GCP-SMP-4513

# SPACEMASTER™

# VEHICLE™ MANUAL

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## TECH™ LAW

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# TECH LAW: VEHICLE MANUAL™


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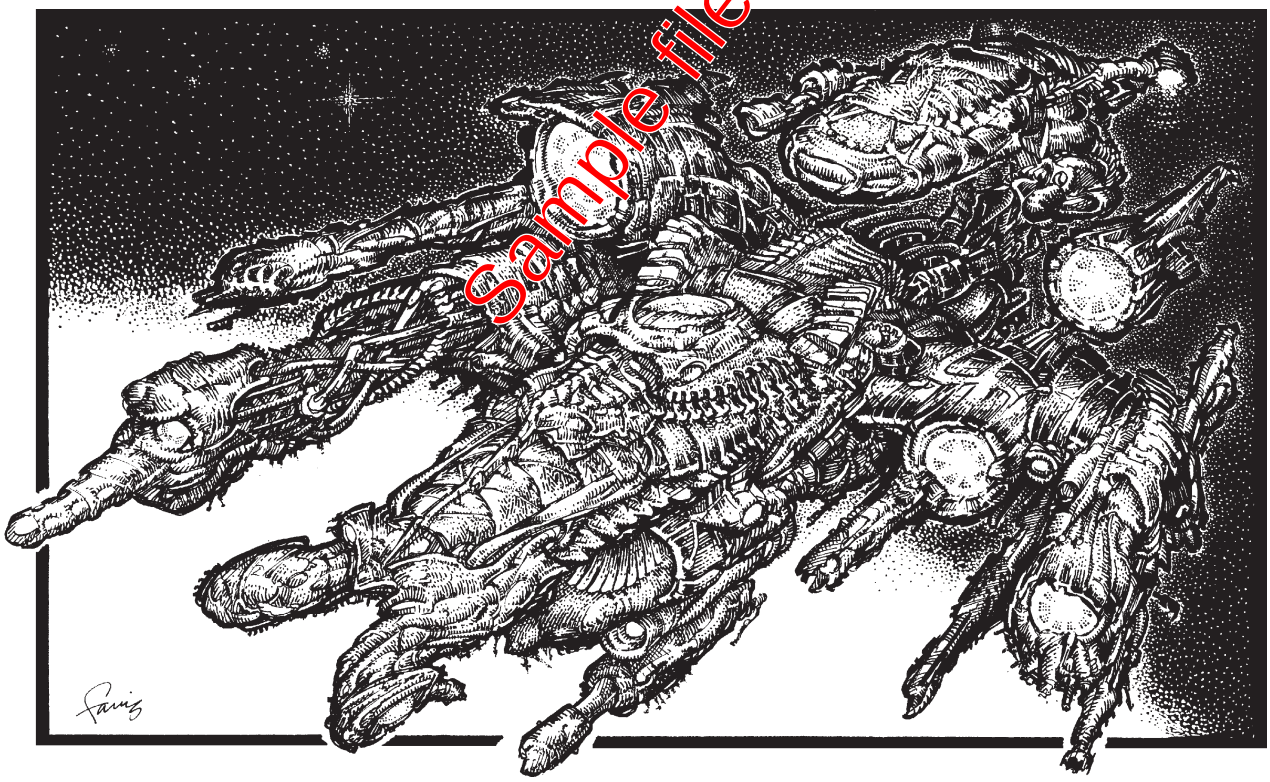


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# PART I
# INTRODUCTION



*"Any sufficiently advanced technology is indistinguishable from magic."*
*— Arthur C. Clarke*

Greetings. This book is called *Vehicle Manual*. It is the second volume of *Tech Law*, which is an integral part of *Spacemaster*, just as technology is an integral part of science fiction.

## WHAT IS SPACEMASTER?

*Spacemaster* is a science fiction role playing game, set to be played in the *Privateers* universe. It uses the same concepts and conventions of Iron Crown Enterprise's *Rolemaster*, and could be played hand in hand with that system.

In *Spacemaster*, the players are whisked away to a science fiction universe where the only limit is the imagination, and whose every turn is fraught with danger. Although *Spacemaster* was published with the *Privateers* universe, it does not *have* to take place in that universe. It can take place in any universe, from the gritty, hard science fiction universes of Greg Bear and Dr. Gregory Benford to the high adventure space operas of "Doc" Smith and George Lucas.

*Tech Law* is an integral part of that flexibility. It allows the Gamemaster (GM) to customize his game, defining what levels of technology are available and what aren't. It allows him to decide what is possible and what isn't. It is the GM's choice, and *Tech Law* is the tool that will allow him to make a good one.

## SPACEMASTER ELEMENTS

*Spacemaster* contains several books. These books provide all of the rules necessary to play *Spacemaster*. These books interlock into more than just a game, but a complete system of role playing, allowing a GM to not only adjudicate rules, but combine societies, cultures and settings into wondrous and (hopefully) realistic vistas of imagination.

**Spacemaster: Privateers (SM)** — This is the core book of the system. All the subjects necessary to play the game are at least touched upon in this book. Character creation, action resolution, combat, psychic powers, experience and advancement are interlaced with history, culture, social structure and points of interest.

