence
Laser cannon.
Legality: 3; **TL:** 9; **Mass:** 300kg ; **Cost:** 150 K Cr
Load: 300; **Str:** 8; **Reach:** 5; **Atk:** +17; **Dmg:** 22
Increment: 100m; **Range bands:** 2km / 4km / 6km
Capacity: 120; **RoF:** 10; **Recoil:** 0
Hv Fi Au-10 Ls Lo-3 Vc

The XV-A2 enters operational service with the military in early TL 9, and is one of the first practical uses for a laser based weapon system. Designed principally as point defence, it's high accuracy makes it ideal for use against missiles and aircraft.

Gear

There are plenty of gadgets available in TL 9 to make a person's life easier (or, in some cases, longer). Most of the items available at TL 8 are also available at TL 9, though they are quicker and have better battery life.

For electronic gadgets, power has been the limiting factor for many years. It is assumed that better standards are in place, with most devices supporting wireless power (either on a power mat, or over-the-air wireless transmitters). Many small devices allow trickle charge through renewable means, such as solar power, body heat or kinetics.

Medi-gel
A medical gel to seal wounds.
Legality: 6; **TL:** 9; **Mass:** 250g ; **Cost:** 75 Cr
Load: 0.25; **Uses:** 3
Skill bonus: First aid (+20)

A spray can of gel which binds to skin and flesh, automatically sealing and cleaning open wounds, as well as providing local anaesthetic to dull the pain. A spray can contains 3 doses, and takes a round to apply.

PD-3 Light Body Armour
Lightweight ballistic vest.
Legality: 4; **TL:** 9; **Mass:** 4kg ; **Cost:** 375 Cr
Load: 4; **Soak:** +7; torso
Li BP

A lightweight ballistic vest constructed of a variety of materials to provide a combination of flexibility and ability to absorb damage. It's main advantage over earlier designs is the greatly reduced weight for only a minor reduction in protective ability.

PD-6 Heavy Body Armour
Heavy ballistic vest.
Legality: 4; **TL:** 9; **Mass:** 7kg ; **Cost:** 600 Cr
Load: 7; **Soak:** +10; torso
Li BP

An early TL9 design of ballistic armour that is heavy and bulky but which provides reasonable protection against small arms fire.

PDX-12 Combat Armour
Heavy ballistic vest.
Legality: 4; **TL:** 9; **Mass:** 8kg ; **Cost:** 2,400 Cr
Load: 8; **Soak:** +13; torso arms legs
Hv BP

A late TL9 design of full body armour for protection against ballistic weapons, using the latest in composite materials. It is capable of providing some protection against high powered rifles and light machine guns, unlike previous designs.

Smart Phone
Smart phone.
Legality: 5; **TL:** 9; **Mass:** 400g ; **Cost:** 450 Cr

A typical smart phone of the type available in early TL9. It has voice and data capability, plus about 1TB+ of data storage. It almost certainly has a touch screen and may have a small keyboard. Battery life will be in the order of a week, depending on capabilities, and can be recharged by cable or short-range wireless power (since most vehicles and homes provide this, users rarely have to actively recharge their devices).

It will be able to play and record HD audio, pictures and video, as well as providing the ability to connect into computer systems for remote administration, use of SatNav, automatic payment systems and the monitoring of other devices (including medical) via a personal area network. They will generally be automatically hooked into social networking systems, tracking a user's movements and activities.

Tablet Computer
A typical tablet computer.
Legality: 6; **TL:** 9; **Mass:** 1kg ; **Cost:** 500 Cr

Tablet computers first become available at the turn of the millennium, but don't start to become popular (or truly useful) a decade later. Most tablets have touch screens, voice recognition and control, detachable keyboards, video conferencing facilities and about a terabyte of solid state storage. Battery life is generally a few days.

For twice the price, you can get a rugged model which has fewer features but is more likely to survive abuse plus will last about a week of heavy use on a single charge.

Cybernetics

Good quality prosthetics started to become available in TL8, but it is in TL9 where they really begin to exceed typical human ability. Such enhancements begin to be taken up by first the military, and then civilians involved in extreme activities, such as certain sports.

