William H. Keith, jr

Absent Friends

The **Traveller** universe has been a community of friends since even before its first publication. **Traveller** players are a unique and diverse group who enjoy the opportunities the game provides them for camaraderie and imagination.

Lamentably, some of our friends are no longer with us, but their memory remains…

J. Andrew Keith
1958-1999

Andrew was a prolific science fiction and role-playing game author with **Traveller** clearly predominant in his writings. He was intelligent and creative in his writings and an asset to the **Traveller** system.

Clayton R. Bush
1958-2007

Clay was an independent author of convention scenarios in 'odd' systems, but he always returned to **Traveller**. In 1991, he received a *'Lifetime Achievement Award'* for writing and running over 100 convention events.

Don Rapp
1936-2007

Don caught the **Traveller** bug early and enjoyed promoting **Traveller** at conventions. He was the author of some of the first supplements to **Traveller**: *Scouts and Assassins*, and *SORAG*.

Bari Z. Stafford Sr.
1953-2002

Bari enjoyed designing ships, sectors, and situations for **Traveller**, and he enjoyed sharing them with fellow **Travellers**. His *magnum opus* was *Turokan's Expedition to the Rim*.

John M. Ford
1957-2006

John as an extraordinarily intelligent and witty man with exceptional writing talents on the larger science-fiction scene. He nonetheless lent his talents to gaming and to **Traveller**. He wrote GURPS **Traveller** *Starports* and was a frequent contributor to the Journal of the Travellers' Aid Society.

Paul Montgomery Crabaugh
d. 1985

Paul was an early asset to **Traveller**, and regrettably an early loss. Issue 51 (1982) alone of *Dragon* featured four of his articles on **Traveller**, each short, punchy, and insightful. He was also an advocate and a pioneer of the Civilian-- the career for players to experiment with being an average Joe.

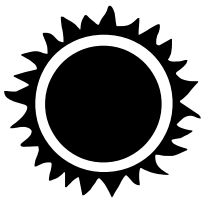
Robert E. "Bob" Bledsaw
1942-2008

Bob pioneered the licensed role-playing supplement with D&D materials, and expanded to produce **Traveller** materials in 1979. Notable among the items he published were *Starships and Spacecraft*, the **Traveller** *Judges Screen*, and *Dra'k'ne Station*.

E. Gary Gygax
1938-2008

All role-players owe a debt of gratitude to Gary Gygax. It was his pioneering of the recreational role-playing genre with *Dungeons & Dragons* that created the modern role-playing game. In the long view, he ranks with H.G. Wells (whose *Little Wars* pioneered military battle games) and Fred Jane (whose *Jane's Naval Wargame* pioneered sea battle games).

Dungeons & Dragons had a strong and lasting influence on **Traveller**.



The early editions of **Traveller** led RPG design with evolutions.

Classic Traveller was one of the first RPGs to abandon classes or levels. A character's experience was based on how old he was, and what career he pursued.

MegaTraveller added the task system: its flexibility and adaptability an inspiration to so many RPGs, with it's flexibility and adaptability.

But **Traveller: The New Era** had no evolutions – it was a conversion to a different game system. And when **T4** was released, there were too many compromises between the various editions. I have to confess: as with many fans, I stayed with **MegaTraveller** and its accompanying errata; others went back to **Classic Traveller**, and still others combined their favorite pieces from the various editions into their games.

The first discussions Marc and I had about a new **Traveller** edition were in 1997; he was cleaning up the **T4** mechanics at the time, and I wasn't interested. Over the next decade, many rumors came out about what Marc was working on, and every **Traveller** fan had their opinion of how he had to do it. I did keep an ear out on what might be changing, but nothing I saw changed my mind to keep my favorite edition.

Late in 2007, Marc passed me a new draft, and I saw something different. This was not a redone **T4**, not a cleaned up **MegaTraveller**, not even a revised **Classic** edition. This was an evolution. It was just notes on some careers, but I saw something there. So he invited me to join a group (the infamous "Sewing Circle") and he e-mailed us updates on an infrequent basis. My infrequent involvement shortly became deeper, and I found myself having more fun buried in **Traveller5** drafts than I had ever had before in gaming. From the early sewing circle discussions to the incredibly rewarding forum errata-fests, it's been an amazing experience watching these rules develop.

I encourage you to read through these rules several times. Let the overall concepts seep in. Then go through it again, and you'll see nuances you missed. **T5** is as much an evolution in some places as adding the task system was to **MegaTraveller**. In other places, it's even more. RPGs have evolved a lot since 1974 and 1977. Now **Traveller** finally catches up, and then jumps ahead.

Welcome to **T5**.

Don McKinney

Preface

This volume may seem daunting: hundreds of pages about the universe of the future. Where should you start? What material is new? What has changed?

This is a daunting volume, more than ten years (in some respects more than that) in the making. There was a point when the text flowed non-stop evening after evening almost directly into the original Little Black Books. The concepts that went into those three books have come back time and again, to be revised, expanded, and elaborated upon. A few words about mercenaries and the military became a major emphasis in **Traveller**; a few more worlds about space navies became another emphasis.

This text takes so many of the ideas from the original **Classic Traveller** and all that followed it, and brings them to maturity. It helps to point out some of the advances and details in this volume, rather than make you dig for them.

The Foundations

We lay out early many basic concepts that come back time and again.

The chapter on **Dice** provides the statistical expectations for die rolls: to help player make better choices. Then it defines the types of die rolls that will be used throughout these pages: rather than define them again and again as they come up. We introduce terms like Assets and Target Number and Mod and DM. We introduce standard rolls, and special purpose rolls, and a new one: Flux.

Standard Die Rolls
Standard Die Roll Terms
Probabilities of Die Rolls
Flux

We cover **Traveller's** traditional hexadecimal "use letters as numbers" concept now labeled **Ehex**.

Ehex

We define what a **ton** is (it's the volume of 1000 kilograms of liquid hydrogen) and how its used to measure cargo, and ship size, and more.

The Ton

We define the values for **Range Bands**: in fact, we define several different types of Range Bands for use on worlds, for use in space, for calculating altitudes, and even social distance (see the chart for Fame). Flyers can fly at specific altitudes; starships can skim gas giants at specific altitudes; submarines can dive to specific depths.

World Range Bands
Space Range Bands
Attitudes on Worlds
Depths of Oceans
The Depths of Gas Giants

We define what **money** is: the Credits that characters carry in their pockets; the MegaCredits that business and companies spends, and the Aryu that worlds use in their budgets.

Money
Credits, MegaCredits, and Aryu

We also define **Benchmarks** for money: how much a person needs to live on; how much a person can earn at various jobs; how much common items cost. We also address Benchmarks for Sizes: we discuss how big some things are, and then assign number values to them.

Benchmarks
Costs
Values
Sizes

The preliminaries define early in the text some very basic concepts that are helpful for players.

Characters

We took a careful look at the six personal characteristics and defined them in detail. Earlier **Traveller** aliens had alternative characteristics, and we have expanded that concept to include alternative or analog characteristics for some non-humans. We also defined two secret (or at least obscure) characteristics: Psi and Sanity.

Characteristics
Alternative Characteristics
Sanity
Psi

We considered a wide variety of career types and narrowed them down to 13: any other career is really just a subset or a specialization of these 13. We defined how to create homeworlds; what sorts of education are available; what benefits accrue when a character retires.

13 Basic Careers

Yet the basic concept of career resolution for characters remains: updated, refined, but still recognizable to veteran **Traveller** players.

We have added **Genetics**. A character can record genetic information during character generation, or discover it later through genetic testing. Genetics allows characters to establish a link with characters (ancestors, descendants) in other milieux. Genetics is also a basis for **Geneering**.

Genetics
Geneering

We provide detailed rules for **Clones**, including Life Insurance. We go beyond clones to address **Chimeras** and **Androids**.

Clones
Chimeras
Androids

We address (at length) **Sophonts**: aliens of all sorts and types, including the ability to create new sophonts (or import your favorites) with relative ease.

Sophonts

Basic System Mechanics

The central mechanics of **Traveller** remain the detailed task resolution system and its companion skill set. A defined set of skills is paired with an unlimited set of knowledges: characters can turn their attention to anything they want and find the task system supports them. We have implemented Talents: special abilities for non-humans.

Task Resolution
Skills
Knowledges
Talents

Some details may seem superficial: Birthdays, for example. But the character's birthday provides a recurring time for that character to evaluate experience and increase abilities.

Birthdays
Experience

We have defined how the senses work: a character can ask "Can I overhear that conversation?" or, "Can I see anyone through this haze?" and get a reasonable answer. We have defined two alien senses which non-humans may make use of. And having defined how the senses work, we have provided the ability to reasonably determine how binox and sound amplifiers work.

The Senses

We have defined a system for evaluating the **Quality** and performance of objects. Calling a rifle High Quality means something; saying a communicator is Easy-To-Use also means something. It's possible to find a device and find its dangerous to use, or buy a computer that is extremely reliable. The **QREBS** System (for Quality, Reliability Ease-of-Use, Bulk, and Safety) defines a range of characteristics for equipment.

Quality

The QREBS System

We have refined the Interpersonals from **MegaTraveller** into **Personals**: a system, for interaction with Non-Player Characters. Personals guide a Referee as he role-plays a Patron or a casual encounter.

Personals

Combat

The Traveller Combat System implements a two stage process of weapons attacking, penetrating armor, and finally inflicting wounds. The system is easy to use and provides detailed information about injuries to characters.

Personal Combat

Non-Bullet Weapon effects

We have implemented a wide range of weapon Effects: Acid, Burn, Hot, Cold, Electric Shock, Infection, as well as traditional Bullets.

Non-Lethal Weapons

In response to the weapon Effects, we have implemented protections which resist them: Insulation (protecting against Hot and Cold and Electric), Sealed Environments, SoundProof, RadProof, and more.

Armor and Protections

Effects which penetrate Protections inflict injuries on characters and damage to vehicles. Injuries produce reductions in Characteristics. Damage affects locations based on a Hit Location Chart. If the damage is not too severe, it can be repaired after the battle.

Injuries to Characters

Damage to Vehicles

Supporting the Combat system is a series of Makers:

GunMaker creates guns from small pistols to gatlings, each with its own special features. Many weapons are non-lethal; others are weapons of mass destruction. GunMaker includes a variety of options for weapons (folding stocks, special sights). Silencers are available (and the Sense rules make it harder to hear Silenced weapons).

GunMaker

ArmorMaker defines a variety of protections: filter masks and respirators, ballistic vests, and more. It also creates vacc suits and battle armor in a broad range of tech levels and armor levels. Some armor is traditional; others are small vehicles. Armor Maker also allows creation of Oversized and even Titan suits: for larger, non-human soldiers.

ArmorMaker

VehicleMaker creates a broad range of vehicles, customized for special purposes.

VehicleMaker

In many ways, **Traveller5** has abandoned the detailed piecemeal construction systems of **Fire Fusion and Steel**, and replaced it with the faster, easier, and often more satisfying, Maker systems.

Starships and Space Travel

We define Starports in detail.

Starports

We also define star travel in detail, including how Jump works.

How Jump Works

This volume includes ACS Adventure Class Starship Design and Construction. It covers ships from 100 to 2400 tons with an easy-to-use FillForm for recording the design process.

Ship Design 100 to 2400 tons

The design system integrates extensive coverage of Sensors, Weapons, and Defenses. The system allows one weapon as a MainWeapon; it includes turrets, barbettes, and bays. Some defenses operate in Absolute Mode against a specific weapon; some weapons can be deployed in a defensive Anti-Missile Mode.

Sensors
Weapons
Defenses
Armor

Armor can be installed in Layers.

A powerful Computer system produces networked computers on-board ships. integrated with Software and Computer Architecture that allows sophisticated computer operations and artificial intelligence.

Computers
Software
Computer Architecture

The system creates a powerful interaction between the design choices of the Naval Architect and the final values on the ShipSheet (the Ship Damage Sheet) used in Space Combat.

The Ship Design System also introduces the logical technological extensions of drives and power plants: Anti-Matter Plants and Energy Collectors, the Hop and Skip Drives, and NAFAL.

Advanced Drives
Advanced Power Plants

Space Combat

The Space Combat system produces a clearly defined procedure for resolving attacks.

Combat uses Range Bands with clear definition of what weapons can attack when. Missiles launched from far away attack in the next (or later) turn. Ships can ram targets. We have introduced Kinetic Kill Missiles, Nukes, Battery Fire, and allocation of some weapons to Anti-Missile Mode.

Ramming
Kinetic Kill Missiles
Nukes
Ortillery Bombardment

DataCasters can try to insert viruses in enemy ships. CommCasters can co-ordinate attacks by multiple ships. Ortillery can bombard worlds.

Space Combat normally hits specific parts of ships: a turret, the drives, the bridge. But some hits (if big enough) can blow a ship up.

Hit Locations
Critical Hits

Charted Space: Within and Beyond

We define Charted Space: the miniscule portion of the Galaxy inhabited by humans and other races. We also give a glimpse of what lies beyond the boundaries of Charted Space.

Sector Mapping
Subsector Mapping

We detail interstellar mapping on a Sector and Subsector basis.

World and System Creation

Then we move into a rational star system and world creation system based on Classic Traveller. It covers creating one or more stars and then a mainworld. Other worlds are created as necessary.

The MOARN Concept

We introduce the concept of **MOARN** Map Only As Really Necessary; detailed systems are necessary only as they are visited or explored. But let's look at what is possible. Worlds have the traditional UWP. New provisions allow for occasional world sizes and occasional world populations above 10 (to as high as 15). There are a variety of new trade classifications (which have extensive effects throughout the entire game system).

World Size to 15

Population to 15

We introduce three "Extensions" of additional information about Worlds: Importance (ranking worlds in a region and governing the designation of the Capital and placement of Trade Routes), Economic (providing insights in the world's budget), and Cultural (providing insights into social behaviors).

The Importance Extension
The Economic Extension
The Cultural Extension

The old tradition of Starport X for Red Zones has been displaced by Trade Classifications; Starport X simply means "No Known Starport."

Multiple Stars in a System

A system can have as many as eight stars, although that many is very rare. Many systems do have multiple stars: some are near companions; some systems essentially have two or three systems crammed into a stellar hex.

Multiple Systems within a System

The other worlds in a system have more flavor: IceWorlds, RadWorlds, Infernos, Stormworlds, and more.

IceWorlds
RadWorlds
Infernos

Gas Giants are differentiated into Small and Large, with the addition of Ice Giants. There is also the occasional Brown Dwarf.

The Star System is broken into the Inner System (Orbits 0 to 5), the Outer System (Orbits 6 to 12), and the Remote System (Orbits 13 to 19). Graphic charts show the location of the Habitable Zones for the placement of Mainworlds. An M9 II has a Habitable Zone at Orbit-11 (21 light-hours out).

Inner, Outer, and Remote Systems.

Easy to use graphic FillForms record the worlds in a system.

Terrain and Mapping

We define world terrain (for habitable and inhospitable worlds) and its effect on vehicle movement. Charts define altitudes for use by Flyers, and depths for use by submersibles.

Defined Terrain

World maps have been standardized on 1000 km hexes; the standard geodesic world map changes in number of hexes based on world size.

Standard World Maps

Sample blank world maps are provided for all sizes from 1 to 15.

Blank Maps

World Hexes have a hierarchy: World Hexes contain many Terrain Hexes, which contain many Local Hexes, which contain many Single hexes. It is possible to map a world down to 1 km hexes.

Technology

While based on traditional technology levels in **Traveller**, the Technology chapter defines all possible tech levels, including the theoretical maximum Tech Level (Z) and its repercussions on the universe in general.

All Tech Levels Defined

The Technology chapter also details creating objects at higher than their normal TL (as Improved or Advanced devices) or lower (as Prototypes or Experimental). Tech Level for objects becomes a range rather than a point on a scale.