## RULE BOOKS

**Tech Law** (*three volumes*) — There are three *Tech Law* volumes: *Equipment Manual*, *Robotics Manual*, and *Vehicle Manual*. These three books contain extensive information on the use and application of technology.

**Future Law** — Add the power of expanded character development to your game with *Future Law*. *Future Law* is the ultimate player's guide to *Spacemaster*, giving new professions and hundreds of new character options.

**Blaster Law** — This book deals with energy weapons and their use in combat. It uses a tech level system and gives complete weapon creation rules for use with anything from primitive spacefaring worlds to power weapons invented by worlds yet to be discovered.

**Gamemaster Manual** — The last book of the core support series is *Gamemaster Manual*. This book explores the ins and outs and pitfalls of gamemastering compiled from some of the nation's top role playing GMs!

## SETTING BOOKS

**Privateers: Races & Cultures** — A must for any *Spacemaster* game, this book details the races of the Privateers universe.

**Privateers: The ISC** — This book details the history, locations, corporations, military, and prominent people of the ISC.

**Privateers: The Jeronan Empire** — This book details the Empire, its structure, and its military.

## ROLEMASTER PRODUCTS

**Rolemaster Fantasy Role Playing** — For a game where science and fantasy are to be combined, *RMFRP* contains all the rules necessary to play a magic wielding character. It is a must for cross genre campaigns.

**Arms Law** — *Arms Law* contains attack charts for many primitive weapons: more weapons, more critical hit tables, more carnage for your game.

**Spell Law** (*three volumes*) — For games where magic and science are combined, *Spell Law* is a vital expansion. All lists go up to 50th level, that's over 2,000 spells in all!

**Creatures & Monsters** — ICE's full-blown bestiary.

**"Companion" Products** — Companions contain optional material that will add detail and/or depth to your game.

## STANDARD SYSTEM PRODUCTS

**Weapon Law: Firearms** — A book dealing with firearms of all types. Capable of dealing with any firearm, real or fictional. A must for any game where the bullets fly!

**Ten Million Ways to Die** — This product has weapon charts for all sorts of different weapons. Everything from swords, to guns and blasters is covered.

**...and a 10' Pole** — A compilation of adventuring equipment and a system for defining and integrating various lower levels of technology.

More support products are planned. So, keep your eyes peeled for more information on ICE's website (www.ironcrown.com)!

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## VERY SPECIAL THANKS

I would like to thank Rob Bott, Physicist, for the help he gave me with the relativity equations in this book. Without him, my Calculus Made Easy book would be unreadable from tears of blood.

## OTHER SPECIAL THANKS

I also thank my play testers. Mike "I'm not a sadist, but I play one on TV" Renstrom, Scott "I killed the entire party" Llewelyn, Gary "Captain Bligh" Llewelyn, Matt "I had a character once..." Fitt, Aaron "I like making characters" Brown, Chris "Kneel before me!" Brashier, Stephen "You may call me the Great One" Johnson.

I alos thank Jeff Rossiter who, in spite of his lack of interest in physics and engineering, listened to my facts and put up with my research. Hey, Jeff, get off Everquest, I need to look up the fuel to mass ratio of an F-4 Phantom.

## APOLOGIES

We apologize to Ron Carnegie, who contributed a great deal to the original creation process of *Spacemaster,* both with materials and ideas. He should have been listed in a contributor to *SM: Privateers,* but was left off by mistake. Look for his name in the upcoming *Gamemaster Manual*.

**Note:** *For readability, Tech Law uses standard masculine pronouns when referring to persons of uncertain gender. In such cases, these pronouns are intended to convey the meanings: he/she, her/his, etc.*

# 1.0 :: WELCOME

*"Please allow me to introduce myself . . ."*
*— The Rolling Stones, Sympathy for the Devil*

Welcome to the *Vehicle Manual*. This book is designed to work in conjunction with the *Spacemaster* role playing game. This book deals with the heart of science fiction: technology. In the *Vehicle Manual*, we cover a wide variety of vehicles, as well as how to handle vehicle combat, manuevering, and construction. Combined with the other two *Tech Law* tomes, this manual will guide you through using, shaping, building, and repairing technology in your science fiction role playing game.

The primary goal of this work is to give the Gamemaster rules and guidelines to help him create a realistic backdrop of technology for his science fiction game. Although this book is part of the *Spacemaster* system, it can easily be adapted (along with *Blaster Law*) to any other RPG, allowing you to bring the realism and detail of *Spacemaster* to your favorite game.

## USING TECH LAW WITH SPACEMASTER

*Spacemaster: Privateers* is the main rule and setting book for *Spacemaster*. It contains all the rules and background necessary to begin playing in this dynamic system.

But perhaps you want more.

In that case, this book is provided. It expands and details the rules for using all types of vehicles in your *Spacemaster* game. Other books expand upon other aspects of the *Space-master* rules. *Equipment Manual* and *Robotics Manual* expand the range of equipment, cybernetics, computers, and robots for your game, and complete the *Tech Law* volume. In *Blaster Law* you will find all of the attack tables necessary for resolving energy attacks, as well as conversion rules for firearms and other primitive weapons. *Future Law* expands and details many new, exciting character creation options. *Gamemaster Manual* provides dozens of rules for unique and interesting situations, such as vacuum exposure, high gravity environments, and radiation.