Dermal Armour

Armour implants.
Legality: 3; **TL:** 9; **Mass:** 2kg ; **Cost:** 150 K Cr
Load: 2; **Soak:** +3; torso
Li BP

This advanced armour is implanted beneath the skin, providing the ultimate in covert protection. It is uncomfortable, and gives the wearer a certain bulk, making a thin person look quite 'wrong'. It has the disadvantage of not being removable without surgery. Implanting (or removing) it requires 6 months of surgery and bed rest.

After all that, the protection it provides is limited. However standard armour can be worn over the top and any protection afforded stacks with the dermal armour.

Eyes

Cybernetic eyes.
Legality: 4; **TL:** 9; **Mass:** 0g ; **Cost:** 60,000 Cr
Attribute bonus for skill: Vision tests (+1)
Awareness (20): *Notice that eyes are unnatural if actively paying attention to them. Double difficulty if just in conversation. Triple the price for hyper-realistic eyes which add +10 to the base difficulty.*

Implanted eyes, originally designed as a prosthetic for the blind have evolved into something also useful for the fully sighted. Such eyes completely replace a healthy pair, and look normal to cursory examination. They provide increased visual performance, plus the ability to switch to infra red or low light vision.

Remote Synthetic

Remote operated synthetic robot.
Legality: 5; **TL:** 9; **Mass:** 95kg ; **Cost:** 50,000 Cr
Awareness (15): *Notice that the android is artificial if actively paying attention, double the difficulty if only notice in passing. Add +10 to the difficulty for a double price version.*

This is synthetic android which is modelled to look as realistic as possible. It has skin, hair, body warmth and the ability to speak, walk and do what most humans can do. However, it must be remotely operated at all times, generally by a person hooked into VR sensors fed from the android's eyes and ears.

They generally come in a variety of standard appearances (randomly generated from a basic template), but a specific person can be mimicked for twice the price. It has internal power to last about 12 hours of standard use in an office-like environment.

Skeletal Enhancement

Strength upgrade.
Legality: 3; **TL:** 9; **Mass:** 3kg ; **Cost:** 750 K Cr

This is a complex procedure that replaces much of the skeleton with a hardened alloy, plus reworking of the nerves and muscles to integrate with this. It provides a +1 bonus to strength.

Turing Synthetic

Automated synthetic robot.
Legality: 4; **TL:** 9; **Mass:** 95kg ; **Cost:** 150 K Cr
Awareness (10): *Notice that the android is artificial if actively paying attention, double the difficulty if only notice in passing. Add +10 to the difficulty for a double price version.*

This is synthetic android which is modelled to look as realistic as possible. It has skin, hair, body warmth and the ability to speak, walk and do what most humans can do. It is controlled by a 'Turing Personality' software program which can mimic human behaviour and actions to a certain degree.

The personality has access to an expert system, so can respond to a conversation for a limited domain. They are generally used as receptionists, information kiosk attendants or in similar roles where they need to answer questions about a topic. They can be used as waiters, but the manual dexterity required is stretching the limits of what they are capable of, and they are not well suited to the task.

Assume that they have a strength of 3, but agility and dexterity of 2. Empathy and Intelligence are 1. They can fake being polite and knowing a lot, but they have issues if anything goes outside their programmed parameters.

TL10: The Whole Planet

> *Once a person has all the things they need to live, everything else is entertainment.*
>
> *-- Neal Stephenson*

Some time in TL 10, civilisation becomes Type I on the *Kardashev Scale*, achieving mastery of the resources of its home planet. Energy production and consumption is considerably beyond what was available in TL 8, and continues to grow beyond expectations.

A TL 10 Culture

By TL 10 cities are smart. Automated surveillance is everywhere, monitoring where people are and what they are doing. This flow of information allows for a degree of efficiency not seen before, but also limits the privacy available to everyone. Many people record their whole lives, video and audio captured though implants inserted soon after birth. The legal ramifications are massive, and there's either a crack down on such technology or an opening up of restrictions on what can be recorded (and played back for public consumption).