Experimental Devices

Advanced Technology is defined and used consistently in this edition to a far greater degree than ever before.

Advanced Devices

Trade And Commerce

We define a trade system with hundreds of differentiated goods and how they are priced for buyers and sellers.

Hundreds of Trade Goods

Psionics

The entire Psionics system has been rationalized and defined to make it useful and usable (for those who dare pursue its secrets). Psionic Senses mimic the real senses; Psionic Actions are clearly defined.

Psionic Senses
Psionic Actions

Sophonts

Our extensive sophont creation system produces detailed non-humans: some are very near human; others are strange and fantastic. The range from small intelligent creatures to huge lumbering but intelligent beasts. Their many differences present intriguing challenges to players who take them on as characters.

Complete Alien Creation

There is, of course, much more than this short overview…

Traveller Is About Travel

Most people never venture beyond the familiar boundaries of their village: they live their lives close to home. They pursue honorable goals; they raise families; they sustain the fabric of society and economy that drives civilization. But they also fade into obscurity.

Adventure comes only to the bold: to those who move, who travel, who act.

Traveller is about travel.

"For my part, I travel not to go anywhere, but to go. I travel for travel's sake. The great affair is to move."

Robert Louis Stevenson

Players want to know about the universe… about other worlds and other cultures, about space travel and aliens, about fantastic technology and incredible science.

Traveller gives player the opportunity to fulfil that quest.

Traveller is about the human condition.

"We travel to try to outrun death, attempting to see all of the sights creation has to offer before the day comes that we can see no more."

Clif

Players encounter strange worlds, alien races, and exotic cultures, but they always see them through human eyes.

Aliens so random, so incomprehensible, or so illogical that players cannot understand them serve no useful purpose.

On the other hand, many alien cultures are puzzles: careful attention slowly reveals the underlying logic of their behavior and their values. Well-thought-out alien cultures stimulate thought and, ultimately, promote understanding. A warrior race makes us think about violence and how we perceive it. A world that prohibits music forces us to examine the value of music in our own society.

Traveller is a journey of understanding about what it means to be human.

Traveller is about consequences.

We set out to rule the world!
Maybe I'm dreaming, but I don't care
Because whether I'm asleep or awake,
doing good is what matters.
When I'm awake, for its own sake
if not, to win friends for when we awake.

Pedro Calderón de la Barca,
La Vida Es Sueño

Everything we do has consequences: kindness is repaid at some other place and some other time; malice triggers consequences years later.

The fact that acts have consequences strongly influences (or should strongly influence) the decisions every role-player makes.

Traveller is about danger.

In those times it was not safe for anyone to go or come, for great disturbances afflicted all the inhabitants of the lands.

2 Chronicles 15:5 (NRSV)

Travel without danger is mere tourism: it's no more than casual viewing of interesting locations.

The element of danger is what transforms travel into adventure.

Traveller is about risk and reward.

"Shall we rise again to be lords of space and the rangers of the star lanes?" he wondered. "Do we begin this day a second cycle leading to another empire?"

He was a little startled when Zicti's thought answered his. "It is just history, my boy, history. We fashion that whether or no. But there is a very old saying known to my people--- 'When a man comes to the end of any road let him remember that the end is not yet and a new way shall open for him.' "

Kartr turned his back upon the Hall of Leave-Taking and ran lightly down the eroded steps. The wind was chill but the sun was warm. Dust puffed up from beneath the marching feet.

"Yes, the end is not yet! Let us go!"

Andre Norton,
Star Rangers

Gains by chance are no more than lottery prizes; true rewards come when players make plans, take risks, and act boldly in pursuit of their goals.

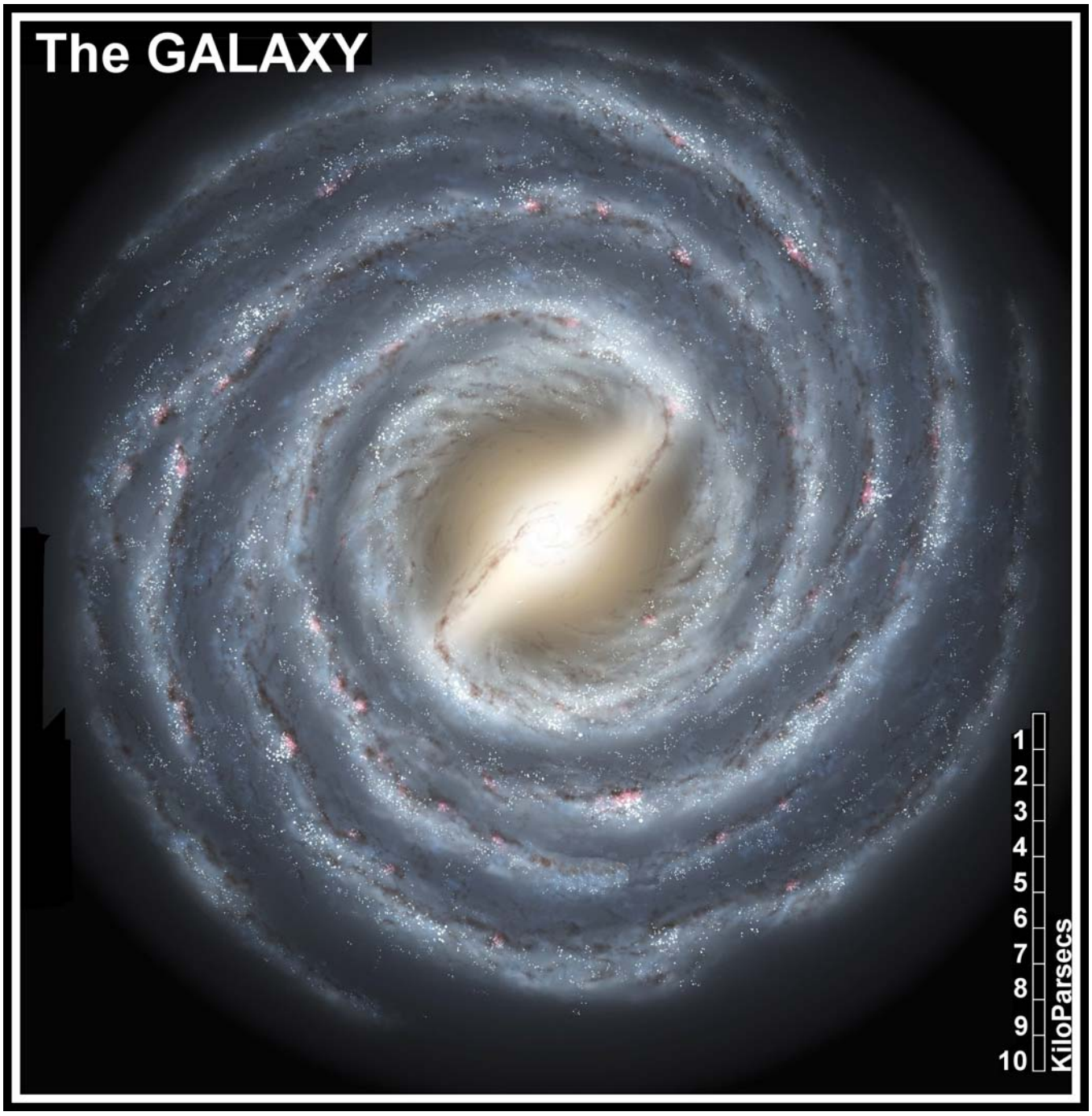
And so, Traveller is ultimately about goals.

Even though eternity lies before us,
this is the life in which
the work of this life is to be done.
The life that lies beyond will have
its own work to do,
its own decisions to be made,
its own distance to be travelled.

Richard L. Evans,
The Spoken Word

Some people want to build empires. Some care about money, others about power, still others about knowledge. Each player is different: each sets his own goals and his own pace. And so, ultimately…

Travel (and **Traveller**) is a process, not a goal.



The Galaxy (also **Our Galaxy**, the **Milky Way Galaxy**, **Galaxias**, or **Dakhaseri**[1]) is the barred spiral galaxy which is home to Humanity. It is 30 kiloparsecs in diameter, approximately 3 kiloparsecs thick at its center, and contains an estimated 200 billion to 400 billion star systems.

The Galaxy is almost as old as the universe: its oldest stars date mere millions of years after the beginning of time. The majority of its stars, however, are between 6 and 10 billion years old.

The Galaxy has held life from its earliest moments. There is evidence that even the earliest stars had planets and that those planets generated the primordial soups that breed life. Wherever life can appear, it does appear.

[1] **Dakhaseri.** Literally, Audience of Stars. There is an ancient Vilani story of meritorious souls being allowed to watch the events of the world.

A Brief History of the Universe

The universe teems with life: everywhere, worlds coalesce from gas and stardust; everywhere, life begins; everywhere, life evolves toward intelligence. On some of those worlds, intelligence reaches for the stars, and on some of those worlds, intelligence succeeds.

The history of the universe is the history of the exploits of many different intelligent species and their interactions (a euphemism for expansion, aggression, and conflict) with other intelligent species.

This history is divided broadly into **milieux** (the singular is milieu) or **eras** dominated by a few intelligent species and a few important controlling facts. Each milieu is focused on some specific step in the progress (or sometimes the decline) of interstellar civilization. And each milieu has a long-lasting and profound influence on future generations.

LONG AGO

Intelligence does not guarantee success. For eons, worlds evolved intelligent life, and each of these sophont[1] species lived and died without ever leaving its home system.

Eventually, some sophonts reached beyond their system to the nearest stars. Some established colonies on other worlds; some tried to explore the universe with generation ships. But all were restricted by their NAFAL[2] technology ships, and even long-lived races found the speed limits of the universe frustrating.

The Grandfather Era (300,000 BC)

The universe as we know it was irrevocably changed by a meek, even dull, pastoral intelligent race (the Droyne) which thrived some 200 parsecs from Earth in the long ago past.

Droyne society prospered at a comfortable, if not very high, technology level. They expanded to settle their homeworld and then achieved a plateau of civilization and of progress. Their society remained static (but reasonably happy) for thousands of years.

Then, some 300,000 years ago, one of the newborn Droyne was different… a mutation, incredibly intelligent, incredibly talented, and incredibly ambitious. In his early adulthood, he realized the full power of his talents and used them to conquer his world and his people (not that either really resisted). This super-genius (called Grandfather by modern anthropologists; they call this genius race the Ancients) then turned his attention to space, inventing powerful space ships and then even more powerful starships with jump drive.

He and his people ventured boldly out into the universe. He raised a family of super-genius children (nearly as smart as he) and they flew in many different directions to settle hundreds, even thousands, of worlds. Each of his children focused his genius on conquering some aspect of the universe.

One discovered a means of controlling stellar evolution; another invented a series of custom crafted elementary particles. Some of their discoveries and inventions had practical uses; others were mere curiosities.

Back on the homeworld, Grandfather invented immortality (for himself only it seems; he shared a lesser form of it with his children). He invented new energy sources, world shattering weapons, mind-boggling transportation systems, and pocket universes. He found an exploited loopholes in the laws governing the universe. Much of what he invented is still unattainable to modern man.

At some point, he and his children had a disagreement. It escalated into a galaxy-wide war that completely destroyed their civilization and their thousands of cities on thousands of worlds. The modern universe can see evidence of this Ancient War: worlds with poison atmospheres, worlds scrubbed clean of life and cratered by asteroid bombardments; worlds with ruined cities littered with high-tech devices that no longer work (that still perform incomprehensible functions).

But there is another, less obvious, far more important reminder of the Ancients. At some time in their travels, the Grandfather's children (or perhaps Grandfather himself) visited Earth and carried away several thousand near-intelligent cavemen. They must have been useful in some obscure way because these humans were transported to hundreds of worlds.

At the end of the Ancient War, their worlds lay in ruins, but their humans lived on. Each of those planets became a new world which humans conquered and on which they created a unique yet human culture. Today, humans inhabit many of the worlds of Charted Space[3].

The False Dawn (200,000 BC)

There was a point in time, after the Ancients, before the rise of Humaniti, when at least one other intelligent race rose to technological power, reached the stars, and then faded to obscurity.

From an undetermined homeworld somewhere in or near the Third Imperium, these sophonts reached out and settled approximately five thousand worlds (one world in four sectors over a region more than 3000 parsecs in diameter).[4]

Over the next 200,000 years the many worlds of the

---

[1] **Sophont.** An intelligent species. The term covers all intelligent species (including Humans). Alien covers all intelligent species except Humans.

[2] **NAFAL.** Not As Fast As Light. Contrast with FTL Faster Than Light.

[3] **Charted Space.** A small part of one spiral arm of the Galaxy inhabited by humans (and others) and dominated by the Third Imperium.

[4] These distances imply a 10,000 year journey from their homeworld to the farthest settled worlds. The NAFAL drives they used are mentioned (ambiguously) in their myths.

Kursae followed a common path: a downward spiral into a comfortable low tech, where they are today… sharing a common heritage of myths about their past.

The Vilani Era (9200 BC to 2300 AD

The first of the human races to reach many stars was the Vilani. About 9,200 BC, they invented (discovered? stumbled upon?) the Jump Drive: the key to FTL. They kept their technology secret, and used it to create a star-spanning empire. Its 7000 year reign can be divided into three periods:

The Early Empire (about 9200 BC to about 5400 BC). With a monopoly on FTL, the Vilani dominated both human and non-human cultures for dozens of light years around. The Early Empire was a time of expansion and easy domination.

Consolidation (about 5400 BC to about 4400 BC). As other cultures achieved higher tech levels they began to compete with the Vilani, and to resist their domination. The Vilani reaction was a series of Consolidation Wars which forcibly absorbed many worlds into the Empire.

Rigid Culture (about 4400 BC to 2300 AD). With Consolidation complete, Vilani society became a rigid, brittle culture dedicated to maintaining the status quo. Laws, politics, social pressure all emphasized conformity and resistance to change. Innovation and technological change were prohibited. Their four thousand year empire was drawing to an end.

First Contact (2000 to 2100)

In the 21st century, Terrans achieved interplanetary travel and by late century they had established bases throughout the solar system. About 2100, Earth invented the jump drive and reached the stars, only to find them already taken.

The Interstellar Wars (2100 to 2300 AD)

Fortunately for tiny Earth, the vast Vilani Empire ignored the Terran upstarts long enough for them to gain a foothold among the stars. Over the course of 200 years, the Vilani and the Terrans fought a dozen interstellar wars, each one seemingly inconclusive, but each one edging the Vilani Empire closer to collapse. In 2299, the Vilani were defeated so soundly that they surrendered.

The Rule of Man (2300 to 2750 AD)

Terra, with perhaps a hundred worlds in its confederation, now faced the formidable task of ruling, as a conquered territory, the now collapsed Ziru Sirka, with 11,000 worlds. Terra created the Rule of Man: the Second Imperium, to govern the conquered worlds, often assigning mere lieutenants as governors of worlds, and naval captains to rule subsectors of 30-40 worlds.

The valiant effort was doomed from the start. Nothing, not technological innovation, not social change, not new blood, not threat of outside invasion, was sufficient to raise the former Vilani worlds from their cultural lethargy. Over the next 400 years, the worlds of the Rule of Man drifted deeper and deeper into a dark age.

The Long Night (2750 AD to 4550 AD)

When interstellar trade shut down, the Rule of Man collaped as an interstellar government. Each world found itself on its own, living or dying on its own resources. Outpost worlds dependent on food or supplies simply died. Scattered starship trade kept other worlds alive, but after a few centuries, even the starships stopped running. Each world found itself alone in the sea of space, completely dependent on its own resources.