## USING TECH LAW WITHOUT SPACEMASTER

*Tech Law* can be used without *Spacemaster*, but this probably isn't desirable without using *Blaster Law* as well. With *Blaster Law* and *Tech Law*, the *Spacemaster* combat system can be used with other role playing games, lending *Spacemaster's* realism to other systems.

If this is the intention, then *Blaster Law* contains all the rules for handling combat without *Spacemaster*. See *Blaster Law* for more details.

## USING ROLEMASTER

If a serious supply of melee weapons and firearms is desired, then *Rolemaster* is the way to go. *Arms Law* is the *Rolemaster* equivalent of *Blaster Law*. It contains all of the weapons common to a medieval or fantasy setting.

If your campaign is going to use a lot of firearms, then *Weapons Law: Firearms* is very handy. This *Rolemaster* book contains an extensive list of firearms and, with a little work, nearly any firearm imaginable can be assigned to one of the attack tables contained within. With this book, *Blaster Law* only becomes necessary for handling futuristic combat.

All the rules necessary for using these books are contained in Appendix A-4. These rules allow the GM to convert these books, using their greater selection of weapons with *Spacemaster* armor types.

# 2.0 :: TECH LEVELS

*"The most incomprehensible thing about the world is that it is comprehensible."*
*— Albert Einstein*

Science fiction is poorly named. It would be much more accurate to call it "Technology Fiction," because at the heart of all science fiction is technology. Perhaps it isn't the main character, as the diehards claim it should be; but in a science fiction story, the technology lives and breathes. It moves and interacts with the main characters. Sometimes it even takes over and steals the show.

Gadgets, space ships, and ray guns are why the masses flock to see science fiction. This is what draws them like a moth to a flame, so when a GM decides to run a SF (science fiction) campaign, the phrase "what gadgets" had better not issue from his lips. When the time comes, he better be ready with all the equipment his players need.

Once a GM has worked out what races or cultures exist in his universe, he should sketch out an idea of how these races and cultures interact. Part of that will involve defining the technical abilities of all the major players. This section deals extensively with the use of technology and its application in the game.

## 2.1 TECH LEVEL CONCEPTS

Technology, for the sake of a SF game, must be qualified and quantified. Part of how this is done is the use of "tech levels."

Tech levels are a rating system by which technological advancement can be judged. Listed in this section are a series of tech level ratings. Each technological or scientific advance can then be dropped into the tech level system. In addition, every individual piece of tech can be placed somewhere in this structure.

## 2.2 USING TECH LEVELS

Each nation or race should be given tech levels. These need not be uniform, as not all races will develop at the same rate that Earth has. A pacifistic society, for instance, could easily have developed agriculture five or six tech levels higher than arms and armor.

But it's not necessary to travel to another star empire just to drop tech levels. You could drop a few on modern day Earth if you travel to the right location. The GM can have a lot of play in his tech levels, if he uses them properly.

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## 2.3 TIME TRAVEL

A time travel campaign will most likely to span a great deal of tech levels. The trick in a time travel campaign is whether to allow characters to take high tech items back in time with them. In Simon Hawke's *Time Wars* books, Lucas Priest was let loose on Richard the Lionhearted's England armed with an assortment of high tech gadgets, disguised as medieval equipment. This can lead to an interesting game, but can also be unbalancing, so it must be carefully monitored.

## 2.4 TECH LEVELS & SKILL USE

Many skills depend heavily on the technology level at which they were learned. Medicine, for instance, is heavily dependant on pharmaceuticals and equipment. Replace a modern doctor's scalpels and drugs with leaches and herbs and watch him flounder.

The following chart depicts the penalties incurred when using skills and equipment of a differing tech level.

**Note:** *Skills could be learned at a lower tech level than the user on purpose. For instance, a time traveling doctor might learn First Aid and Medical Practice on a medieval level so as to be able to treat his patients in the field.*

*In addition, certain skills would be unaffected. For instance, tracking is used independent of tech level, and would not be affected by temporal displacement.*

## 2.5 RAISING THE LOCAL TECH LEVEL

In *A Connecticut Yankee in King Arthur's Court* by Mark Twain, the main character begins making gun powder and building guns. Could a group of characters accomplish the same thing?

Possibly, if they knew the formula for black powder, had primitive gunsmithing skills, and knew a good blacksmith. Should players be allowed to do it?

That is left up to the GM. The characters would definitely need unique backgrounds. To pass themselves off as wizards like the Connecticut Yankee, they'd need to be able to do a good bit of acting as well.

So what skills would characters need to make black powder? Chemical Engineering, Weapon Technology, or Gunsmithing (Crafts) might be good choices. To create gunpowder out of raw materials (sulphur (brimstone), charcoal, and saltpeter), the characters would need to make at least a Hard maneuver. If they can pull this off without blowing themselves up, they'll have it.