Fusion power is the most common form of large scale power generation, but power is reclaimed via other means on a smaller scale. Solar, tidal and wind power grabs what it can and feeds it into national energy grids in a greatly distributed system of power generation. Highly efficient energy storage systems can store power locally, minimising the effects of national failures, and reducing the need to crank up large scale generation during short term spikes in demand.

Everybody is connected, and access to information is pretty global. Wireless communication connects most devices - long range for access to news and information, short range for eCash transfers. The technology is there to support automatic micro-transactions for most services, which could replace some forms of taxation if the will is there.

As well as smart devices, there is smart textiles which can change colour and texture based on environment and body state. Smart composites make for good body armour which can switch from flexible to stiff as a bullet tries to penetrate. For that matter, smart bullets which can control their trajectory and behaviour depending on the type of target they've hit are also available.

Replacement organs can be grown in vats, genetically programmed to match the host recipient within hours of being implanted. Regrowth of limbs is possible, though expensive, and for a price pretty much any disease can be cured. Drugs and nano machines for physical enhancement also exist.

In space, efficient and fast drive systems allow trade between worlds within a star system, and orbital and planetary colonies are common. Towards the latter part of the TL, the first Jump drives are constructed, allowing travel to distant stars.

Weapons

The biggest shift in weapons technologies comes not from weapons, but from armour. Flexible but strong armour which can react to absorb and dissipate damage becomes possible and common. This in turn requires more powerful small arms to keep infantry effective.

Larger calibre chemical slug throwers are still used in pistols and assault rifles, but gauss and laser weapons become the norm in larger rifles. Battle rifles come equipped with smart ammunition.

Spacecraft

Though spacecraft are just another type of vehicle, they are provided their own section here for a number of reasons. Firstly, all the interesting spacecraft tend to be imaginary works of fiction, and the physics by which most of them operate are incompatible with each other. Firstly then, we need to lay down the laws by which spacecraft in ***YAGS*** work.

Secondly, the ***YAGS*** rules for vehicles assume that designs are based on real life, or near real-life, designs. There is no real design system as such - just a set of guidelines to try and keep things vaguely consistent. Spacecraft will often be designed entirely from scratch without any basis in reality, so it helps to tie things down a bit.

Thirdly, whilst most people have a good idea about how a car behaves, few people can get their head around space travel. Even if you don't drive, you've almost definitely been in a car that's travelled through a town centre, so you know how fast it goes and how long a journey takes. Most people don't have that common sense knowledge for a journey from Earth to Mars, or a trip around the moons of Saturn. A set of rules helps fill in for that lack of common sense.

As with all rules in games, they can be ignored. However, the rules here do allow ships to be designed with a reasonable degree of accuracy. However, this does also mean that a little bit of maths may be involved.

The Ground Rules

> *Space is big. Really big. You just won't believe how vastly mind-bogglingly big it is. I mean, you may think it's a long way down the road to the chemist, but that's just peanuts to space.*
>
> *-- Douglas Adams*

The physics of ***YAGS SciFi*** is somewhat harder than most Hollywood fiction. It can take days to weeks to travel across the solar system, and weapon ranges are in the order of tens of kilometres. Anti-gravity exists, though only at higher tech levels and it can be quite limited. Ships generally still move by throwing hot stuff out the back very fast according to the principles of Newtonian motion.

Sizes

The size of ships is measured in displacement tonnes of liquid hydrogen. 1 dt is about 15 cubic metres (about 14.75 to be more precise, but 15 is assumed). Ships below 10dt are rare - generally light fighters and similar vessels. A typical ship that might be owned by a group of PC's will be on the order of 100dt - 500dt in size.

Even the smallest fighters tend to be around Size 15 in ***YAGS*** terms - larger than any modern day tank. The largest vessels will be hundreds of thousands of displacement tonnes, with a million tonnes being extremely rare.