The Third Imperium (4521 AD to 5637 AD)

One world tenuously held on to its technology, its resources, and its knowledge, remaining a beacon of hope throughout the Long Night. Sylea began its own reconquest of the worlds of the former empire under the Starburst Banner of the Third Imperium. From a base of a dozen worlds, the forces of the Third Imperium began a systematic effort to recontact the 10,000 worlds of the old Ziru Sirka and bring them under one rule. Some accepted immediately; others hesitated, but none could resist the combined military might and economic incentives that the Imperium could offer.

The Imperium grew, and prospered. It expanded to rule thousands of worlds and dominate its neighbors, with trade if possible, with force if necessary. The Imperium's persistent expansion made it the central force to be reckoned with. Over the course of a thousand years, the Imperium grew to include most of the former First Imperium, plus other neighboring regions.

Ultimately, the Third Imperium reached its pinnacle of achievement: the Imperial Golden Age (1000 to 1116) of relative peace and great prosperity.

THE IMPORTANT ERAS IN HISTORY

Era	Important Players	typical date	Note
Grandfather's Children	Droyne	300,000 BC	
The False Dawn	Kursae	200,000 BC	
Ziru Sirka	Vilani	1500 AD	
First Contact	Terrans, Vilani	2100 AD	
Interstellar Wars	Terrans, Vilani	2200 AD	
The Rule of Man	Terrans, Vilani	2500 AD	
The Long Night	- -	3500 AD	
Early Imperium	Syleans	4500 AD	4
Aslan Border Wars.	Aslan, Imperial	4800 AD	
Vargr Campaigns	Vargr, Imperial	4850 AD	
The Barracks Emperors	Imperials	5100 AD	
Psionic Suppressions	Imperials, Zhodani	5300 AD	
The Golden Age	Imperial	5600 AD	1
The Rebellion	Imperials	5636 AD	2
Virus Era	-	5640 AD	3
The New Era	-	5700 AD	3
The Far Far Future	-	7500 AD	

This list is not comprehensive.

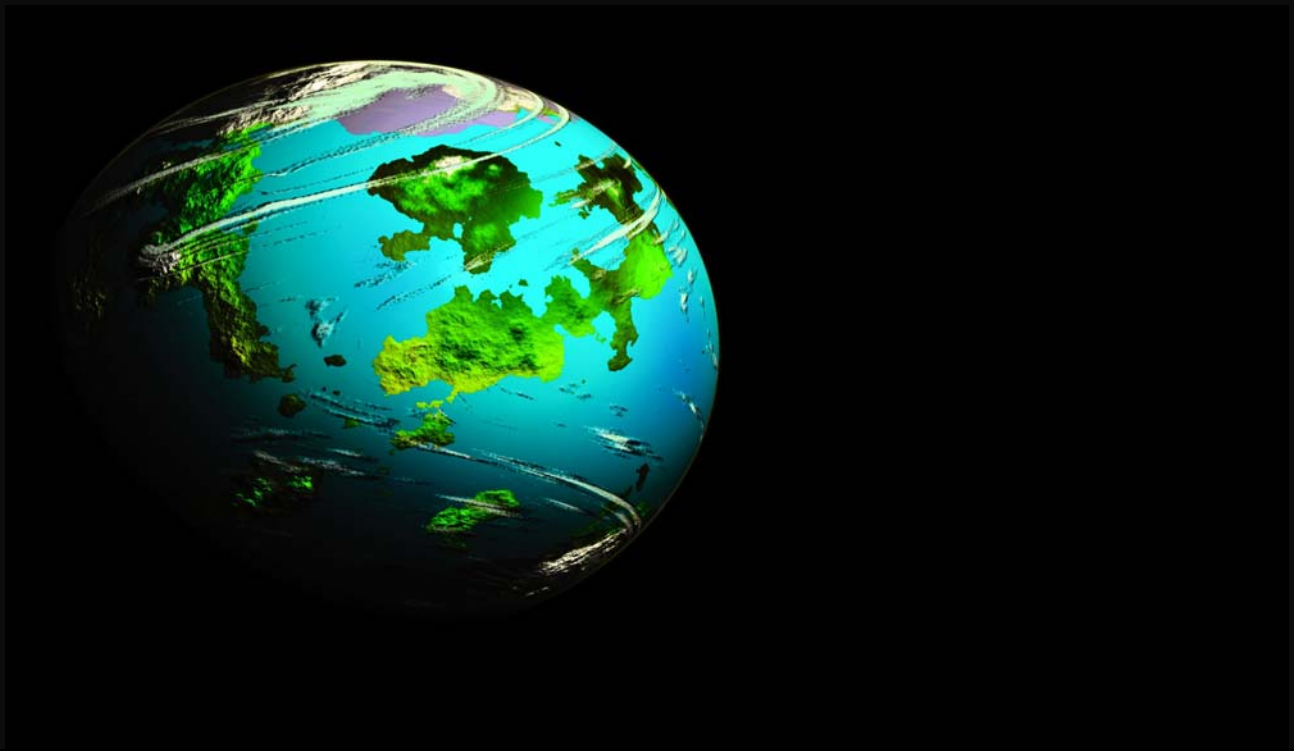
Notes

1. As chronicled in **Classic Traveller.**
2. As chronicled in **MegaTraveller.**
3. As chronicled in **The New Era.**
4. As chronicled in **T4.**

Dates shown are Earth-centric; local dates and calendars may vary.

Important players are the major races which participate and shape events in the era.

How The Universe Works



1 Communication is limited to the speed of transportation.

2 It takes about a week to travel between two neighboring stars.

3 Society is ruled by persons, not laws; honor is of supreme importance.

4 Everything is driven by economics.

5 There is no Prime Directive.

Valuable Benefits for Traders' Guild Members:

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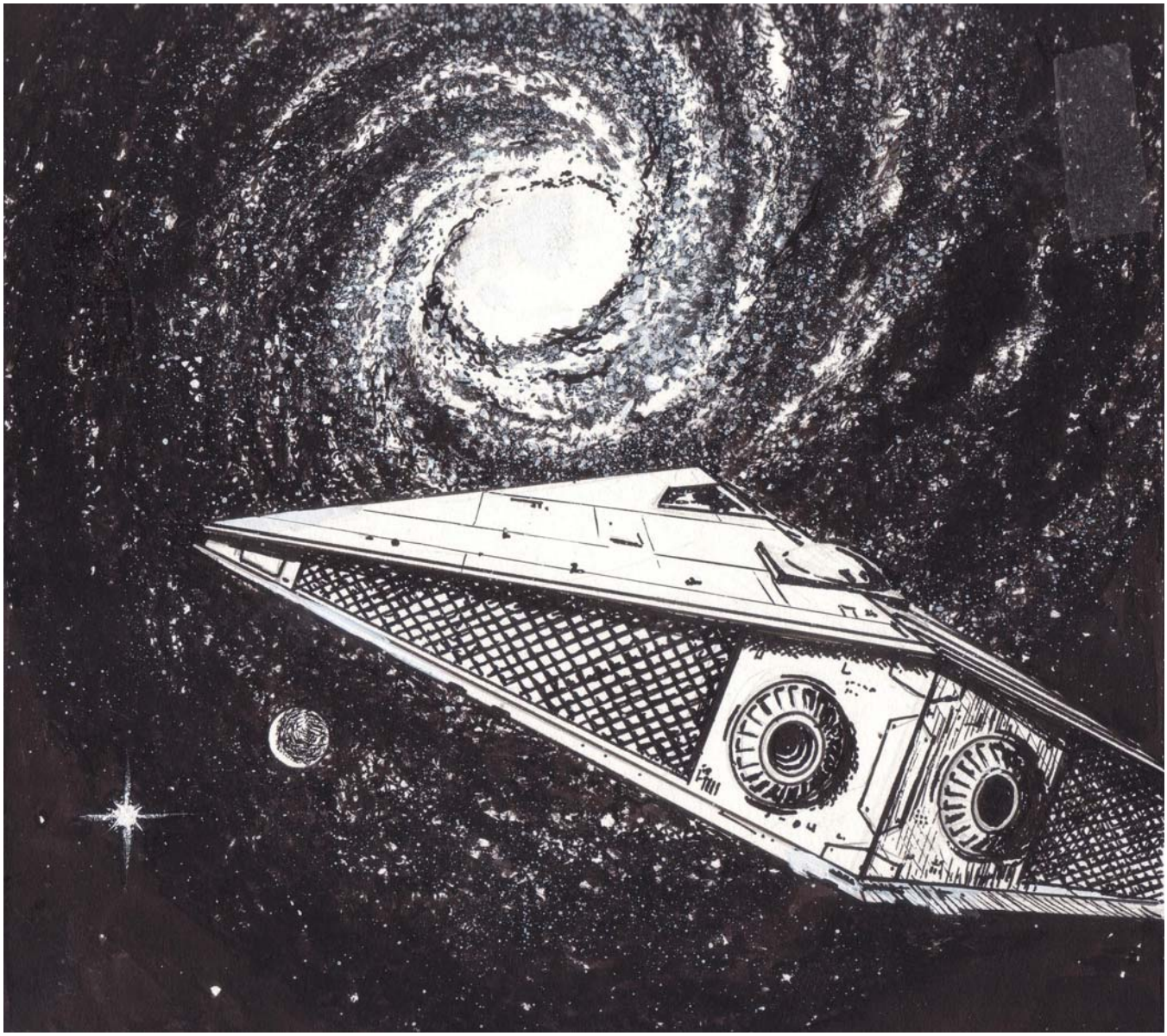
The Foundations of the Traveller Universe

Traveller is a comprehensive science-fiction system spanning a major portion of the galaxy and reaching far into the future and far into the past. Fundamental to the **Traveller** science-fiction game system are answers to myriad questions about life, society, civilization in the universe. Yet everything is part of a cohesive structure that gradually unveils itself… to the participants and to observers (whether they are readers, viewers, or players).

Traveller describes a vast future universe in which mankind has already reached the stars and conquered thousands of worlds, but still faces the never-ending struggle to conquer more worlds and wrest more secrets from the universe.

Based On A Role-Playing Game. The basis for all of **Traveller** is a science-fiction role-playing game which details the fundamental principles of the universe… how people interact, how starships fly, how guns work, how business operates, how worlds are defined. Using those principles, any activity is possible, and players attempt most of them. Over time, the adventures of players and the ideas of writers has helped to create the future **Traveller** universe.



FOUNDED ON BOTH HARD AND SOFT SCIENCE

Traveller is founded on the sciences: technological science and social science. Each adds realism to the system's universe while enhancing its adventure potential.

Technological Science Provides A Foundation

The technological basis for **Traveller** provides a common ground from which all extrapolations and story ideas can spring.

The Jump Drive. The secret of interstellar travel is the jump drive. While in normal space, travel is limited to the speed of light (and it takes years to go from one star to another), jump drive leaps around space: a jump covers one parsec (3.26 light years; the average distance between stars) in about a week. Improved ships can reach speeds of more than 1,000 times the speed of light.

Jump Drive is a foundation that makes interstellar travel easy to accomplish and easy to understand. Behind the future technology is a basic idea that can be conveyed visually or through simple conversations between crewmembers.

Communication Limited To The Speed Of Transportation. The universe is so vast that even the mega-speeds of jump drive can't work miracles. No one has yet (or ever will) invented a hyper-communicator that will send messages faster than light -speed. Communication is limited to the speed of transportation; a message to the edge of the empire needs to be carried there. For an empire 300 parsecs to the border that message takes more than a year to deliver, even under the best of circumstances. News of war, conflict, invasion, disaster, or even peace takes just as long to get back to the center of government.

Consequently the folks governing "out there" have a lot of independence. A war can be over before the news of it reaches the Capital--and orders return--so, Dukes and Archdukes have to act on their own. Commanders of ships (exploring or warring) have a lot of independence as well. The characters have to think on their own--if they work for a merchant company, opening new markets, they can't "phone home" every time negotiations break down--and on the other hand, the company needs to accept all sorts of wacky contracts and situations!

Restricted communication speeds mean that characters at great distance from their bosses are free to act as they wish. Characters without the restrictions of bosses are also thrown on their own initiative.

A Spectrum of Available Technology. Technology is not evenly distributed throughout the universe; instead, world and cultures can be classified by their achieved technology level.

The technology available includes alternatives to traditional or normally expected technology, but radical deviations from "normal" technology are rare and unusual encounters.

Yet primitive technology has its place: backwaters off the main routes are often content with their own levels of technology.

Allowing for different levels of technology permits players many different alternatives in how they approach situations.

Gravity Manipulation. The advance of technology has resulted in practical methods of gravity manipulation. Gravity manipulation expresses itself in four ways: as artificial gravity, as inertial dampers, as lifters, and as maneuver drives. **Artificial gravity** is built into the deck plates of starships; ship environments are similar to planetary surfaces. **Inertial dampers** eliminate the extremes of inertia which can pull and push people and equipment as a ship maneuvers. Although such dampers are imperfect, they do allow a normal environment on starships as they maneuver, and they allow extreme physical maneuvers on small craft as they perform high-G maneuvers. A range of gravity-based drives move ships round in a star system: **Lifters** negate gravity and let ships (and other vehicles) to move more easily near world surfaces. Lifters operate effectively only near large masses. They are ineffective (and aren't really needed anyway) in deep space. Finally, gravitic technology is the foundation for Gravitic Drives, Maneuver Drives, and even NAFAL: the systems that carry ships between worlds in a star system.

Grav Plates, Inertial Compensators, Lifters, and various Drives are included because they make it easier for players to conceptualize the actions of their characters, and because dramatic renderings of actions are realistic if they simply show people standing up.

Fusion Power. Cheap fusion power means that the inhabitants of this universe are not tied to gas stations or complex fuel systems. Hydrogen from water, ice, even the atmospheres of gas giants (like Jupiter) is all that is required to produce abundant electricity. Once a culture rises to the minimum required tech level, its cities depend on electricity produced by efficient, pollution-free fusion power. Starships draw their fuel from the worlds they visit.

Cheap fusion power simplifies adventuring by eliminating the need for routine refuelling on world surfaces. At the same time, the concept allows fueling requirements to be inserted where they add to the adventure situation.

Artificial People. A natural result of technology is the ability to create artificial people: clones, chimeras, synthetics (androids, sophontoids), robots, even raw personalities in computers. Non-anthropomorphic robots (robots not in the shape of people) are common place at the higher technological levels, although they are also effectively invisible… they fade into the background. People-like robots appear at the upper limits of technology and are always imitations; they may be superior in one or more areas, but they all lack a common feature… initiative. Robots are unable to act with clear initiative in unfamiliar situations.

Although robots are possible and present, they are not an overwhelming influence (or they are, if the referee and the players want to interact with them).

Social Science Adds Character And Flavor

The social sciences add their own flavor to the universe and impact many activities. Psychology supports the role and skill of counsellor; psychohistory adds the potential for large-scale manipulations of society; archeology helps understand the relicts of the past; and sophontology helps understand the intelligent beings of society.

A Cosmopolitan Universe. Traveller is a diverse, heterogeneous universe composed of many different factions, concepts, races, communities, and individuals. People (and the term is used to refer to "beings") come in many different forms, all of whom constantly interact as a

matter of course. Unless local circumstances require a homogeneous local population, travellers will continually encounter local populations which reflect diversity in terms of age, gender, and race. Even apparently homogeneous groups will reflect (upon examination) more diversity than expected.

Naturally, there is conflict, antagonism, friction, and strife between various groups, but the universe itself allows any individuals with talent to rise to the top of their field.

Traveller accepts diversity and allows (even requires) a wide variety of beings to interact for their mutual benefit. Such a universe is richer than a purely human environment.

A Human-Dominated Universe. Through a combination of fortuitous accident and strong-willed effort, humanity has reached a position of dominance in the universe. Three distinct groups of humans (the Vilani, the Solomani, and the Zhodani) have each created empires that span thousands of stars and trillions of citizens. In addition, more than a hundred additional human societies are scattered among the stars; each is, in its own way, a commentary on the strengths and the particular weaknesses of the human condition.