### NOTATION

As technology, even on Earth, has developed at different rates, these levels are not necessarily intended to reflect the development of the western technology after which the ages were named. The discrepancies are purposeful and meant to represent the fact that no society evolves along a perfect tech level progression.

## 2.6 FITTING TECHNOLOGY TO YOUR CAMPAIGN

This is the most difficult part of building a science fiction universe. The GM must carefully assign his technology to keep the game balanced and to provide the appropriate feel to the setting.

A GM should start with these basic questions:

*What genre would I like to play in?* This is the most important question. An early starfaring campaign is going to have a very different feel from a game involving a vast, galactic empire.

*Is this a hard science or space opera game?* This is the second most important question. What kind of feel do you want? The Star Wars movies depict a society with a very high level of technology, and yet it is very unobtrusive. Holo-sights, specialized scanners and ultra advanced targeting systems are almost unheard of. These detract from the feeling of the individual's story, and therefore they're removed. On the other hand, the characters in any book by Dr. Gregory Benford could not possibly survive without their scanners, HUDs, and other advanced gadgets.

*How restricted is technology?* It's possible that many individual pieces of tech will be unbalancing or inappropriate for the game. They can be limited by imposing strict laws on their use.

*Is this piece of tech right for this universe?* Certain pieces of tech may be inappropriate. After assigning all of the generic factors, the GM needs to go through and decide if any tech that was included by default needs to be removed. Maybe force fields don't fit in this game, even if they're available at this tech level.

*Are there any pieces of tech that need to be included?* Perhaps in this universe, pieces of tech have been discovered that the tech level says are unavailable. For instance, maybe in this universe, the force field was discovered in the year 2001, instead of many years after.

### TECH LEVEL PENALTIES

| User's Lvl - Equipment's Lvl | Penalty |
|---|---|
| -10 or Lower | Impossible |
| -9 | -512 |
| -8 | -256 |
| -7 | -128 |
| -6 | -64 |
| -5 | -32 |
| -4 | -16 |
| -3 | -8 |
| -2 | -4 |
| -1 | -2 |
| 0 | 0 |
| 1 | 0 |
| 2 | -1 |
| 3 | -2 |
| 4 | -4 |
| 5 | -8 |
| 6 | -16 |
| 7 | -32 |
| 8 | -64 |
| 9 | -128 |
| 10 or more | -256 |

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# PART II
# TECHNOLOGICAL DEVELOPMENT

*"I have yet to see any problem, however complicated, which, when you looked at it in the right way, did not become still more complicated."*
*— Poul Anderson*

## 3.0 :: TECH LEVEL BENCHMARKS

*"Success is a journey, not a destination."*
*— Proverb*

This section contains a listing of the tech levels, broken into various categories. The general category is meant to give an overview of technological development. This treatment is not accurate enough to give a GM a truly comprehensive look on how tech levels affect a society. Therefore, this section has been further broken into specific categories, such as agriculture. These describe in more detail the progress that comes with the advances in technology. This allows the GM to make more informed decisions involving tech levels.

### 3.1 GENERAL

This chart depicts a general overview of the tech levels. They are listed as a series of historical, Earth equivalents to give the reader a better idea of how the tech levels fit into the overall scheme.

Each major age of man is listed below, along with the major technological achievements of the age. Note that these ages are listed with a bias toward Western civilization. To get a good idea of how different cultures develop at different rates, look up when the oriental cultures developed these same levels of technology.

**Note:** *For those GMs in possession of ICE's sourcebook, ". . . and a 10-Foot Pole" (ATFP) a notation has been placed after each tech level which corresponds to a section in that book. . . . and a 10-Foot Pole is an invaluable resource. It is much more complete than this book was intended to be, because most of the items in there do not require descriptions for those of us who are used to them in our every day lives.*

*This still requires some careful watching by the GM. First of all, many devices were invented slightly out of their tech levels, so if a GM is using this for an non-terrestrial civilization, he should keep that in mind. In addition, many of the ages from that book span multiple tech levels, so there may be equipment on a list that hasn't quite been invented yet.*

0 **Pre Stone Age** — No technology exists. Even language has yet to be invented.

1 **Stone Age** — Language is invented. Fire is discovered. The club becomes the weapon of superiority. Hunting and gathering are the norm. [*ATFP* Sec. 3.0, The Stone Age, p. 10]

2 **Dawn of Civilization** — Domestication of sheep and cereal grains. Invention of pottery. The invention of the wheel. Tools are made of stone. Fallowing and irrigation are invented. [*ATFP* Sec. 4.0, The Copper Age, p. 15]

3 **Bronze Age** — Writing and bronze working are invented. Weapons and tools are made from bronze. The chariot is invented and dominates the battle field. [*ATFP* Sec. 5.0, The Bronze Age, p. 23]

4 **Age of Reason** — Philosophy and higher learning come into play. Paved roads are invented. Geometry and mathematics are invented. [*ATFP* Sec. 5.0, The Bronze Age, p. 23]

5 **Iron Age** — The ability to smelt and work iron is invented. This primarily affects the trappings of war. Construction with stone undergoes many advances. The keystone arch is invented. The waterwheel, and its use in mills, is discovered. [*ATFP* Sec. 6.0, The Iron Age, p. 34]