Note that an Imperial class Star Destroyer from Star Wars would be over 4 million tonnes, so ships are relatively small compared to those in many Hollywood films.

Time and Movement

Time is measured in turns of 10 seconds. This is twice as long as a standard **YAGS** round, but is a simpler number to deal with when working out distances and acceleration.

All distances are measured in kilometres. Effective ranges of most space combats will vary from tens of kilometres to hundreds of kilometres, depending on the size of vessels involved. This ranges are relatively small for space, and it means that objects such as planets are huge relative to a combat arena.

How quickly a spacecraft moves is measured by its *acceleration*, which is given in 'g'. Every 'g' of acceleration allows the ship to accelerate up to (roughly) 1km/turn/turn. A craft with an acceleration of 3g, will be moving at 3km/turn after the first turn, 6km/turn after the second turn and so on.

Delta V (dV) represents the maximum speed of a space craft. Any ship using reaction drives (i.e., the type that burn 'fuel' and throw it out the back) will have a maximum speed. *dV* means change in velocity, so any acceleration (even if it is to slow down, or change direction) comes out of your total dV.

Technology Levels

The technology level (TL) is crucial in a SciFi game, and likewise that carries over to the design of spacecraft. It is assumed that all spacecraft are TL6+, though really interesting designs don't start becoming possible until TL9-10. If you want galaxy spanning science fiction, then using these rules you should be looking at TL13+

TL 6

The first space rocket was the German V2 which was used in very late TL 6, however the 'going into space' part was a side effect of the 'bomb London' part, so space travel is normally thought to have started in TL 7. However, the technology was there to do in TL6, and people were definitely thinking about the subject.

Spacecraft built in this period are very basic, have no computers of any sort and have very low performance.

TL 7-8

By TL 7 we got to the Moon, by TL 8 we'd forgotten how to do it. Space travel is hard and expensive, and getting living creatures out of orbit is a big project. Much better designs are

possible at these levels, as long as we don't mind irradiating ourselves by using nuclear propulsion systems.

TL 9-10

Interplanetary travel starts to become feasible at these levels, and space combat does as well. Travel to the outer planets is still hard, and expensive, but by late TL 10 it's not beyond the capability of large corporations.

It is assumed that basic interstellar travel becomes possible during TL 10, in the form of Jump drives or Hyperspace.

TL 11-12

At this point space travel starts to become affordable and practical for a much larger number of people, and trade between worlds is an everyday occurrence.

Design the Hull

The first decision point is the size of the ship. This is measured in displacement tonnes, and for most jump capable craft will be in the order of 100dt - 1000dt. Ships bigger than this tend to be military vessels, large freighters or cruise ships. The tonnage controls how much room there is for weapons, drives, crew etc, and also how much damage the ship can take.

The second decision is the rough shape of the vessel. This affects the internal volume (space for things), surface area (weight of armour and space for turrets) and modifiers to Health and Agility.

Shape	Vol.	Area	Aero.	H	A
Block	0.95	1.00	0.10	+0	+0
Flat	0.90	1.25	1.00	+0	+0
Wing	0.85	1.50	3.00	+0	+1
Sphere	1.00	0.75	0.25	+1	+0
Wedge	0.75	1.25	1.00	+1	+0
Cone	0.85	1.25	0.75	+1	-1
Cylinder	0.95	1.00	0.50	+0	-1
Dispersed	0.50	2.00	0.10	-2	+1
Agile	0.75	1.50	0.50	-1	+2

The volume multiplier gives the internal volume of the craft. A 200dt *Dispersed* hull for example will only have 100dt available for systems.

Area gives the surface area multiplier. The surface area is equal to the square of the cube root of mass. Turrets, drives and other surface features have to fit into the available area. Surface area also governs armour - the bigger the surface area, the greater the mass of armour required to give a certain soak bonus.

Area = Volume^(2/3)

Modifiers to Health and Agility apply to the final statistic, not to derived statistics. So checks and skill modifiers are affected, but ship mass is not.