Although the universe is cosmopolitan, it is human dominated primarily in order to retain an element of familiarity for the players.

Duty, Honor, and Loyalty. Interstellar society naturally values people (human or not) on whom it can depend: those who are loyal and who faithfully do their duty are the ones to whom society awards responsibility. A natural nobility arises of those leaders of society who faithfully and with innovation follow the orders of their superiors. At the same time, superiors have learned to express their orders in the most general of terms: to give greater freedom of action.

People with responsibilities are expected to act responsibly. If they do not, they won't hold their positions for long.

There Is No "*Prime Directive.*" Interstellar governments have never felt it their duty to impede development, especially economic development. No government has ever promulgated the "*Prime Directive*" (that undeveloped cultures and societies be allowed to develop without interference until they can enter the community of interstellar civilizations). Instead, economic forces have driven the development of those worlds rich in natural or exploitable resources, and have retarded the development of worlds without resources.

Players are not hampered by artificial rules restricting what they can and cannot do.

Everything Is Driven By Economics. Economics is not strictly the study of finance; it is the study of making choices from limited possibilities. Regardless of the pronouncements of political, moral, or cultural leaders, action in this universe takes place because it will produce some economic advantage. Economic advantage generally means rewards in a monetary sense, but it can also mean rewards in political or social power.

But at the foundation of all action is lies some economic motive.

Players can understand what happens in **Traveller** because it is driven by the same elements that drive all human (or sophont) endeavor: economics.

Alternatives To Capitalism. Between worlds, trade is governed by pure economics and by capitalism. Regionally, governments may impose laws (essentially uniform business codes) which allows everyone to interact using the same rules. On some worlds, special economic systems may be adopted by the local governments.

Even alternatives to free market economics are possible.

Wheels Within Wheels. The quest for meaning is always fruitful in the **Traveller** universe. Events, ideas, concepts, and beliefs are shaped by environments, but they are also shaped by the thinkers themselves. And as those thinkers (readers, players, or viewers) learn and mature, they begin to have new insights into their beliefs. For example, the casual player knows the Imperial beliefs about the Zhodani (that they are an evil empire intent on destroying the Imperium). Over time, some players may see these Zhodani as humans with families, goals and desires just like other humans. With time, some players may see some Zhodani as inherently good. And over time is it possible to see that some Zhodani are still evil. In the **Traveller** system, **Wheels within Wheels** constantly shows new ideas and new facets of old ideas to the participants.

Crucial to the **Traveller** adventure concept is the idea that the rationale behind events or situations has a surface explanation, but when examined fully there are often deeper explanations which in turn give a greater understanding of how the universe works.

ADVENTURE!

Above all, this universe is filled with *adventure*. Individuals can own starships and travel on their own to distant worlds. Individuals can undertake literally world-shattering missions whose results depend on their personal courage and resources. Individuals are the key to discovery, progress, and the turning points in history.

The **Traveller** system addresses adventure through three specific areas:

Casual Players

Any role-player can play **Traveller**. The concepts are intuitive: travel, exploration, interaction, negotiation, combat, and all kinds of tasks. Individuals can role-play diverse characters or they can play themselves.

Casual players can be so casual that they know nothing about the game system at all, leaving it to the referee to handle the details.

Detailed Role-Players

Traveller provides dedicated gamers the opportunity to role-play complex characters with strong motivations and intricate backgrounds. The **Traveller** system can be as casual or as rich as the participants want it to be.

Systems Engineers

The **Traveller** system provides referees and game masters the materials with which to explore the **Traveller** universe in

detail. Starship design systems, world generation systems, vehicle description systems, trade and commerce systems, and encounter systems. Each is produced with two specific goals in mind: as a prod to the imagination, and to allow game masters opportunities to create custom equipment or information.

CHARACTERS

The central focus of **Traveller** is its vast array of characters. While every person in this universe of the future is a potential character to be played by a participant, **Traveller** concentrates on the exciting potential of explorers, powerful negotiators, military leaders, and intelligent academics. Each player assumes the alter ego of one or more characters and it is through these characters that the adventures of **Traveller** are played out.

Characters naturally follow a progression as the players behind them grow in knowledge and sophistication.

Money

At the elementary level, characters (and their players) are interested in economic benefits and in the adventures and means that bring them money and equipment.

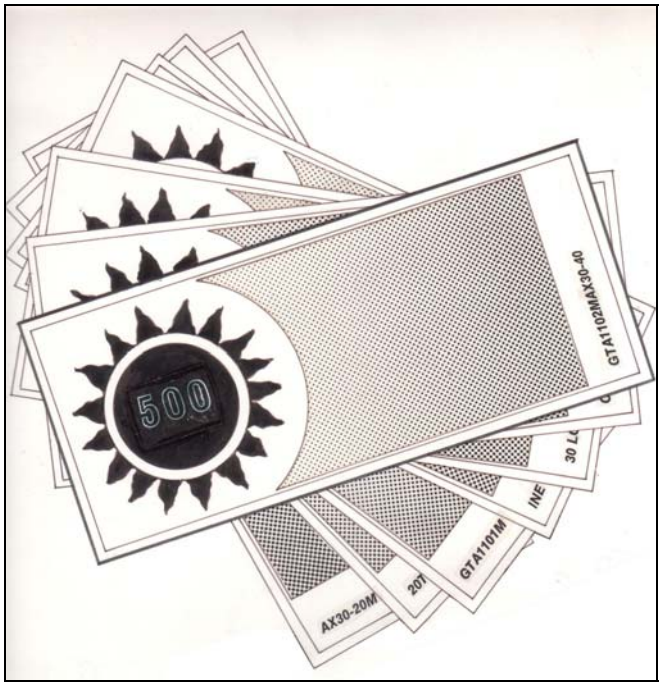
Power

Once a certain level of economic independence is reached and money declines in importance as a personal goal, the individual characters tend to focus on power and the means of achieving power. Power is expressed in many different ways: corporate power, political power, reputation.

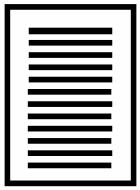
Understanding

Once a certain level of power has been achieved, the individual characters move on to the next step of personal development: understanding the many aspects of the universe that surrounds them. Again, **Traveller** satisfies this goal with its rich, varied universe filled with information and the potential for discovery.

Ultimately, the player behind the character reaches the next level of achievement within the **Traveller** universe: he or she becomes a referee devoted to administering the **Traveller** universe for other players.



Dice Results Are Random But Understandable



Playing **Traveller** is a continuing process of decision making. **Traveller** provides rules for manipulating the universe of the future through a variety of activities: tasks, personal combat, and character generation. Just as people make decisions based on the information they have and then see what happens, players in **Traveller** make decisions based on the game information they have and then see what happens.

To make the results of player decisions unpredictable but understandable, **Traveller** uses dice to produce random numbers, which in turn govern the outcomes of tasks, combat, or character generation. Without die rolls, players could make choices with perfect knowledge of the outcome. Life rarely allows us to know for sure how a choice or an action will turn out. **Traveller** presents situations with many possible outcomes and imposes die rolls to determine the outcome. The rolls may be weighted toward some outcomes more than others, but there's always the chance that something could go wrong. Players make decisions throughout **Traveller**; the die rolls make those decisions interesting.

The **Traveller** game system uses six-sided dice exclusively. This convention in **Traveller** began in the earliest versions of the game as a reaction to the wide variety of dice used in fantasy role-playing game systems. Six-sided dice are easy to find and easy to understand.

Linguistically, the dice is plural; die is singular: one die, two dice, three dice.

In most role-playing, the types of dice used are identified by the letter D followed by the number of sides: D6 indicates a six-sided die; D8 indicates an eight-sided die, D20 indicates a twenty-sided die.

When more than one die is to be rolled, the number of dice is indicated by a number in front of the D: 2D6 is two six-sided dice; 5D20 is five twenty-sided dice.

Only Six Sided Dice

The **Traveller** system, however, uses D6 dice exclusively. Sometimes the system contorts D6 die rolls to achieve even distributions from 1 to 10 or 1 to 9. While purists may object, no one else will mind if you use an available D10 or D20.

Dice Abbreviations and Instructions

The **Traveller** game rules routinely calls for specific and often complex die rolls. In charts especially, these instructions generally take the form 1D, 2D, or Flux.

A capital D indicates that a standard six-sided die is used. The number in front of the die tells how many of these dice to roll, and any addition (or subtraction) after the D indicates how the die roll result is changed.

Typical instructions include:

1D. Roll one die.

2D. Roll two dice (or 8D: Roll 8 Dice)

2D-2. Roll two dice and subtract 2.

2D-7. Roll two dice and subtract 7. This roll may produce negative numbers (the result of this throw is identical in output to Flux and with D-D).

2D+2. Roll two dice and add 2.

D-D (or +D-D). Roll one die, then roll a second die and subtract it from the first. This roll may produce negative numbers (the result of this throw is identical in output with 2D-7 and with D-D).

D/2. Roll on die and divide by 2. The accepted convention is to round in favor of the rolling player.

Flux. Roll one die, then roll a second die and subtract it from the first. This roll may produce negative numbers (the result is identical in output to 2D-7 and with D-D).

(2D +3) x (3D-2). Roll two dice and add three, then roll three dice and subtract two, and then multiply the two together. This one is probably not used very often.

BASIC TERMS

The following basic terms apply to dice:

Dice. The randomizers used in **Traveller** are ordinary six-sided cubic dice marked with sides marked 1 to 6.

Die Roll. The result of rolling the dice.

D. Abbreviation for six-sided dice. Other game systems may use different dice. The convention is a die with 3 sides is D3; a die with 10 sides is D10.

D6. Another abbreviation for six-sided dice. This term is encountered and reiterates that the dice used are six sided.

Roll. An instruction to roll dice. A rare synonym is Throw. For example, Roll 2D. Throw 2D.

Target Number. The number the player is trying to roll. Some uses of dice call for a specific number to be rolled. Others call for a number or less to be rolled. Still others call for a number or greater to be rolled. In each case, focus is on a Target Number.

Modifier. Mod. Instructions may call for modifiers which increase or decrease the target number. As compared to a DM which alters the actual Die Roll. Mods are primarily used with Target Numbers.

DM. Die Modifier. Dice Modifier. Instructions may call for Die Modifiers for an event, such as DM +1 or DM -3. A DM changes the roll of the dice before it is compared to the target number, as opposed to a Mod which changes the target number itself. DMs are primarily used on Tables.

Throw: An instruction to roll dice. A synonym is Roll.

Mods Versus DMs

It is important to understand the difference between Mods and DMs.

A **Mod** is an Asset and a component of the Target Number.

A **DM** is a change to the Die Roll and is applied to the dice after they are rolled.

For example, the typical **Traveller** usage is Roll Low. The situation defines some Target which is the number (or less) that the player is trying to roll.

MOD VS DM (Roll Low)

Mod +	Increases Target	=More Success
DM -	Decreases Die	
Mod -	Decreases Target	=Less Success
DM +	Increases Die	

A **Mod** changes the Target Number. Mod+3 increases the Target Number by three and makes it easier to roll lower than the Target; positive Mods are beneficial. Mod-2 decreases the Target Number by two and makes it harder to roll lower than the Target; negative Mods are detrimental.

A **DM** changes the die roll. DM +3 increases the Die Roll by three and makes it harder to roll lower than the Target; positive DMs are detrimental. DM-2 decreases the Die Roll by two and makes it easier to roll lower than the Target; negative DMs are beneficial.

BE PREPARED

The referee and each player should have a pool of dice:

Ten Six-Sided White Dice. These dice are used for standard rolls. Actually, any of the dice shown here can be used for standard rolls.

Two Contrasting Flux Dice. Two dice of contrasting colors are used as Flux Dice. The lighter colored die is always positive; the darker colored die is negative.

Even Distribution
From 1 to 9

	1	2	3	4	5	6
1	1	2	3	1	2	3
2	4	5	6	4	5	6
3	7	8	9	7	8	9
4	1	2	3	1	2	3
5	4	5	6	4	5	6
6	7	8	9	7	8	9

This table produces an equal chance of achieving the digits 1 through 9.

Even Distribution
From 0 to 9 (or 1 to 10).

	1	2	3	4	5	6
1	0	0	0	1	1	1
2	2	2	2	3	3	3
3	4	4	4	5	5	5
4	6	6	6	7	7	7
5	8	8	8	9	9	9
6	rr	rr	rr	rr	rr	rr

This table produces the digits 0 through 9 equally.
rr= reroll.

Randomly Selected C1 C2 C3 C4 C5 C6

1D	Char	1	2	3	4	5	6
1	C1			Strength			
2	C2	Agility		Dexterity		Grace	
3	C3	Stamina		Endurance		Vigor	
4	C4			Intelligence			
5	C5	Training		Education		Instinct	
6	C6	Charisma		Social		Caste	

If not all Characteristics are in the desired mix, ignore inappropriate results and reroll.

Special Throws

2D Roll	Roll%	D+D	Flux D-D	Flux* 2D-7	2D-2	
2	3%	2	-5	-5	0	
3	6%	3	-4	-4	1	
4	8%	4	-3	-3	2	
5	11%	5	-2	-2	3	
6	14%	6	-1	-1	4	
7	17%	7	0	0	5	
8	14%	8	+1	+1	6	
9	11%	9	+2	+2	7	
10	8%	10	+3	+3	8	
11	6%	11	+4	+4	4	9
12	3%	12	+5	+5	5	10

* Alternate Calculation Method.

EVEN DISTRIBUTIONS

Even Distributions use six-sided dice to produce a range of numbers beyond 1 to 6 (specifically 1-9, or 0-9 or 1-10).

Even Distribution 1 to 9. Consult the Even Distribution From 1 to 9 Table.

This table is most commonly used in creating the Population Multiplier associated with the population exponent of worlds. Because the population multiplier modifies the exponent, a result of 0 or 10 is not applicable.

Even Distribution 0 to 9. Consult the Even Distribution From 0 to 9 Table.

Even distribution between 0 and 9 creates the equivalent of a decimal die (D10). If the desired result is 1 through 10, substitute 10 for 0.

RANDOMLY SELECTED CHARACTERISTICS

There is sometimes (particularly in wounding or damage) a need to select specific characteristics for characters.

Randomly <u>Selected</u> Characteristic. A range of characteristics is stated (usually in Damage as a result of Fighting or a Mishap). Roll 1D= the result is the position code for the selected characteristic.

For example, to randomly select from C1 C2 C3, roll 1D (= 3 selects Characteristic C3). If the die roll does not match a characteristic in the range, reroll.

Randomly <u>Determined</u> Characteristic. A characteristic must be selected (often without regard to those available). Roll 1D for the appropriate column, followed by 1D for the row. For example, rolling 3 and 2 = Stamina.

SPECIAL THROWS

The **Special Throws Tables** show several different combinations of dice and their results.

D +D. *The standard two dice throw.* The range is 2 through 12 centered on 7. This is a variant description of 2D.

+**D -D***. Roll the white die and the black die.* Subtract the black die from the white die. The results range from -5 to +5 centered on 0 (in fact, 0 is most frequent: 6 out of 36 times, or about 17%). This roll is called **Flux**.

2D-7. *Roll two dice and subtract 7.* The range and probabilities are the same as +D -D, but they are achieved somewhat differently.

Although this throw is statistically equivalent to +D -D (and to Flux) it omits the drama.

2D-2. *Roll two dice and subtract 2.* The results range from 0 to 10 centered on 5 (5 is most frequent: 6 out of 36 times).

THE DICE TABLES

The dice tables in **Traveller** are provided as a reference for both players and game masters.

The Reference Tables. The reference tables show the results of throwing one die through ten dice. These dice correspond roughly to the levels of task difficulty:

1D	Easy
2D	Average
+D - D	Flux
3D	Difficult
4D	Formidable
5D	Staggering
6D	Hopeless
7D	Impossible
8D	Beyond Impossible
9D	Hasty Beyond Impossible
10D	Extra Hasty Beyond Impossible, and
varies	C+S

Walking Through The Tables

Look at the dice tables**,** and examine the entries.