6 **Dark Ages** — Primarily innovations in warfare and ground tactics. The saddle and the stirrup make cavalry more effective than ever before. [*ATFP* Sec. 6.0, The Iron Age, p. 34]

7 **Medieval Period** — Windmills and wind power are invented. Gothic architecture is perfected. The flying buttress is invented. Mathematics now includes zero. Steel is invented, making warfare even more efficient. [*ATFP* Sec. 7.0, The Middle Ages, p. 51]

8 **High Medieval Period** — Plate armor is invented. The knight rules the battlefield. Bell casting is perfected. At the end of this period, gunpowder is introduced, but doesn't really take over until the next period. [*ATFP* Sec. 7.0, The Middle Ages, p. 51]

9 **Renaissance** — Gunpowder and advances in shipbuilding techniques revolutionize warfare. Fencing is invented as armor becomes obsolete. [*ATFP* Sec. 8.0, The Renaissance, p. 68]

10 **Colonial Period** — Ship advancements of this and the last period lead to a great spurt of exploration. The printing press hits wide-spread usage. [*ATFP* Sec. 9.0, The Age of Reason, p. 86]

11 **Low Industrial Revolution** — Sound cast iron is produced in a blast furnace. The steam engine is invented. A series of important inventions combine to make the steam engine more efficient. The telegraph is invented. [*ATFP* Sec. 10.0, The Industrial Revolution, p. 103]

12 **High Industrial Revolution** — The assembly line brings mass production into full swing. The telephone is invented, and the revolver enters the scene. Iron begins to play a part in building, and suspension bridges enter the scene. The internal combustion engine is invented and undergoes several overhauls through the end of this age. The dynamo makes electrical power useful. The incandescent lamp is invented. [*ATFP* Sec. 11.0, The Age of Steam, p. 121]

13 **Low Industrial Civilization** — Mass production and the automobile change the world. The airplane is invented. The radio enters widespread use. [*ATFP* Sec. 12.0, The Electric Age, p. 139]

14 **Middle Industrial Civilization** — Jet power becomes practical. The rocket is invented. Nuclear fission is first achieved. The television enters widespread use. The machine gun, long range artillery, poison gas, and many other military advances change warfare. [*ATFP* Sec. 13.0, The Atomic Age, p. 158]

15 **High Industrial Civilization** — The computer is invented. Orbital and lunar space flight is achieved. Atomic power is put into wide use. The maser and laser are invented. Transplant technology takes off. [*ATFP* Sec. 13.0, The Atomic Age, p. 158]

16 **Low Cyber Age** — The personal computer is invented. Orbital space flight becomes routine. Medical research takes off. The genome begins to be mapped. The early stages of human-machine interaction begin. Cloning is achieved. Subatomic particles are successfully teleported. [*ATFP* Sec. 14.0, Information Age, p. 174]

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17 **High Cyber Age** — Cybernetics are invented and spread like wildfire. Planetary exploration begins. Rudimentary success with simulated intelligence is achieved. The neural interface revolutionizes entertainment. The first Self-Generating-Discharge Plasmatrons are built.

18 **Spacefaring Age** — Planetary colonies are established. Fusion power is in widespread use. Man-portable lasers & particle beams become the weapons of choice. Small scale genetic manipulation of an unborn fetus is achieved.

19 **Starfaring Age** — Ramjets begin to explore the stars. Slow colony ships leave for nearby systems. Simulated intelligence is perfected. Large scale genetic manipulation is achieved on fetuses with moderate success.

20 **Star Colonial Period** — Faster than light travel is discovered. The tachyon is discovered. Artificial intelligence is invented. Increases in medical and agricultural technology allow for colonies to survive with minimum support. Genetic manipulation, on a small scale, is achieved with adult specimens.

21 **Antimatter Age** — Antimatter power enters widespread use. Antimatter weapons are created. Medical science can now fix almost any non neural damage.

22 **Age of Gravity** — Invention of artificial gravity expands man's living capacities. Genetic manipulation on a reasonable scale can be performed on a living organism. Neural Pathway Reconstruction Therapy is invented. Non locality physics splits off of quantum physics.

23 **Quantum Age** — Vacuum energy is fully tapped. Early force screens are invented. Teleportation, on a small scale, becomes possible. Major brain reconstruction becomes possible.

24 **Age of Force** — Force screens are developed on both a large and personal scale. Direct manipulation of alloys makes engineering advances possible.

25 **Age of Antigravity** — Antigravity is invented. Inertial dampers revolutionize space combat.

26 **Age of Terraforming** — Large scale ecological engineering becomes possible.

27 **Age of World Building** — Ringworlds and zero fault technology become possible. There is little out of reach.

28 **Dysonian Age** — Dyson spheres can now be built. Zero fault technology makes them practical.

29 **Cosmic Age** — Limitless, cosmic power is discovered

30 **Age of Omnipotence** — Direct, mathematical manipulation of reality is possible. Anything can now be achieved.

31+ **And Beyond**... — Unknown.