Derived Statistics

Size

The **Size** of a spacecraft is the same as for any vehicle in **Yags**, and increases by +5 for every tenfold increase in vehicle size. It's a simple logarithm to work out the Size for any volume, but the following table gives some common values.

Size	Volume (dt)	Hull	Example
11	1	6	
12	2	7	
13	3	8	
14	4 - 5	10	
15	6 - 8	11	
16	9 - 13	13	Light fighter.
17	14 - 21	14	
18	22 - 33	16	Heavy fighter.
19	34 - 52	18	
20	53 - 83	20	Titan II
21	84 - 133	22	Small trader.
22	134 - 210	24	
23	211 - 334	26	
24	335 - 529	29	
25	530 - 839	31	
26	840 - 1,330	34	
27	1,331 - 2,108	36	Saturn V
28	2,109 - 3,341	39	
29	3,342 - 5,295	42	
30	5,296 - 8,392	45	
31	8,393 - 13,301	48	Small warship.
32	13,302 - 21,081	51	
33	21,082 - 33,412	54	
34	33,413 - 52,955	58	
35	52,956 - 83,298	61	
36	83,929 - 133,017	65	
37	133,018 - 210,818	68	
38	210,819 - 334,124	72	Large capital ship.
39	334,125 - 529,552	76	
40	529,553 - 839,283	80	

The hull of a ship is the number of damage levels it can sustain before being destroyed, and goes up with the square of the **Size**.

Since each +5 **Size** is a tenfold increase in volume, this roughly translates as a doubling of length, width and height, assuming that the ships are of a similar shape.

Health, Soak and Mass

A typical space craft has a **Soak** equal to its **Size**, but this is modified by the craft's *Health*. Health is a measure of the general toughness of a vehicle, and affects both the soak and mass.

Mass represents how hard a craft is to accelerate, and increasing it reduces both acceleration and delta vee. Adding armour also increases the mass, so heavy warships tend to be slower than flimsier craft.

Note that generally, the internal components of a craft do not affect mass. It is assumed that everything has roughly the same density for simplicity.

Health	Modifier	Description
1	x 0.25	Fragile.
2	x 0.50	Weak.
3	x 1.00	Average.
4	x 1.50	Reinforced.
5	x 2.00	Strong.
6	x 2.50	Very strong.
7	x 3.00	Super strong.
8	x 4.00	Super strong.
9	x 5.00	Super strong.

If the craft's *Health* is modified by its design, then this modifier applies after working out the above. The modifier applies to both Soak and Mass.

Weapons

Space is big, really big, and the ranges of many space-born weapons are huge compared to the sort of scales present in ground combat.

The *short range* of a space weapon is the distance at which it does the stated damage. Each increment of the short range reduces the damage by -25.

Since such weapons are designed to be used at massive distances, the distance increment is normally in multiples of 1km.

Space Drives

There are three broad types of drive systems assumed.

Reaction Drive

The least *magical* of the drive systems is a form of reaction drive, which at higher technology levels are assumed to be high efficiency and high thrust, enabling craft to accelerate at multiple g's, without requiring much in the way of reaction mass.

The simplest reaction drives are chemical rockets, but more exotic forms are available at higher technology levels.

Designer's Notes

Acceleration Over Time

Most rockets consist of 90% fuel by mass. As the craft burns fuel, so its mass drops, so its acceleration increases. Doing this correctly involves a lot of maths, so we ignore this and assume an averaged constant value for simplicity.

If you want, assume that an empty fuel tank has a mass of 10% of a full one.

The **Thrust** of a reaction drive is the force it puts out any given second. The higher the thrust, the faster a rocket will accelerate.

The **Impulse** of a reaction drive is a measure of how efficient it is.

Designer's Notes

Real Physics

Units are deliberately not given for either *Thrust* or *Impulse* since they aren't direct analogues to anything in the real world. However *Thrust* is related to force, and *Impulse* is related to specific impulse (seconds).

The actual numbers have been multiplied in order to give the in-game values without needing further tweaking. *Impulse* is approximately specific impulse divided by 170. *Thrust* is Kilo-Newtons divided by 180. The constants were chosen to give an approximation of real world space ship designs.