Title shows the number of dice being rolled.

Roll: The actual numerical die roll result.

N: The number of times the roll occurs if all possible rolls are each made once. N indicates the number of ways that the die roll can be achieved (for example, on the Two Dice table, a 2D roll of 11 can be achieved two different ways (5 and 6 or 6 and 5).

%**N (Percent N):** The percentage chance that the specific roll will be made.

N- (N Minus). The number of times that the roll **or less** occurs. N- indicates the number of ways the die roll or less can be achieved. For example, in the Two Dice table, a 2D roll of 3 - (three or less) can be achieved three different ways (1 and 2, or 2 and 1, or 1 and 1).

%N- (Percent N Minus). The percentage chance that the specific roll **or less** will be made. This is the percentage chance (on any one throw) that the result will be the roll stated on this line or less. The chance of rolling 7 or less on two dice is 58%.

N+ (N Plus). The number of times that the roll **or more** occurs. N+ indicates the number of ways the die roll or greater can be achieved. For example, in the Two Dice table, a 2D roll of 3 + (three or more) can be achieved 35 different ways (every possible roll except 1 and 1).

%N+ (Percent N Plus). The percentage chance that the specific roll **or less** will be made. Percent N Plus is the percentage chance (on any one throw) that the result will be the roll stated on this line or more. The chance of rolling 3 or more on two dice is 97%.

The C+S Table (Chance Of Success)

Tasks call for die rolls equal to or less than a number which is created by adding a characteristic (also ranging from 1 to 15 or so) and a skill level (ranging from 1 to 15 or so). If the die roll is equal or less than this C + S (Characteristic Plus Skill), the attempt at the task succeeds.

The **Chance of Success Table** shows the percentage chance that such a task will succeed. For example, if a character with Skill-2 and Characteristic-2 (S+C=4) attempts a task, using 2D, he has a 17% chance of succeeding.

Why Is This Chapter Necessary?

Dice and their ability to create random numbers are at the core of this (and most) role-playing games. In the dawn of role-playing game systems, the types of dice were specified, and a variety of rolls were used in the course of the game.

As role-playing games matured, the role-playing media published a variety of articles analyzing the outcomes of various dice mechanics and addressing how they translated into probabilities. Both players and referees who read those articles found that a better understanding led to a better playing experience. That alone should be enough to justify this chapter, but there's more.

This edition of **Traveller** introduces a variety of new dice mechanics and formalizes several older ones. Prior editions often introduced mechanics in the middle of rules discussions, or simply left it to the referee to define a mechanic (for example, to select one thing from a group, or to select a number from 1 to 10). This chapter brings all dice mechanics into one chapter, defines them, and then discusses them in terms of probabilities.

The **C+S Chart** gives any player an indication, in percentage probability terms, of the likelihood of success for specific tasks. He isn't required to guess about potential success, and he isn't required to make detailed calculations.

The **Dice Charts** give similar information about rolling one die, or ten dice, or any number in between. The tables show that there is a chance of rolling 10 on 10D, but at 60,466,176 to 1, it is probably better to spend any possible good luck involved on the lottery than on a single role-playing die roll.

An understanding of the dice mechanics in **Traveller** creates better players more capable of using the nuances of the game system to their advantage. That same understanding creates better referees more capable of presenting interesting and challenging situations to the players.

Dice

The Dice Charts reflect the statistical details of dice rolls. Using these charts, any player or referee can understand the probability that any specific dice roll will succeed.

Dice-1

1D ONE DIE (6^1 = 6 outcomes; range 1-6)

Roll	N	N%	N -	N -%	N+	N+%
0	0	no	0	no	6	100%
1	1	17%	1	17%	6	100%
2	1	17%	2	33%	5	83%
3	1	17%	3	50%	4	67%
4	1	17%	4	67%	3	50%
5	1	17%	5	83%	2	33%
6	1	17%	6	100%	1	17%
7	0	no	6	100%	0	no

There are 6 possible outcomes ranging from 1 to 6.
Outcomes are equally possible; the average is 3.5 (3 or 4).

2D TWO DICE (6^2 = 36 outcomes; range 2-12)

Roll	N	N%	N -	N -%	N+	N+%
1	0	no	0	no	36	100%
2	1	3%	1	3%	36	100%
3	2	6%	3	8%	35	97%
4	3	8%	6	17%	33	92%
5	4	11%	10	28%	30	83%
6	5	14%	15	42%	26	72%
7	6	17%	21	58%	21	58%
8	5	14%	26	72%	15	42%
9	4	11%	30	83%	10	28%
10	3	8%	33	92%	6	17%
11	2	6%	35	97%	3	8%
12	1	3%	36	100%	1	3%
13	0	no	36	100%	0	no

There are 36 possible outcomes ranging from 2 to 12.
The most probable roll is 7 (17%).

3D THREE DICE (6^3 = 216 outcomes; range 3-18)

Roll	N	N%	N -	N -%	N+	N+%
1	0	no	0	100%	216	100%
2	0	no	0	100%	216	100%
3	1	<1%	1	<1%	216	100%
4	3	1%	4	2%	215	>99%
5	6	3%	10	5%	212	98%
6	10	5%	20	9%	206	95%
7	15	7%	35	16%	196	91%
8	21	10%	56	26%	181	84%
9	25	12%	81	38%	160	74%
10	27	13%	108	50%	135	63%
11	27	13%	135	63%	108	50%
12	25	12%	160	74%	81	38%
13	21	10%	181	84%	56	26%
14	15	7%	196	91%	35	16%
15	10	5%	206	95%	20	9%
16	6	3%	212	98%	10	5%
17	3	1%	215	>99%	4	2%
18	1	<1%	216	100%	1	<1%
19	0	no	216	no	0	no

There are 216 possible outcomes ranging from 3 to 18.
The most probable roll is 10 or 11 (equally at 13% each).

4D FOUR DICE (6^4 = 1296 outcomes; range 4 - 24)

Roll	N	N%	N -	N -%	N+	N+%
0	0	no	0	no	1296	100%
1	0	no	0	no	1296	100%
2	0	no	0	no	1296	100%
3	0	no	0	no	1296	100%
4	1	<1%	1	<1%	1296	100%
5	4	<1%	5	<1%	1295	>99%
6	10	<1%	15	1%	1291	>99%
7	20	2%	35	3%	1281	99%
8	35	3%	70	5%	1261	97%
9	56	4%	126	10%	1226	95%
10	80	6%	206	16%	1170	90%
11	104	8%	310	24%	1090	84%
12	125	10%	435	34%	986	76%
13	140	11%	575	44%	861	66%
14	146	11%	721	56%	721	56%
15	140	11%	861	66%	575	44%
16	125	10%	986	76%	435	34%
17	104	8%	1090	84%	310	24%
18	80	6%	1170	90%	206	16%
19	56	4%	1226	95%	126	10%
20	35	3%	1261	97%	70	5%
21	20	2%	1281	99%	35	3%
22	10	<1%	1291	>99%	15	1%
23	4	<1%	1295	>99%	5	<1%
24	1	<1%	1296	100%	1	<1%
25	0	no	1296	100%	0	no
26	0	no	1296	100%	0	no
27	0	no	1296	100%	0	no

There are 1296 possible outcomes ranging from 4 to 24.
The most probable roll is 14 (11.3%).

FLUX TWO DICE -7 (6^2 = 36 outcomes; - 5 to +5)

Roll	N	N%	N -	N -%	N+	N+%
- 6	0	no	0	no	36	100%
- 5	1	3%	1	3%	36	100%
-4	2	6%	3	8%	35	97%
-3	3	8%	6	17%	33	92%
-2	4	11%	10	28%	30	83%
-1	5	14%	15	42%	26	72%
0	6	17%	21	58%	21	58%
+1	5	14%	26	72%	15	42%
+2	4	11%	30	83%	10	28%
+3	3	8%	33	92%	6	17%
+4	2	6%	35	97%	3	8%
+5	1	3%	36	100%	1	3%
+6	0	no	36	100%	0	no

There are 36 possible outcomes ranging from – 5 to +5.
The most probable roll is 0 (17%).

Flux introduces additional variation into dice rolls. It offers the opportunity for an additional modification up to 5 points in the player's favor, but at the risk of receiving instead up to 5 points negatively.

Dice

The Dice Charts reflect the statistical details of dice rolls. Using these charts, any player or referee can understand the probability that any specific dice roll will succeed.

5D FIVE DICE (6^5 = 7776 outcomes; range 5 - 30)

Roll	N	N%	N -	N -%	N+	N+%
0	0	no	0	no	7776	100%
1	0	no	0	no	7776	100%
2	0	no	0	no	7776	100%
3	0	no	0	no	7776	100%
4	0	no	0	no	7776	100%
5	1	<1%	1	<1%	7776	100%
6	5	<1%	6	<1%	7775	>99%
7	15	<1%	21	<1%	7770	>99%
8	35	<1%	56	<1%	7755	>99%
9	70	<1%	126	2%	7720	>99%
10	126	2%	252	3%	7650	98%
11	205	3%	457	6%	7524	97%
12	305	4%	762	10%	7319	94%
13	420	5%	1182	15%	7014	90%
14	540	7%	1722	22%	6594	85%
15	651	8%	2373	31%	6054	78%
16	735	9%	3108	40%	5403	69%
17	780	10%	3888	50%	4668	60%
18	780	10%	4668	60%	3888	50%
19	735	9%	5403	69%	3108	40%
20	651	8%	6054	78%	2373	31%
21	540	7%	6594	85%	1722	22%
22	420	5%	7014	90%	1182	15%
23	305	4%	7319	94%	762	10%
24	205	3%	7524	97%	457	6%
25	126	2%	7650	98%	252	3%
26	70	<1%	7720	>99%	126	2%
27	35	<1%	7755	>99%	56	<1%
28	15	<1%	7770	>99%	21	<1%
29	5	<1%	7775	>99%	6	<1%
30	1	<1%	7776	100%	1	<1%
31	0	no	7776	100%	0	no
32	0	no	7776	100%	0	no
33	0	no	7776	100%	0	no
34	0	no	7776	100%	0	no
35	0	no	7776	100%	0	no
36	0	no	7776	100%	0	no
37	0	no	7776	100%	0	no

There are 7776 possible outcomes ranging from 5 to 30.
The most probable roll is 17 or 18 (equally at 10% each).

6D SIX DICE (6^6 = 46,656 outcomes; range 6 - 36)

Roll	N	N%	N -	N -%	N+	N+%
0	0	<1%	0	no	46656	100%
1	0	<1%	0	no	46656	100%
2	0	<1%	0	no	46656	100%
3	0	<1%	0	no	46656	100%
4	0	<1%	0	no	46656	100%
5	0	<1%	0	no	46656	100%
6	1	<1%	1	<1%	46656	100%
7	6	<1%	7	<1%	46655	>99%
8	21	<1%	28	<1%	46649	>99%
9	56	<1%	84	<1%	46628	>99%
10	126	<1%	210	<1%	46572	>99%
11	252	<1%	462	<1%	46446	>99%
12	456	<1%	918	2%	46194	>99%
13	756	2%	1674	4%	45738	98%
14	1161	2%	2835	6%	44982	96%
15	1666	4%	4501	10%	43821	94%
16	2247	5%	6748	14%	42155	90%
17	2856	6%	9604	21%	39908	86%
18	3431	7%	13035	28%	37052	79%
19	3906	8%	16941	36%	33621	72%
20	4221	9%	21162	45%	29715	64%
21	4332	9%	25494	55%	25494	55%
22	4221	9%	29715	64%	21162	45%
23	3906	8%	33621	72%	16941	36%
24	3431	7%	37052	79%	13035	28%
25	2856	6%	39908	86%	9604	21%
26	2247	5%	42155	90%	6748	14%
27	1666	4%	43821	94%	4501	10%
28	1161	2%	44982	96%	2835	6%
29	756	2%	45738	98%	1674	4%
30	456	<1%	46194	>99%	918	2%
31	252	<1%	46446	>99%	462	<1%
32	126	<1%	46572	>99%	210	<1%
33	56	<1%	46628	>99%	84	<1%
34	21	<1%	46649	>99%	28	<1%
35	6	<1%	46655	>99%	7	<1%
36	1	<1%	46656	100%	1	<1%
37	0	no	46656	100%	0	no

There are 46,656 possible outcomes ranging from 6 to 36.
The most probable roll is 21 (9.3%).

READING THE DICE CHARTS

The Dice Charts show the possible outcomes of dice from 1D (a single six-sided die) to 10D (ten six-sided dice). These charts are not used directly in the course of play; instead, a player or referee can consult the charts to determine the likelihood of specific outcomes. For example, if rolling two six-sided dice, the 2D Chart shows: 36 possible outcomes ranging from 2 to 12; a 7 is possible 6 (N=6) out of 36 times, or 17% (N%= 17%); a 4 or less is possible 6 (N- = 6) out of 36 outcomes.

Results are rounded to even percent except at the ends of the scales.

<1%. The result has a probability of less than 1%. There is less than one chance in 100 that this result will occur.

>99%. The result has a probability of greater than 99%. There is less than one chance in 100 that this result will not occur.

N. The number of times the die roll result will occur in all possible outcomes.

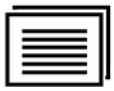
N%. The percentage chance of this die roll result occurring. Calculated as N / Outcomes.

N- (N minus). The number of times this die roll or less result will occur in all possible outcomes.

N-%. The percentage chance of this die roll result or less occurring. Calculated as N- / Outcomes.

N+ (N plus). The number of times this die roll result or more will occur in all possible outcomes.

N+%. The percentage chance of this die roll result or more occurring. Calculated as N+ / Outcomes.



Dice

The Dice Charts reflect the statistical details of dice rolls. Using these charts, any player or referee can understand the probability that any specific dice roll will succeed.

Dice-3

7D SEVEN DICE (6^7 = 279,936 outcomes; 7 - 42)

Roll	N	N%	N -	N -%	N+	N+%
0	0	<1%	0	no	279936	100%
1	0	<1%	0	no	279936	100%
2	0	<1%	0	no	279936	100%
3	0	<1%	0	no	279936	100%
4	0	<1%	0	no	279936	100%
5	0	<1%	0	no	279936	100%
6	0	<1%	0	no	279936	100%
7	1	<1%	1	<1%	279936	100%
8	7	<1%	8	<1%	279935	>99%
9	28	<1%	36	<1%	279928	>99%
10	84	<1%	120	<1%	279900	>99%
11	210	<1%	330	<1%	279816	>99%
12	462	<1%	792	<1%	279606	>99%
13	917	<1%	1709	<1%	279144	>99%
14	1667	<1%	3376	1%	278227	>99%
15	2807	1%	6183	2%	276560	99%
16	4417	2%	10600	4%	273753	98%
17	6538	2%	17138	6%	269336	96%
18	9142	3%	26280	9%	262798	94%
19	12117	4%	38397	14%	253656	91%
20	15267	5%	53664	19%	241539	86%
21	18327	7%	71991	26%	226272	81%
22	20993	7%	92984	33%	207945	74%
23	22967	8%	115951	41%	186952	67%
24	24017	9%	139968	50%	163985	59%
25	24017	9%	163985	59%	139968	50%
26	22967	8%	186952	67%	115951	41%
27	20993	7%	207945	74%	92984	33%
28	18327	7%	226272	81%	71991	26%
29	15267	5%	241539	86%	53664	19%
30	12117	4%	253656	91%	38397	14%
31	9142	3%	262798	94%	26280	9%
32	6538	2%	269336	96%	17138	6%
33	4417	2%	273753	98%	10600	4%
34	2807	1%	276560	99%	6183	2%
35	1667	<1%	278227	>99%	3376	1%
36	917	<1%	279144	>99%	1709	<1%
37	462	<1%	279606	>99%	792	<1%
38	210	<1%	279816	>99%	330	<1%
39	84	<1%	279900	>99%	120	<1%
40	28	<1%	279928	>99%	36	<1%
41	7	<1%	279935	>99%	8	<1%
42	1	<1%	279936	100%	1	<1%
43	0	no	279936	100%	0	no
44	0	no	279936	100%	0	no
45	0	no	279936	100%	0	no
46	0	no	279936	100%	0	no
47	0	no	279936	100%	0	no
48	0	no	279936	100%	0	no
49	0	no	279936	100%	0	no

There are 279,936 possible outcomes ranging from 7 to 42. The most probable roll is 24 or 25 (equally at 9% each).