## 3.2 AGRICULTURE

Agriculture is the science of raising deliberately bred crops and livestock. Whereas the technology of herding animals has changed little over the years, the technology of growing food has undergone many changes. In the early days of agriculture, farmers were little more than hunter-gatherers. Since that time, chemistry, genetic engineering, and other sciences have combined to make farming a more advanced discipline.

Out of the thousands of plant and animal species that exist, only about two hundred plants and fifty animals have been used for agricultural purposes. Around twelve or thirteen plant species are important staples of humanity's diet, and are grown in greater volumes than any other.

Note that these advances generally are restricted to herbivore and omnivore races. Carnivores develop this area slowly, as the only application they have is for their herds.

0 **Pre Stone Age** — Hunting and gathering are the means of obtaining sustenance.

1 **Stone Age** — Little in the way agricultural development, though the development of tools for the harvesting of wild grains does begin.

2 **Dawn of Civilization** — Plant husbandry, mostly the scattering of seeds, begins. People begin herding sheep. The only tool needed is a simple scythe for the harvesting of grain.

3 **Bronze Age** — Many cereal grains grown. Implements are primarily wooden. Vineyards are kept.

4 **Age of Reason** — The water wheel is invented to bring water to elevated crops.

5 **Iron Age** — Tools such as the plow, reaper, hoe, and sickle begin to gain metal parts. Slaves are used to increase productivity.

6 **Dark Ages** — Little in the way of technological increases. Farmers are forced to surrender to nobles for protection.

7 **Medieval Period** — Little in the way of technological advances occur.

8 **High Medieval Period** — Farmers farm in strips, leaving every other strip fallow for a year.

9 **Renaissance** — Farmers begin enclosing land. This allows larger blocks of the same crop to be developed. Farmers also begin rotating crops, eliminating the need to let the land lie fallow.

10 **Colonial Period** — Invention of early mechanical farm implements.

11 **Low Industrial Revolution** — The horse drawn drill, reaper, and cotton gin are invented.

12 **Low Industrial Civilization** — Increased transportation capabilities, such as use of canals, steamboats, and locomotives, allow more centralization of goods. Invention of the steel plow allows the cultivation of the heavy, rich soils of the prairie. Invention of barbed wire allows cattle ranching on the open range and brings about the end of the cowboy. Refrigeration allows export of goods to other countries. Steam power allows the invention of mechanized combines, tractors, and threshers.

13 **Low Industrial Civilization** — Gasoline tractors increase efficiency. Theories in heredity allow plant breeding.

14 **Middle Industrial Civilization** — Agriculture evolves into big business. High tech pesticides hit the market.

15 **High Industrial Civilization** — Environmental impact of pesticides causes experiments with more eco-friendly "organic farming."

16 **Low Cyber Age** — Genetic engineering allows production of more efficient grains, bred for desired traits.

17 **High Cyber Age** — Engineered food and genetically enhanced strains allow food supplies in spite of pollution and overpopulation.

18 **Spacefaring Age** — Increased genetic manipulation of grains and fruits allow farming to be carried out in extreme and sparse environments, such as the exposed surface of Mars. Lack of nitrogen and other general terraforming techniques render these advances moot.

19 **Starfaring Age** — Genetically manufactured bacteria and other microorganisms make sterile and nitrogen deficient soils marginally fertile. This in conjunction with previous genetic hybrids allows the farming of previously untenable land.

20 **Star Colonial Period** — Advances in chemical fertilizers and genetic hybrids allow the cultivation of land that is almost completely sterile. Unfortunately these chemicals render the land almost permanently useless for any other cultivation. This will cause problems later, at tech level 26.

Sample file

21 **Antimatter Age —** A combination of hybrids, nanites, and engineered microorganisms allow the cultivation of any environment, but with less long term impact than the previous tech level.

22 **Gravity Age —** Food can be grown anywhere, anytime. From this point on, the technology merely becomes more efficient and cheaper.

23 **Quantum Age —** Meat can now be cloned more cheaply than by use of herd animals. "Genuine" living meat becomes a luxury, only for the eccentric.

24 **Age of Force —** Prior technologies become cheaper and more efficient.

25 **Antigravity Age —** Vat-grown meat can now be grown in days or hours. Limitless energy, combined with genetic engineering makes food cheap and plentiful.

26 **Age of Terraforming —** Terraforming allows colonies to grow food for their own eccentrics. Once living tissue need no longer be imported.

27 **Age of World Building —** Technology becomes cheaper and more effective.

28 **Dysonian Age —** Food is no longer a problem anywhere.

29 **Cosmic Age —** There are few advances left to make.

30 **Age of Omnipotence —** Food can be created out of nothing.

31+ **And Beyond...** Unknown.

## 3.3 ARMS AND ARMOR

The art of war precedes civilization and social order. It's likely that it even precedes sapience. From the earliest days of intelligence weapons have been used by the strong to steal from the weak. They have also been used by the strong to protect the weak. The warrior is in fact the oldest profession.

0 **Pre Stone Age** — No weapons exist. War is conducted with fists and teeth.

1 **Stone Age** — Rocks and sticks are used. The club is invented. Hide armor and hide shields are invented.