A *reaction drive* is defined by its **Thrust** and its **Efficiency**. Thrust scales with the size of the drive, so a 10dt drive produces ten times as much total thrust as a 1dt drive of the same type. The efficiency remains the same regardless of size.

The **acceleration** of a craft is equal to its *total thrust* divided by its *mass*, in 'g' (where 1g = 10m/s/s for simplicity).

The **delta vee** is equal to the *basic thrust* divided by the *mass* times the amount of fuel (in dt) times the *efficiency*. This gives a value in metres per second, so divide by 1000 to get km/s.

Chemical Rockets (TL 6+)

The standard low tech way of getting around in space, using a chemical reaction to force matter out the back which propels the spacecraft forward. They are generally moderately high thrust, but very inefficient. There are three common types of chemical rockets.

Solid rocket engines are cheaper and easier to maintain, but not as powerful as liquid engines. They also have the disadvantage that once they are 'lit', they cannot be throttled or switched off. They are normally used as booster rockets.

Liquid rocket engines are much more efficient, but because they require the storing of two different super cooled liquids, they are harder to build and maintain. Keeping them ready for launch can be difficult.

Metallic Hydrogen is an exotic material that consists of another state of Hydrogen. It produces considerably more energy than liquid Hydrogen, but can only be formed under extreme pressures.

Chemical rockets always have an **Area** equal to half the volume, rounded up. Unless separate engines are mounted, up to one tenth the normal thrust can be used to manoeuvre.

TL	Type	Cost (Cr)	Thrust	Impulse
6	Solid rocket	$5M	20	1.4
7	Solid rocket	$3M	21	1.5
8	Solid rocket	$2M	22	1.6
9+	Solid rocket	$1MK	23	1.7
6	Liquid rocket	$100K	30	350
7	Liquid rocket	$75K	35	400

TL	Type	Cost (Cr)	Thrust	Impulse
8	Liquid rocket	$50K	40	450
9+	Liquid rocket	$30K	45	450
10	Metallic Hydrogen	$300K	40	1500
11	Metallic Hydrogen	$200K	60	2000
12	Metallic Hydrogen	$150K	70	2250
13+	Metallic Hydrogen	$100K	75	2500

Chemical rockets often remain in use up until TL 12 when the *plasma torch* becomes available. Despite being inefficient, they are the cleanest form of drive, and don't leave behind radioactive residue, making them suited for getting off planets where you care about the environment. For interplanetary travel, they stop being used around TL 9 or 10, as more efficient (but dirtier) drives take over.

Fuel for both solid and liquid rockets is measured in dt, and includes all the necessary containment facilities. Fuel is assumed to have a mass of 0.5 (an average between a full tank and an empty tank).

Example

Solid Rocket Boosters, TL 7

The Space Shuttle's SRBs (solid rocket boosters) are each about 30dt in size. With 27dt of solid fuel, and 3dt of thruster, they have a total mass of 16.5 (fuel counts as half, though the gross mass is 30, the empty mass closer to 3).

The *thrust* is 3 * 21 = 63. This gives an acceleration of 63 / 16.5 = 3.8. The delta vee of the booster is fuel tonnage (27) * impulse (1.5) = 40.

So the booster has a thrust of 3.8, which it will burn for slightly over 10 turns. Once its fuel is depleted, it will be travelling at 4 km/s.

Nuclear Thermal Rockets (TL 7+)

Nuclear fission rockets work on a similar principle to chemical rockets - a propellent is heated and thrown out the back. However, instead of the propellent being used as the fuel, the fuel is Uranium in a nuclear reactor, which is used to heat a propellent such as water or hydrogen.

They are bigger and heavier than chemical rockets, so a larger engine is needed for the same thrust. However, they are a lot more efficient, so require far less fuel for the same delta-v.

They are both expensive and incredibly dirty, requiring a lot of radiation shielding. If water is being used as a propellent instead of hydrogen, add +5 to the basic thrust, but reduce efficiency by 500.