8D EIGHT DICE (6^8 = 1,679,616 outcomes; 8 - 48)

Roll	N	N%	N -	N -%	N+	N+%
0	0	no	0	no	1679616	100%
1	0	no	0	no	1679616	100%
2	0	no	0	no	1679616	100%
3	0	no	0	no	1679616	100%
4	0	no	0	no	1679616	100%
5	0	no	0	no	1679616	100%
6	0	no	0	no	1679616	100%
7	0	no	0	no	1679616	100%
8	1	<1%	1	<1%	1679616	100%
9	8	<1%	9	<1%	1679615	>99%
10	36	<1%	45	<1%	1679607	>99%
11	120	<1%	165	<1%	1679571	>99%
12	330	<1%	495	<1%	1679451	>99%
13	792	<1%	1287	<1%	1679121	>99%
14	1708	<1%	2995	<1%	1678329	>99%
15	3368	<1%	6363	<1%	1676621	>99%
16	6147	<1%	12510	<1%	1673253	>99%
17	10480	1%	22990	1%	1667106	>99%
18	16808	1%	39798	2%	1656626	99%
19	25488	2%	65286	4%	1639818	98%
20	36688	2%	101974	6%	1614330	96%
21	50288	3%	152262	9%	1577642	94%
22	65808	4%	218070	13%	1527354	91%
23	82384	5%	300454	18%	1461546	87%
24	98813	6%	399267	24%	1379162	82%
25	113688	7%	512955	31%	1280349	76%
26	125588	7%	638543	38%	1166661	69%
27	133288	8%	771831	46%	1041073	62%
28	135954	8%	907785	54%	907785	54%
29	133288	8%	1041073	62%	771831	46%
30	125588	7%	1166661	69%	638543	38%
31	113688	7%	1280349	76%	512955	31%
32	98813	6%	1379162	82%	399267	24%
33	82384	5%	1461546	87%	300454	18%
34	65808	4%	1527354	91%	218070	13%
35	50288	3%	1577642	94%	152262	9%
36	36688	2%	1614330	96%	101974	6%
37	25488	2%	1639818	98%	65286	4%
38	16808	1%	1656626	99%	39798	2%
39	10480	<1%	1667106	>99%	22990	1%
40	6147	<1%	1673253	>99%	12510	<1%
41	3368	<1%	1676621	>99%	6363	<1%
42	1708	<1%	1678329	>99%	2995	<1%
43	792	<1%	1679121	>99%	1287	<1%
44	330	<1%	1679451	>99%	495	<1%
45	120	<1%	1679571	>99%	165	<1%
46	36	<1%	1679607	>99%	45	<1%
47	8	<1%	1679615	>99%	9	<1%
48	1	<1%	1679616	100%	1	<1%
49	0	<1%	1679616	100%	0	no

There are 1,679,616 possible outcomes ranging from 8 to 48. The most probable roll is 28 (8%).

Dice

The Dice Charts reflect the statistical details of dice rolls. Using these charts, any player or referee can understand the probability that any specific dice roll will succeed.

Dice-4

9D NINE DICE (6^9 = 10,077,696; range 9 - 56)

Roll	N	N%	N -	N -%	N+	N+%
8	0	no	0	no	10077696	100%
9	1	no	1	no	10077696	100%
10	9	no	10	no	10077695	100%
11	45	no	55	no	10077686	100%
12	165	no	220	no	10077641	100%
13	495	no	715	no	10077476	100%
14	1287	no	2002	no	10076981	100%
15	2994	no	4996	no	10075694	100%
16	6354	no	11350	no	10072700	100%
17	12465	no	23815	no	10066346	100%
18	22825	no	46640	no	10053881	100%
19	39303	no	85943	1%	10031056	100%
20	63999	1%	149942	1%	9991753	99%
21	98979	1%	248921	2%	9927754	99%
22	145899	1%	394820	4%	9828775	98%
23	205560	2%	600380	6%	9682876	96%
24	277464	3%	877844	9%	9477316	94%
25	359469	4%	1237313	12%	9199852	91%
26	447669	4%	1684982	17%	8840383	88%
27	536569	5%	2221551	22%	8392714	83%
28	619569	6%	2841120	28%	7856145	78%
29	689715	7%	3530835	35%	7236576	72%
30	740619	7%	4271454	42%	6546861	65%
31	767394	8%	5038848	50%	5806242	58%
32	767394	8%	5806242	58%	5038848	50%
33	740619	7%	6546861	65%	4271454	42%
34	689715	7%	7236576	72%	3530835	35%
35	619569	6%	7856145	78%	2841120	28%
36	536569	5%	8392714	83%	2221551	22%
37	447669	4%	8840383	88%	1684982	17%
38	359469	4%	9199852	91%	1237313	12%
39	277464	3%	9477316	94%	877844	9%
40	205560	2%	9682876	96%	600380	6%
41	145899	1%	9828775	98%	394820	4%
42	98979	1%	9927754	99%	248921	2%
43	63999	1%	9991753	99%	149942	1%
44	39303	no	10031056	100%	85943	1%
45	22825	no	10053881	100%	46640	no
46	12465	no	10066346	100%	23815	no
47	6354	no	10072700	100%	11350	no
48	2994	no	10075694	100%	4996	no
49	1287	no	10076981	100%	2002	no
50	495	no	10077476	100%	715	no
51	165	no	10077641	100%	220	no
52	45	no	10077686	100%	55	no
53	9	no	10077695	100%	10	no
54	1	no	10077696	100%	1	no
55	0	no	10077696	100%	0	no

There are 10,077,696 possible outcomes ranging from 9 to 54. The most probable roll is 31 or 32 (equally probable at 8% each).

10D TEN DICE (6^10 = 60,466,176; range 10 – 60)

Roll	N	N%	N -	N -%	N+	N+%
9	0	no	0	no	60466176	100%
10	1	no	1	no	60466176	100%
11	10	no	11	no	60466175	100%
12	55	no	66	no	60466165	100%
13	220	no	286	no	60466110	100%
14	715	no	1001	no	60465890	100%
15	2002	no	3003	no	60465175	100%
16	4995	no	7998	no	60463173	100%
17	11340	no	19338	no	60458178	100%
18	23760	no	43098	no	60446838	100%
19	46420	no	89518	no	60423078	100%
20	85228	no	174746	no	60376658	100%
21	147940	no	322686	1%	60291430	100%
22	243925	no	566611	1%	60143490	99%
23	383470	1%	950081	2%	59899565	99%
24	576565	1%	1526646	3%	59516095	98%
25	831204	1%	2357850	4%	58939530	97%
26	1151370	2%	3509220	6%	58108326	96%
27	1535040	3%	5044260	8%	56956956	94%
28	1972630	3%	7016890	12%	55421916	92%
29	2446300	4%	9463190	16%	53449286	88%
30	2930455	5%	12393645	20%	51002986	84%
31	3393610	6%	15787255	26%	48072531	80%
32	3801535	6%	19588790	32%	44678921	74%
33	4121260	7%	23710050	39%	40877386	68%
34	4325310	7%	28035360	46%	36756126	61%
35	4395456	7%	32430816	54%	32430816	54%
36	4325310	7%	36756126	61%	28035360	46%
37	4121260	7%	40877386	68%	23710050	39%
38	3801535	6%	44678921	74%	19588790	32%
39	3393610	6%	48072531	80%	15787255	26%
40	2930455	5%	51002986	84%	12393645	20%
41	2446300	4%	53449286	88%	9463190	16%
42	1972630	3%	55421916	92%	7016890	12%
43	1535040	3%	56956956	94%	5044260	8%
44	1151370	2%	58108326	96%	3509220	6%
45	831204	1%	58939530	97%	2357850	4%
46	576565	1%	59516095	98%	1526646	3%
47	383470	1%	59899565	99%	950081	2%
48	243925	no	60143490	99%	566611	1%
49	147940	no	60291430	100%	322686	1%
50	85228	no	60376658	100%	174746	no
51	46420	no	60423078	100%	89518	no
52	23760	no	60446838	100%	43098	no
53	11340	no	60458178	100%	19338	no
54	4995	no	60463173	100%	7998	no
55	2002	no	60465175	100%	3003	no
56	715	no	60465890	100%	1001	no
57	220	no	60466110	100%	286	no
58	55	no	60466165	100%	66	no
59	10	no	60466175	100%	11	no
60	1	no	60466176	100%	1	no
61	0	no	60466176	100%	0	no

There are 60,466,176 possible outcomes ranging from 10 to 60. The most probable roll is 35 (7%)..

Dice

The Dice Charts reflect the statistical details of dice rolls. Using these charts, any player or referee can understand the probability that any specific dice roll will succeed.

C+S ONE THROUGH EIGHT DICE

Hasty	-	-	EAS	AVE	DIF	FOR	STA	HOP	IMP
Cautious	EAS	AVE	DIF	FOR	STA	HOP	IMP	BEY	-
Task	-	EAS	AVE	DIF	FOR	STA	HOP	IMP	BEY
C+S	0D	1D	2D	3D	4D	5D	6D	7D	8D
0	100%	no	no	no	no	no	no	no	no
1	100%	17%	no	no	no	no	no	no	no
2	100%	33%	3%	no	no	no	no	no	no
3	100%	50%	8%	<1%	no	no	no	no	no
4	100%	67%	17%	2%	<1%	no	no	no	no
5	100%	83%	28%	5%	<1%	<1%	no	no	no
6	100%	100%	42%	9%	1%	<1%	<1%	no	no
7	100%	100%	58%	16%	3%	<1%	<1%	<1%	no
8	100%	100%	72%	26%	5%	<1%	<1%	<1%	<1%
9	100%	100%	83%	38%	10%	2%	<1%	<1%	<1%
10	100%	100%	92%	50%	16%	3%	<1%	<1%	<1%
11	100%	100%	97%	63%	24%	6%	<1%	<1%	<1%
12	100%	100%	100%	74%	34%	10%	2%	<1%	<1%
13	100%	100%	100%	84%	44%	15%	4%	<1%	<1%
14	100%	100%	100%	91%	56%	22%	6%	1%	<1%
15	100%	100%	100%	95%	66%	31%	10%	2%	<1%
16	100%	100%	100%	98%	76%	40%	14%	4%	<1%
17	100%	100%	100%	>99%	84%	50%	21%	6%	1%
18	100%	100%	100%	100%	90%	60%	28%	9%	2%
19	100%	100%	100%	100%	95%	69%	36%	14%	4%
20	100%	100%	100%	100%	97%	78%	45%	19%	6%
21	100%	100%	100%	100%	99%	85%	55%	26%	9%
22	100%	100%	100%	100%	>99%	90%	64%	33%	13%
23	100%	100%	100%	100%	>99%	94%	72%	41%	18%
24	100%	100%	100%	100%	100%	97%	79%	50%	24%
25	100%	100%	100%	100%	100%	98%	86%	59%	31%
26	100%	100%	100%	100%	100%	>99%	90%	67%	38%
27	100%	100%	100%	100%	100%	>99%	94%	74%	46%
28	100%	100%	100%	100%	100%	>99%	96%	81%	54%
29	100%	100%	100%	100%	100%	>99%	98%	86%	62%
30	100%	100%	100%	100%	100%	100%	>99%	91%	69%
31	100%	100%	100%	100%	100%	100%	>99%	94%	76%
32	100%	100%	100%	100%	100%	100%	>99%	96%	82%
33	100%	100%	100%	100%	100%	100%	>99%	98%	87%
34	100%	100%	100%	100%	100%	100%	>99%	99%	91%
35	100%	100%	100%	100%	100%	100%	>99%	>99%	94%
36	100%	100%	100%	100%	100%	100%	100%	>99%	96%
37	100%	100%	100%	100%	100%	100%	100%	>99%	98%
38	100%	100%	100%	100%	100%	100%	100%	>99%	99%
39	100%	100%	100%	100%	100%	100%	100%	>99%	>99%
40	100%	100%	100%	100%	100%	100%	100%	>99%	>99%
41	100%	100%	100%	100%	100%	100%	100%	>99%	>99%
42	100%	100%	100%	100%	100%	100%	100%	100%	>99%
43	100%	100%	100%	100%	100%	100%	100%	100%	>99%
44	100%	100%	100%	100%	100%	100%	100%	100%	>99%
45	100%	100%	100%	100%	100%	100%	100%	100%	>99%
46	100%	100%	100%	100%	100%	100%	100%	100%	>99%
47	100%	100%	100%	100%	100%	100%	100%	100%	>99%
48	100%	100%	100%	100%	100%	100%	100%	100%	100%

Default	-	-	EAS	AVE	DIF	FOR	STA	HOP	IMP
Hasty	-	-	-	EAS	AVE	DIF	FOR	STA	HOP
Cautious	-	EAS	AVE	DIF	FOR	STA	HOP	IMP	BEY

READING THE C+S CHART

This table shows the chance of rolling less than the number C+S (Skill + Characteristic).

For example, if (in resolving a 3D Difficult task), the skill level is 4 and the characteristic is 7, then C+S = 11. The chance of rolling 11 or less on 3D is 63%.

100%: The result is automatic or 100% probable.

No: The result is not possible; zero percent probability.

<1%. The result has a probability of less than 1%. There is less than one chance in 100 that this result will occur.

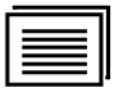
>99%. The result has a probability of greater than 99%. There is less than one chance in 100 that this result will **not** occur.

DIFFICULTY HEADERS

Abbrev	Description
EAS	Easy
AVE	Average
DIF	Difficult
FOR	Formidable
STA	Staggering
HOP	Hopeless
IMP	Impossible
BEY	Beyond Impossible

The columns on the C+S Chart are labeled with the typical difficulty for tasks.

For example, the standard for an AVE Average Task is 2D. A Hasty AVE Average Task is one level of difficulty more difficult, which is 3D; a Cautious AVE Average Task is one level of difficulty easier, which is 1D. The headings on the C+S Chart reflect these considerations.



Flux

Flux is a standard system for creating a reasonable variation between -5 and +5.

Flux

Flux is **Traveller's** quick and easy dice-rolling mechanism for creating a reasonable range of variation between -5 and +5. The most probable result is zero: no change.

Rolling Flux: Flux is rolled with two dice. Roll 1D. Roll a second 1D and subtract it from the first. This process is most easily done with a light and a dark die: roll the two dice and subtract the light from the dark. Flux is Light Die minus Dark Die.

Flux = + 1D - 1D

Good Flux. Good Flux is a variant of Flux which produces only positive results (average +2, ranges from +1 to +5). Roll 2D and subtract the smaller from the larger. Good Flux is High Die minus Low Die.

Bad Flux: Bad Flux is a variant of Flux which produces only negative results (average - 2, ranges from - 1 to - 5). Roll 2D and subtract the larger from the smaller. Bad Flux is Low Die minus High Die.