2 **Dawn of Civilization** — Spears and then arrows are invented. The bow follows.

3 **Bronze Age** — Bronze working brings about the forging of blades and armor. Armor consists of bronze and leather.

4 **Age of Reason** — Refinements in armor is the majority of this age's accomplishments. The paved road allows the more rapid movement of troops. The phalanx is devised.

5 **Iron Age** — Forged iron revolutionizes weapons and armor. The cavalry is first used successfully, despite the lack of the stirrup. The ballista, catapult, and mangonel enter widespread use.

6 **Dark Ages** — Greek fire is introduced to maritime combat. The stirrup and saddle are introduced, increasing the effectiveness of cavalry. The reign of the heavy cavalry begins. Ground tactics are refined somewhat.

7 **Medieval Period** — Steel is invented. Armor and weapons are refitted using this lighter, stronger material. Improvements in architecture and stone masonry create bigger and more fortified castles. The heavy horse becomes more and more powerful. Chain mail is brought into its first full-scale use.

8 **High Medieval Period** — Plate armor is invented. The crossbow is developed, heralding "The End of Warfare." At the end of this period, gunpowder is invented.

9 **Renaissance** — Gunpowder and advanced shipbuilding techniques revolutionize warfare. Man-portable gunpowder weapons are brought onto the battlefield, as well as catapults. Fencing is invented as armor becomes obsolete.

10 **Colonial Period** — Ship advancements of this and the last period improve capabilities in maritime warfare. Gunpowder cannons allow for more complicated riggings. The paper cartridge increases the firing rate of the infantryman. The smoothbore musket is invented. The bayonet is introduced.

11 **Low Industrial Revolution** — Muskets and the cavalry saber rule the battlefield. Scientific research is directed toward arms technology for the first time. The first maneuverable submarine is invented.

12 **High Industrial Revolution** — The revolver is invented. Steel hulls replace wooden ones. Steam power replaces wind power. Armored turrets and the torpedo are invented. Smokeless powder, the breech loader, and the working machine gun are invented. An array of explosives are invented.

13 **Low Industrial Civilization** — The military airplane, the man-portable machine gun, the submarine, the sea mine, and gas warfare are first brought into full use.

14 **Middle Industrial Civilization** — Jet power becomes practical. The rocket is invented. Radar is invented. Submarine detection methods are invented. Electronic countermeasures, as well the proximity fuse, are invented. The machine gun rules the battlefield. The tank puts an end to trench warfare. Helicopters are invented, but not put to widespread use. Atomic weapons are first developed.

15 **High Industrial Civilization** — The helicopter enters warfare. Increases in medical techniques are the greatest improvements in warfare. Nuclear power is put to use in naval vessels.

16 **Low Cyber Age** — The rocket is brought into wide use, and the helicopter becomes a combat vessel. Ballistic body armor is invented, as are improved chemical and incendiary arms. Increased computer technology allows more accurate use of missiles. The spy satellite comes into full usage. The ICBM is the nuclear delivery system of choice.

17 **High Cyber Age** — Military lasers and particle beams are brought into use. Electrochemical propulsion replaces gunpowder. Cybernetic advancements allow the creation of a new "super soldier." Orbital weapons begin to be utilized. Further advances in computer telemetry allow for increased long range combat capabilities. Gauss weapons are invented. Kinetic armor is invented, and the usefulness of the firearm begins to wane.

18 **Spacefaring Age** — Man-portable lasers and particle beams become the infantry weapon of choice. Planetary based mass drivers replace atomic weapons in interplanetary defense. Reflective armor and aerosol screens become useful in personal defense. Genetic engineering, on a minor scale, is used to produce the next generation of soldiers. Genetically engineered bio-weapons achieve more effectiveness. VT tanks are first built.

19 **Starfaring Age** — The first space combat vessels are built, though not brought into widespread use. Plasma weapons are invented. Ablative body armor is developed to combat particle beam weapons. A new generation of genetic "super soldiers" is produced.

20 **Star Colonial Period** — Man-portable plasma weapons are developed. Personal body armor is advanced to protect against plasma weaponry. The discovery of the tachyon leads to faster than light scanning equipment. The missile nearly becomes obsolete. Space combat vehicles are brought into ready use. Advanced SI computers are now small enough to create automated combat vehicles. The combat 'droid is developed.

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21 **Antimatter Age** — Weapons become smaller and deadlier. Antimatter power is used to run more and more powerful space combat vessels. The potential of tachyon sensors begins to be fully realized. Star combat is now the norm. Combat armor evolves to the point where orbital drops are possible, bringing about a new breed of paratrooper. Land invasions become more and more obsolete, as space superiority takes a central role in warfare. Genetic super soldiers and combat droids vie for supremacy on the battlefield. Medical technology can heal most wounds.

22 **Gravity Age** — Artificial gravity allows longer terms on space situated weapons platforms. Men can be kept in fighting trim even in space. Increased gravity can be used for physical training. Neural pathway reconstruction therapy allows soldiers to be revived and saved after much longer periods of brain death.