TL	Type	Cost (Cr)	Thrust	Efficiency
7	Nuclear Thermal	100 M	10	2,000
8	Nuclear Thermal	60 M	15	2,500
9	Nuclear Thermal	40 M	20	3,000
10	Nuclear Thermal	30 M	25	3,250
11	Nuclear Thermal	25 M	30	3,500
12+	Nuclear Thermal	20 M	35	3,750

Nuclear thermal drives are often invented around TL 7, but are very often ignored as a practical means of getting off planet unless there is an overwhelming necessity for them (e.g., an alien invasion). By the time they can be made light and clean, they have been made obsolete by the *plasma drive* (though even this is really a different implementation of the same idea).

Nuclear Pulse Drive (TL 8+)

Also known as the *Orion Drive*, the Nuclear Pulse Drive works by use of an external pulsed plasma propulsion system. Basically, drop nuclear bombs out the back and use the explosions to push you forward. It sounds insane, but it was seriously considered in the 1960s. It is assumed that a practical working drive could be produced by TL 8.

Early designs use pellets of fissionable material, which would explode (possibly ignited using lasers) against a pusher plate. Nuclear shielding would be necessary, and launching from the surface of an inhabited world is generally considered to be bad form.

Later designs move to pellets of fusion fuel, and later anti-matter fuel. In all cases, the size of the drive includes the pusher plate and shielding.

TL	Type	Cost (Cr)	Thrust	Efficiency
8	Nuclear Pulse	100 M	100	5,000
9	Nuclear Pulse	60 M	125	7,500
10	Pulsed Fusion	40 M	200	10,000
11	Pulsed Fusion	30 M	250	15,000
12	Pulsed Anti-Matter	25 M	400	20,000
13+	Pulsed Anti-Matter	20 M	500	30,000

Ion Drive (TL 8-14)

Ion Drives are small, efficient drives with very low thrust. They are short lived in usefulness, since they cannot compete with the high thrust medium efficiency drives that come into play during TL 9/10, but remain as the most efficient drive type available for a long time, as well as becoming relatively cheap compared to a lot of the alternatives.

TL	Type	Cost (Cr)	Thrust	Efficiency
8	Ion Drive	25 M	2	20,000
9	Ion Drive	10 M	3	25,000
10	Ion Drive	3 M	4	30,000
11	Ion Drive	1 M	5	35,000
12	Ion Drive	300 K	6	40,000
13	Ion Drive	100 K	7	45,000
14+	Ion Drive	30 K	8	50,000

Repulsor Drives

Repulsors are like tractor beams, but they push. What they push against are nearby masses, such as the ground. They are very short range, so can't be used to traverse a solar system, but at high tech levels they can be used to reach orbit.

They may be found on spacecraft which need to land on planets, and tend to be used during the final landing or take

off, so as not to scorch the landing area with the fusion torch drives.

Jump Drives (TL10+)

Jump Drives are used to move between stars, and allow faster than light travel. A 'Jump' always takes a fixed amount of time - about a week - and whilst in jump space a ship is out of contact with the rest of the universe, including other ships in jump space.

Jump drives are rated according to the distance they travel during each jump, generally J1 to J6, where the J number gives the number of parsecs travelled.

A jump drive takes up tonnage equal to some proportion of the ship size. This proportion goes down at higher technology levels. Technology level also limits the range of a Jump drive. Drives also require fuel, which is again based on ship tonnage.

TL	J1	J2	J3	J4	J5	J6
10	50%	-	-	-	-	-
11	30%	-	-	-	-	-
12	10%	30%	-	-	-	-
13	5%	10%	30%	-	-	-
14	5%	5%	10%	30%	-	-
15	5%	5%	5%	10%	30%	-
16	5%	5%	5%	5%	10%	30%
17	5%	5%	5%	5%	5%	10%
18+	5%	5%	5%	5%	5%	5%

The jump drives include fuel for a single jump at maximum range. For extra fuel, enough for another maximum jump, is a further 10% at TL 10-12. At TL13-15, it is 5%. At TL16+, it is 2%.