2D TWO DICE

Roll	N	N%	F=
1	0	0%	
2	1	3%	- 5
3	2	6%	- 4
4	3	8%	- 3
5	4	11%	- 2
6	5	14%	- 1
7	6	17%	0
8	5	14%	+1
9	4	11%	+2
10	3	8%	+3
11	2	6%	+4
12	1	3%	+5
13	0	0%	

(6^2 = 36 outcomes; range 2-12)

The most probable roll is 7 (17%). The average result is 7. F= converts 2D to Flux.

FLUX

Roll	N	N%
- 6	0	0%
- 5	1	3%
-4	2	6%
-3	3	8%
-2	4	11%
-1	5	14%
0	6	17%
+1	5	14%
+2	4	11%
+3	3	8%
+4	2	6%
+5	1	3%
+6	0	0%

(6^2 = 36 outcomes; range -5 to +5)

The most probable roll is 0 (17%). The average result is 0.

Good FLUX

Roll	N	N%
- 6	0	0%
- 5	0	0%
-4	0	0%
-3	0	0%
-2	0	0%
-1	0	0%
0	6	17%
+1	10	27%
+2	8	22%
+3	6	17%
+4	4	11%
+5	2	6%
+6	0	0%

(6^2 = 36 outcomes; range 0 to +5)

The most probable roll is +1 (27%). The average result is +2.

Bad FLUX

Roll	N	N%
- 6	0	0%
- 5	2	6%
-4	4	11%
-3	6	17%
-2	8	22%
-1	10	27%
0	6	17%
+1	0	0%
+2	0	0%
+3	0	0%
+4	0	0%
+5	0	0%
+6	0	0%

(6^2 = 36 outcomes; range 0 to -5)

The most probable roll is -1 (27%). The average result is -2.

USING FLUX

Flux makes the labels on die-roll tables more intuitive. While someone familiar with 2D6 recognizes a die roll table labeled 2 to 12, those same entries marked -5 to +5 become more understandable to the player and user: negatives are bad; positives are good; zero is ordinary or unchanged.

Taking a Risk In Pursuit of a Reward. Flux lets a player to try for a benefit but at the risk of consequences. When evaluating a communicator for Ease Of Use, the player rolls Flux: he hopes for +5, but at the risk of rolling -5.

Variation For Die Rolls. Flux introduces additional variation into dice rolls. It offers the opportunity for an additional modification up to 5 points in the player's favor, but at the risk of receiving instead up to 5 points negatively.

Flux introduces natural variation in physical appearance. The Height and Weight tables determine an individual's height and weight based on the physical characteristics. That raw data would imply that all average humans SDE=777 are 1.8 m tall and 73 kg (5'11'' and 169 pounds). Adding Flux to height and a separate Flux to Weight gives an interesting, realistic range of height and weight (just as real humans with about the same physical characteristics may vary widely in height and weight).

Mods for Tasks. Flux is a standard (and convenient) mechanism by which the referee can create Mods on tasks. In many situations, the referee already knows the details of the task, and there is no need to add further detail. In some situations, however, the task is created on the spur of the moment and the details have not been well-thought-out. The referee can surrender the situation to the dice, roll Flux and use the result as a Mod on the task (notice that a positive Flux result is naturally Good; a negative Flux result is naturally Bad).

WHY DEFINE FLUX AT ALL?

By defining Flux once in detail, we avoid constantly redefining the same roll time after time. By defining the term initially, player and referees understand the standard roll when they encounter it. Finally, by defining the Flux as a standard players and referees are encouraged to use it when the appropriate opportunities arise.

The Expanded Hex Code

The **Traveller** game system uses one-digit alphabetic symbols to represent numbers above 9. This usage has a variety of benefits.

Ehex

THE TRAVELLER EXPANDED HEX CODE

The **Traveller** Expanded Hex Code (Ehex) substitutes single digit letters for Arabic numerals above 9. Hexadecimal numbers use A, B, C, D, E, and F for 10, 11, 12, 13, 14 and 15, respectively, to create a base-16 number system (used in some computer systems). The digits I (eye) and O (oh) are omitted to avoid confusion with 1 (one) and 0 (zero)."

The purpose of the Expanded Hex Code is to allow the representation of a value using a single digit, thus facilitating the number-string profiles used in Traveller. For example, the Universal Personality Profile (UPP) represents the six personal characteristics in a string (in the UPP Human format SDEIES). Using single number digits, the values for each profile digit can range from 0 to 9. Using Hex Code, those digit values can range from 0 to 15. Using the Expanded Hex Code, digit values can range from 0 to 33.

Digits may also be assigned arbitrary values or non-numeric meanings in some usages.

NUMBER TO EHEX

Value	Ehex	
0	0	
1	1	
2	2	
3	3	
4	4	
5	5	
6	6	
7	7	
8	8	
9	9	decimal
10	A	
11	B	
12	C	
13	D	
14	E	
15	F	hex
16	G	
17	H	
-	I	omitted
18	J	
19	K	
20	L	
21	M	
22	N	
-	O	omitted
23	P	
24	Q	
25	R	
26	S	
27	T	
28	U	
29	V	
30	W	
31	X	unknown
32	Y	special
33	Z	ultimate

Upper and Lower Case. Ehex expects its digits to be UPPER Case. Some situations differentiate stages within an Ehex value by using Upper or Lower Case (the Nobility, for example).

Why Use EHex? EHex was created to allow numbers greater than 9 to occupy one place in a string.

123456	**The Situation** **Traveller** uses many different **strings** of digits to show abilities and values for people, equipment, starships, and other items.
89101112	**The Problem** Numerical values greater than nine take up two (or more) places, making it difficult (sometimes) to join them into readable strings. If any value is greater than 9, the string becomes unreadable.
89ABCD	**The Solution** Make each numerical value one digit: values greater than 9 are assigned a corresponding letter 10=A 11=B 12=C 13=D.

THE TRAVELER HEX CODES

Traveller uses the basic alphanumerics (0-9, A-Z) as single digits to represent numeric values and as codes to represent situational and positional meanings. For example, the alphanumeric A represents 10 in Hex and in Ehex. It can also be used as a code (with no specific numerical meaning).

Dec (Decimal Notation). The digits 0-9 represent the numbers in base-10.

Hex (Hexadecimal Notation). Expanding the numbers available, the letters A-F correspond to the values 10-15 in base-16.

Ehex (Extended Hexadecimal Notation). Further expanding the numbers available, the letters G-Z correspond to the numbers 16-33.

Omit I and O. Because of the potential for confusion, with the digits one (1) and zero (0), the alphabetic letters I and O are omitted.

Special Meanings. Digits may also be assigned arbitrary values or non-numeric meanings in some usages. For example, while XYZ have assigned values 31-32-33, they are (sometimes, often) assigned specialized values like Unknown, Special, or Ultimate.

Question (?) can be used to show an unknown value, and Star (*) can be used to show “any” possible value.

EHEX TO NUMBER

Ehex	Value	
0	0	
1	1	
2	2	
3	3	
4	4	
5	5	
6	6	
7	7	
8	8	
9	9	decimal
A	10	
B	11	
C	12	
D	13	
E	14	
F	15	hex
G	16	
H	17	
I	-	omitted
J	18	
K	19	
L	20	
M	21	
N	22	
O	-	omitted
P	23	
Q	24	
R	25	
S	26	
T	27	
U	28	
V	29	
W	30	
X	31	unknown
Y	32	special
Z	33	ultimate

Other Digits

?	Unknown
*	Any

The Ton

The fundamental unit of volume for cargos and freight and for ship construction is the **ton**: a measure of volume in the same way that a displacement ton measures volume on ocean-going ships.

The Ton

The ton is a standard unit of volume commonly used throughout the Imperium. It has applications in starship design, in cargo and freight measurement, and in size designations.

In classic shipbuilding, a ton is the volume of 1000 kilograms of water. A ship with a displacement of 1 ton afloat in water displaces one ton of water.

THE BASIS OF THE TON

A ton is the volume of 1000 kilograms of liquid hydrogen, and is approximately equal to 13.5 cubic meters. While a cube of this volume is approximately 2.4 meters on a size, the ton is more typically shown as a rectangular volume 3 meters high, 3 meters long, and 1.5 meters wide.

Subunits of the Ton. There are instances when volumes less than a ton are more conveniently used (when discussing objects, vehicles, or small craft, for example, and expressing volume in decimal tons is inartful).

SUBUNITS OF THE TON

Unit	Tons	Comment
Ton	1.00	Standard Ton
Ton*	1.037	Regency Ton
Square	0.5	half-ton
Cube	0.25	quarter-ton
Roup	0.10	tenth-ton
Lan	0.01	hundredth ton
Emthree*	0.075	cubic meters
Cyard*	0.05	cubic yard
Cuft*	0.002	cubic foot
Liter	0.00007	
Kiloliter	0.075	

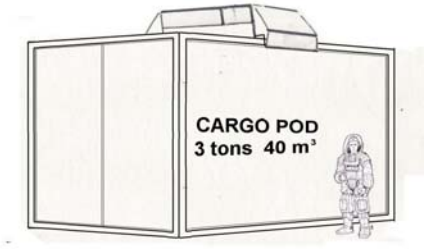
*Archaic or little used.

For example, the smallest available G-Drive is 0.25 tons. It is commonly labeled as a 1-cube drive. A quarter-ton Cube is typically 1.5 meters on a side.

The fusion plant for a grav tank is 0.4 tons. It is commonly labeled a 4-Roup fusion plant, or more rarely a 40-Lan fusion plant. A tenth-ton Roup is a cube slightly more than a meter (1.1 meters) on a side.

A person (a human) probably has a volume of a half-Lan. A hundredth-ton Lan is typically a cube about a half meter (0.502 meters) on a side.

Or, a ton is about 13,500 liters, a Lan is 135 liters. A half-Lan person has a volume (135 /2) = 68 liters. Since a person is mostly water, the weight of a person and 68 liters should be roughly equivalent. A liter of water is 1 kilogram. A half-Lan person should be about 68 kilos = 150 pounds. QED.

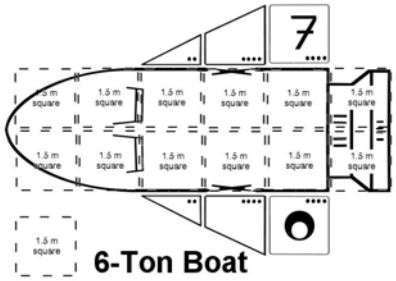


CARGO POD

A three-ton cargo pod measuring 3 meters wide by 3 meters high by 4.5 meters long.

For scale comparison, a half-Lan person (actually closer to a Lan with the vacc suit).

Tightly packed, that cargo container could hold 300 vacc suits or 600 human bodies.



A six-ton small craft showing 1.5 meter deck squares.

TON EQUIVALENTS

Units	Per Ton
Cubic Feet	500
Cubic Yards	18
Kiloliters	13.5
Cubic Meters	13.5

TON DENSITIES

Tons	Material	kg
1	Liquid Hydrogen	1,000
1	Wood	6,750
1	Plastic	12,000
1	Water	13,500
1	Magnesium	25,000
1	Aluminum	35,000
1	Titanium	60,000
1	Steel	100,000

Cubic Meters	13.5
Std Grid Squares	2
Short Grid Squares	4
Tall Grid Squares	1

THE REGENCY TON

The values used for the ton in **Traveller: The New Era** varied slightly from traditional values. Historians call this value the Regency Ton.

One Ton= 14 cubic meters.

Deck Square= 2 meters by 2 meters

Deck Height= 3.5 meters.

Dimensions= 2m x 2m x 3.5 m

Distances and Ranges

Distance is a dominating factor in many interactions: It determines the relative effectiveness of the senses and of sensors, of weapons and attacks, and of communications.

Traveller distills the open-ended concept of distance into a series of range bands, each associated with a typical distance and identified by one or more benchmarks.

For simplicity, and for ease of use in a variety of situations, **Traveller** uses the concept of Range Bands to express the qualitative distance between objects.

THE RANGE BANDS

Ranges are typical distances, standardized for convenience. Using more specific ranges adds little in realism, but much in complexity.

Relative Distances: Descriptive terms state that the distance relation ship between an observer and an object (or an attacker and a target): for example, Range Band 3 has a label Medium (as in Medium Range) and is associated with a distance of approximately 150 meters.

Benchmarks. Range Bands are associated with Benchmarks: with objects which can typically be seen or heard or senses at that distance. For example, a reasonable sense of vision can see a book (or a book-sized object) at Medium range.

Distances. Each Range Band encompasses a spectrum of distances from about half way from the previous range band to about half way to the next range band.

For example, the Medium Range Band extends from about 100 meters to about 325 meters.

THE RANGE BAND CHARTS

The Basics	1a	World Surface Ranges
	1b	Altitudes of the Atmosphere
	1c	Depths of the Ocean
Space	2	Space Ranges
Other Worlds	3a	Gas Giant Altitudes
	3b	StrangeWorld Altitudes
Fame	4	Fame Distances

Sub Bands

Any range band can be subdivided into Sub Bands when the distinction is important.

For example, to reflect various layers within the atmosphere of a Gas Giant, Range 6 is subdivided Bands 6.2, 6.4, 6.6, and 6.8 (which reflect different pressures at those levels).

It is possible to make more extreme Sub Bands (6.1, 6.2, 6.3 and such).

The purpose of Sub Bands is to differentiate rather than lumping all objects at a range into one distance.

The Range to a Sub Band is the range to the Band.

R=	consistently used in Range-related sections to refer to **World** Ranges. R= S+5.
S=	consistently used in Range-related sections to refer to **Space** Ranges. S= R+5.

THE RANGE BAND CHARTS

The Range Band charts and their associated subcharts show distance relationships which govern a variety of interactions.

1a 1b 1c. The **World Charts** show distances (using R=) on world surfaces, atmospheric altitudes, and ocean depths.

World Surface Ranges addresses the typical distances of relatively flat terrain. They are strongly influenced by typical combat ranges and by typical uses of the senses. The Zero or Contact Point is the location of the observer or the character.

Altitudes of the Atmosphere addresses the typical altitudes used by flying vehicles and the typical layers of the atmosphere. The Zero or Surface point is the surface of the world.

Some worlds (most importantly, those with Atmosphere-F Thin Low) have deep canyons or chasms (thousands of kilometers deep) with correspondingly higher atmospheric pressures. The Altitudes table includes negative Altitudes to properly describe these conditions.

Depths of the Oceans addresses the levels or depths of oceans. Levels are important because increased depth imposes increased pressure. The Zero or Surface point is the ocean surface.

Values on the table reflect ocean surface turbulence, and negative values reflect various depths.

Abyss reflects extremes on worlds with unusually deep oceans.

2. The **Space Ranges Chart** shows distances (using S=) in interplanetary space. Interplanetary ranges address the relative distances in space and are used in the operation of long range sensors and in space combat.

Band and Band Name identifies the space combat locations used in space combat.

Stellar and World Diameters shows the range bands corresponding to the stated D values. Diameters govern the effectiveness of lifters, gravitic, maneuver, and jump drives.

Light Delay details the approximate time delay for communicators and sensors.

S= shows the Space Combat Range Band.

R= shows the World Range Band for comparison.

Orbits shows the correspondence of the values to standard orbits.

3a b c. The **Gas Giant Charts** show the depths of massive world atmospheres The **Strangeworlds Chart**s show the atmospheric altitudes for unusual worlds.

Gas Giant Atmospheres addresses the levels or depths of the gas giant atmosphere. Levels are important because increased depth imposes increased pressure and temperature. The Zero or Surface point is the upper layer of the atmosphere (typically the Cloud Deck, and typically with a density of one atmosphere).

Three types of massive worlds are shown: Large Gas Giants (corresponding in size to Jupiter or larger), Small Gas Giants (corresponding in size to Saturn or smaller), and Ice Giants (corresponding to Neptune or Uranus).

Gas Giants are sources of hydrogen for starships in search of cheap fuel, or required to use wilderness refueling. Gas Giant atmosphere levels show the conditions such ships must survive in order to acquire hydrogen.