23 **Quantum Age** — Full utilization of vacuum energy brings freedom to space-based weapons they have never had before. Major brain reconstruction is possible. Increased weapons, armor and genetic technologies bring about the obsolescence of the combat droid.

24 **Age of Force** — Force screens become useful for both large vehicles and personal defense. Direct manipulation of alloys, on a molecular level, increases the effectiveness of fighting vessels. Weapon and armor technologies vie for superiority, but the personal shield has changed everything.

25 **Antigravity Age** — Antigravity allows the creation of hover tanks and other low altitude, all-terrain craft. Inertial dampers allow space combat to achieve new levels of maneuverability. The dogfight is reinvented.

26 **Age of Terraforming** — Terraforming allows holocaust weapons to be employed with greater impunity.

27 **Age of World Building** — Zero fault technology makes fighting implements more durable and effective. Increases in engineering make things harder and harder to destroy. For the first time in history it appears it may one day, be easier to create than to destroy.

28 **Dysonian Age** — Entire worlds can now be built, giving whole new territories to take. Force technology increases to the point where active destruction is becoming more and more difficult.

29 **Cosmic Age** — The discovery of cosmic energy allows offensive technology to outstrip defensive technology.

30 **Age of Omnipotence** — Direct manipulation of reality is possible. Creating and destroying are now one.

31+ **And Beyond... —** Unknown.

## 3.4 COMMUNICATIONS TECHNOLOGY

Communications technology is any technology which allows the exchange of thoughts and ideas between two sapient creatures. It runs the gamut between simple language and high-tech, faster than light, com gear.

0 **Pre Stone Age** — No technology, not even language, exists.

1 **Stone Age** — Language is invented. Increasingly complicated thoughts and concepts are communicated.

2 **Dawn of Civilization** — Language is refined somewhat.

3 **Bronze Age** — Writing is invented. Further refinements in language persist, allowing the communication of complex philosophical concepts.

4 **Age of Reason** — Advancements in language of the last age allow for the birth of philosophy and the communication of scientific concepts. The invention of the paved road allows a communications base which supports larger political bodies.

5 **Iron Age** — Further advancements in language persist. Watch fires and horsemen are the primary couriers of important news. The messenger becomes a trusted commodity.

6 **Dark Ages** — Little in the way of developments are made, though the groundwork for many modern languages are laid.

7 **Medieval Period** — Increased shipbuilding technology allows greater rate of travel by sea.

8 **High Medieval Period** — Advances in this time period primarily involve ship construction.

9 **Renaissance** — More advances in ship construction are known during this period.

10 **Colonial Period** — The printing press hits wide-spread use.

11 **Low Industrial Revolution** — The telegraph is invented.

12 **High Industrial Revolution** — The telephone is invented.

13 **Low Industrial Civilization** — The radio enters widespread use.

14 **Middle Industrial Civilization** — The television enters widespread use.

15 **High Industrial Civilization** — The computer is invented. A network of communication satellites in geosynchronous orbit allow line of sight communications to circumvent the world.

16 **Low Cyber Age** — The personal computer is invented. The Internet comes into being, adding a new level to corporate and private communications. Fiber optics are invented.

17 **High Cyber Age** — Cybernetics are invented. The neural interface revolutionizes the consumption and distribution of data. The Sensenet is born.

18 **Spacefaring Age** — Interplanetary communication is restricted to speed of light signals.

19 **Starfaring Age** — Interstellar signals are still restricted to speed of light signals.

20 **Star Colonial Period** — The tachyon is discovered. Slow faster than light communication is created.

21 **Antimatter Age** — Methods of reducing a tachyon's energy are discovered. The speed of faster than light communication improves dramatically.

22 **Gravity Age** — The speed of faster than light signals is increased still more.

23 **Quantum Age** — Teleportation is heralded as the dawn of a new age of instantaneous communication. However there are many restrictions. Other breakthroughs in nonlocality make instantaneous communication possible.

24 **Age of Force** — Com systems are smaller and more efficient.

25 **Antigravity Age** — Com systems are smaller and more efficient.

26 **Age of Terraforming** — Com systems are smaller and more efficient.

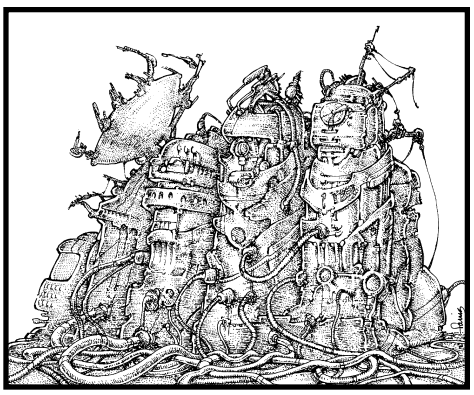
27 **Age of World Building** — Com systems are smaller and more efficient.

28 **Dysonian Age** — Com systems are smaller and more efficient.

29 **Cosmic Age** — Limitless, cosmic power is discovered. Com systems lose all effective range.

30 **Age of Omnipotence** — Direct, mathematical manipulation of reality is possible. This is communication with the universe itself, in the highest form.

31+ **And Beyond...** — Unknown.



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