The **Strangeworld Charts** show the atmospheric altitudes for worlds with dangerous characteristics. The values for these charts may be overlaid on other worlds.

For example, the normal atmospheric values for a world can be taken from 1b Altitudes of the Atmosphere. If that world is a StormWorld (racked by storms constantly, or only currently), the appropriate (H= or Hits=) values created by atmospheric turbulence can be overlaid on Chart 1b.

Inferno is a Venus-Like world with high temperatures.

Stormworld is a world with strong atmospheric turbulence.

Radworld is a world with a high level of surface radioactivity (the 1D Rad levels at altitude 6 and 6.2 are windborne particles).

The Zero or Surface point is the surface of the world.

4. The **Fame Chart** shows the expected distance effect of fame in society.

The **Danger Chart** reflects an evaluation system for threats or potential threats to the continued existence to an object, group, or location. Analysts, officials, or others may subjectively evaluate a danger and express it as Threat-N, where N is the Danger level.

For example, the possibility of the dam breaking outside of town is Threat-5. The activities of a violent anti-government faction may be Threat-8, -9, or even-10. The possibility of a system's star going nova is Threat-14 (a possible supernova might be Threat-17). Scientific research on the origins of the universe (depending on the principles involved) may be Threat-7 or Threat-29.

1a BASIC RANGES

Distance	R=	Descriptor	Benchmark	Range Band Width	S=
Surface	0	Contact	Touching	From the surface to about 25 cm.	
0.5 m	R	Reading	Normal Reading	25 cm to 1 meter.	
1.5 m	T	Talking	Conversations	1 m to about 3 m.	
5 m	1	Vshort	Lectures	3 m to 25 m.	
50 m	2	Short	Pistol Range	25 m to 100 m.	**Space Ranges are World Ranges minus** 5
150 m	3	Medium	Rifle Range	100 m to 300 m (actually 325 m).	
500 m	4	Long	Extreme Gun Range	300 m to 750 m.	
1000 m	5	Vlong		750 m to 3 km.	**B**
5 km	6	Distant	Near the Horizon	3 km to 25 km (actually 27.5 km)	**1**
50 km	7	Vdistant	Beyond the Horizon	25 km to 250 km (actually 275 km).	**2**
500 km	8	Orbit		250 km to 2500 km (actually 2750 km).	**3**
5,000 km	9	Far Orbit		2500 km to 25,000 km (actually 27,500 km).	**4**

"actually" refers to precisely half the distance to the next Range Band value.

SIZES

> Benchmark										
		Needle	Word	Coin	Card	Book	Suitcase	Person	Truck	Tower
Size	**0**	**R**	**T**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Length		1 mm	2 mm	7 mm	75 mm	20 cm	75 cm	1.5 m	7.5 m	75 m

Ranges correspond to Object Sizes. To an observer, any object with Size = Range appears to be the same size.

For example, a Book (Size-3) at Range=3 appears to be the same size as a Coin (Size-1) at Range=1 or a Person (Size-5) at Range=5.

Try it: station a person, a book, and a coin at various distances where they all appear to be the same size and measure the various distances from the viewer to the objects.

5a b c. The **Orbital Distances Chart** shows the standard orbits in star systems.

Orbits may theoretically be at any distance from a central star. Primarily for ease of use, orbital distances are standardized on the Titius-Bode Relation, an 18 th Century attempt to predict orbital values. The actual value predicted values for orbits has been adjusted to include Orbit 0 to accommodate observed orbits.

The Orbital Distances Chart shows Orbit Number (O=) with corresponding distances in AU, Millions of Km, and Light-units.

The far column shows the orbits consumed by giant stars.

For example, for an A0 Ia star, orbits 0 through 3 are inside the star; orbit 4 lies just beyond the surface of the star.

The Habitable Zones Chart shows the orbits with conditions conducive to life based on the primary star for the world.

The Satellite Orbits Chart shows the standard orbits for satellites.

Basic Ranges

Basic Altitudes Depths

1a WORLD SURFACE RANGES

Distance	R=	Descriptor
5,000 km	9	Far Orbit
500 km	8	Orbit
50 km	7	Vdistant
5 km	6	Distant
1000 m	5	Vlong
500 m	4	Long
150 m	3	Medium
50 m	2	Short
5 m	1	Vshort
1.5 m	T	Talking
0.5 m	R	Reading
Surface	0	Contact

Basic Ranges are used in personal and vehicle combat, especially on world surfaces.

Basic Ranges are used with the Senses.

1b ALTITUDES OF THE ATMOSPHERE

Distance	R=	Descriptor
250,000 km	11	Satellite
50,000 km	10	Geo
5,000 km	9	Far Orbit
500 km	8	Orbit
400 km	7.8	Upper8
300 km	7.6	Upper6
200 km	7.4	Upper4
100 km	7.2	Upper2
50 km	7	Upper
30 km	6.8	Mid8
20 km	6.6	Mid6
12 km	6.4	Mid4
8 km	6.2	Mid2
5 km	6	Mid
1000 m	5	Airspace5
500 m	4	Airspace4
150 m	3	Airspace3
50 m	2	NOP
5 m	1	NearSurface
1.5 m	T	Talking
0.5 m	R	Reading
Surface	0	Contact
0.5 m	-R	
1.5 m	-T	
5 m	-1	
50 m	-2	
150 m	-3	
500 m	-4	Chasm Rim
1000 m	-5	Chasm Wall
5 km	-6	Chasm Floor
50 km	-7	
500 km	-8	
5000 km	-9	

NOP= Nap of the Planet.

Chasm= Of special importance on worlds with Atm= F (Thin, Low).

1c DEPTHS OF THE OCEANS

Distance	R=	Descriptor
50 m	2	Tsunami
5 m	1	Vbig Waves
1.5 m	T	Big Waves
0.5 m	R	Waves
Surface	0	Surface
0.5 m	R	Wading
1.5 m	T	Fording
5 m	-1	Pond
50 m	-2	Thermocline
150 m	-3	Shelf
500 m	-4	Lake Bottom
1000 m	-5	Deep Lake
5 km	-6	Bottoms
50 km	-7	Depths
500 km	-8	Abyss
5000 km	-9	

ThermoCline= Of importance in underwater sensor use.

Abyss. Of special importance on Ocean Worlds.

2 SPACE RANGES

Distance	S=	Descriptor	Band	Band Name	Stellar Diameters*	World Diameters**	Orbits	Light Delay	R=
500 mn km	12		DS	Deep Space	100 D		To Orbit 5	30 lm (3 au)	17
150 mn km	11						To Orbit 3	8 lm (1 au)	16
50 mn km	10	Siege					To Orbit 0	3 lm	15
5 million km	9		LR	Long Range	10 D	1000 D		16 ls	14
2.5 million km	8				1 D			8 ls	13
500,000 km	7		AR	Attack Range		100 D		2 ls	12
250,000 km	6	Missile						1 ls	11
50,000 km	5	Beam	SR	Short Range		10 D			10
5,000 km	4	Far Orbit				1 D			9
500 km	3	Orbit							8
50 km	2	Fighter	F1	Fighter Range					7
5 km	1	Close Fighter	F0						6
1000 m	B	Boarding	B	Boarding					5
500 m									4
150 m									3
50 m									2
5 m									1
1.5 m									T
0.5 m									R
Surface	0								0

S= Space Combat Ranges.

Space Ranges are used with Space Combat and with Space Sensors. S= R-5.

Band= Space Combat Bands.

Space Combat Bands are used in Space Combat, especially with Movement.

R= World Combat Ranges.

World Combat Ranges are used with Personal Combat; they are extended to extreme values for comparison. R= S+5.

Light Delay= Light Speed Distances.

Light Speed Distances provide insight into maximum radio and light time frames over distance.

STELLAR AND WORLD DIAMETERS

*** Assumes Spectral G star.**
Increase Band + 1 for Spectral A or F.
Decrease Band -1 for Spectral K or M.

**** Assumes typical world size = 3+**.
Increase Band +1 for Gas Giant.
Decrease Band -1 for Size 2 or less.

The Diameter Rules

1000 D Maneuver Drives will not operate beyond this limit.

100 D Jump Drives will not operate within this limit.

10 D Gravitic Drives will not operate beyond this limit.

1 D Lifters will not operate beyond this limit.

3a GAS GIANT ATMOSPHERES

Depths	Large Gas Giant R=	P=	T=	Descriptor	Small Gas Giant R=	P=	T=	Descriptor	Ice Giant R=	P=	T=	Descriptor
0	0	1		Cloud Deck	0	1		Cloud Deck	0	1		Cloud Deck
5 km	6	1		NH3 Ice	6	1		Water Ice	6	1		CH4 Ice
10 km	6.2	1		NH3 Ice	6.2	1		NH3 Ice	6.2	1		Clear H2
20 km	6.4	2		Clear H2	6.4	1		Clear H2	6.4	2		NH3 Ice
30 km	6.6	3		NH4SH solid	6.6	1		NH4SH solid	6.6	4		NH3 Ice
40 km	6.8	4		Water Ice	6.8	2		Water Ice	6.8	7		NH3 Ice
50 km	7	6	0	Clear H2	7	2	0	NH3 Water	7	^1		NH3 Ice
100 km	7.2	40	4	Clear H2	7.2	5	1	NH3 Water	7.2	^2		NH3 Ice
200 km	7.4	^3	36	Clear H2	7.4	20	4	Clear H2	7.4	^4	1	NH3 Ice
300 km	7.6	^3	^2	Clear H2	7.6	80	36	Clear H2	7.6	^4	4	NH3 Ice
400 km	7.8	^4			7.8	^3	^2		7.8	^5	36	NH3 Ice
500 km	8	^4			8	^4			8	^5	^2	NH3 Ice
1000 km	8.2	^5			8.2	^5			8.2	^6		
2000 km	8.4	^5			8.4	^6			8.4	^6		Liquid Hydrogen
3000 km	8.8	^6			8.8	^6		Liquid Hydrogen	8.8			
4000 km	9	^6		Liquid Hydrogen	9				9			

R= Range (or Depth from the Upper level of the Atmosphere).

3b StrangeWorlds

Values for StrangeWorlds
can be overlaid on other world atmosphere levels.

Altitude	Inferno R=	P=	T=	Descriptor	StormWorld R=	H=	T=	Descriptor	RadWorld R=	P=	T=	Descriptor
500 km	8	0	0		8	0			8	0		
400 km	7.8	0	0		7.8	0			7.8			
300 km	7.6	0	0		7.6	0			7.6			
200 km	7.4	0	0		7.4	0			7.4			
100 km	7.2	0	0		7.2	0			7.2			
50 km	7	1	0	Cloud Tops	7	0			7			
30 km	6.8	^2	64		6.8	0		Calm	6.8			
20 km	6.6		^2		6.6	5			6.6			
12 km	6.4		^2		6.4	10		Turbulent	6.4			
8 km	6.2		^2		6.2	5			6.2			Rad= 1D
5 km	6		^2		6	0		Calm	6			Rad= 1D
1000 m	5		^2		5	5			5			Rad= 10
Surface	0	^3	^3	Surface	0	10		Turbulence	0			Rad=1000

R= Range (or Altitude from the Surface).

Effects (Applies to All Tables)

P= Pressure in Bars (Terra Surface Pressure = 1). P Effect is Blast-P: P=4 produces Blast-4 = 4D hits.
H= Turbulence in Hits (Calm atmosphere = 0). Effect is Blast-H: H=5 produces Blast-5 = 5D hits.
T= Temperature. If T is Positive, the Effect is Hot-T (T= 6 is Hot-6); if T is Negative, the Effect is Cold-T (T= - 6 is Cold-6).
Values above 99 use are exponents (^2 = 10^2 = 100; ^3 = 10^3 = 1000).

4a FAME

Distance	F=	Descriptor	Alternate Descriptor
	0	Unknown	
	1	Mother	1 person.
	2	Close Family	
	3	Family	10 people.
	4	Neighborhood	1,000 people.
	5	Town	10,000 people.
	6	City	1,000,000 people.
	7	Urban	
	8	Regional	Small Business
	9	Continental	Corporation
	10	World	
	11	World Complex	
	12	World System	
	13	Inner System	
	14	System	
	15	Greater System	
	16	Outer System	
	17	Systems	
	18	Many Systems	Large Corporation
	19	Subsector	
	20	Sector	MegaCorporation
	21	Domain	
	22	Domain	
	23	Domains	
	24	Empire	
	25	Beyond Empire	
	26	Several Empires	
	27	This Spiral Arm	
	28	Many Spiral Arms	
	29	The Galaxy	
	30	Several Galaxies	
	31	Many Galaxies	
	32	Domain	
	33	All Reality	

Alternates: Based on Fame or Reputation within Organizations or Societies (as opposed to Standard Fame based on distance).

4b DANGER

Size	D=	Descriptor
	0	Safe
	1	Self
	2	Companions
	3	Family
	4	Group
	5	Town
	6	City
10 km	7	Large City
100 km	8	Region
1000 km	9	Continent
	10	World
	11	World Complex
	12	World System
	13	Inner System
	14	System
	15	Greater System
	16	Outer System
	17	Several Systems
	18	Many Systems
	19	Subsector
	20	Sector
	21	Sectors
	22	Domain
	23	Domains
	24	Empire
	25	Beyond Empire
	26	Several Empires
4000 pc	27	This Spiral Arm
10,000 pc	28	Many Spiral Arms
20,000 pc	29	The Galaxy
	30	Several Galaxies
	31	Many Galaxies
	32	The Universe
	33	All Reality

Danger is the relative level of a threat to the continued existence of an object, group, or location.

Danger is often expressed as a threat level: Threat-N where N is the Danger level.

Benchmarks

Understanding the unfamiliar or the unknown is made easier when players have standards against which items can be compared.

A Benchmark is a standard by which objects, concepts, or values can be compared or evaluated. Benchmarks provide the players and the referee with standards by which they can better understand what they encounter.

UNDERSTANDING BENCHMARKS

Benchmarks provide insights into three distinct concepts.

Benchmarks for Value and Cost provide insights and guidelines into the value of money and how it can be earned and used.

Benchmarks for Range help in the understanding of distance and its interaction with the senses, sensors, weapons, and travel times.

Benchmarks for Size provide an understanding and useful measure of relative size.

FINANCIAL INFORMATION

The basic financial information on which economic activities are based includes:

Salaries and Wages. Characters can expect to receive payment for their labor based on specific standards. By knowing the benchmarks, the player can understand if an offer of employment will pay wages which are too low or too high, and they can then react accordingly.

The Cost of Living. The typical costs of housing, meals, and other details give players insights into basic costs which they must meet before they can begin accumulating wealth.

Investment and Speculation Returns. The discussion of investment and speculation provides a basis for players' efforts to accumulate wealth.

Help For The Referee

The Benchmarks support the Referee in deciding on the costs of, and potential rewards from, adventures

FINANCIAL ELEMENTS THAT TRAVELLER IGNORES

Among the elements that are routinely ignored in the course of play are:

Taxes. It is assumed that taxes on goods and income are paid as part of the price or the paycheck. Many mechanisms are possible: Perhaps they are an included Value Added tax, or a routinely imposed sales tax. In any case, taxes are invisible to the user.

Inflation. It is assumed that the rate of inflation is both constant and low, and that it can be ignored for most purposes. Prices are constant and do not change without specific important circumstances.

RATIONAL CONSTRAINTS

History has repeatedly seen the creation of terribly rich people, but with such wealth comes equally terrible responsibilities: primary among them is an all-consuming obsession with the accumulation of wealth. Such extreme wealth is incompatible with the central tenets of **Traveller**. Within **Traveller**, the primary purpose of wealth is to support continuing adventures and travel; a character obsessed with unconscionably great wealth has no time for adventures and is more properly a non-player character (usually willing to spend large amounts of money, or to temporarily lend assets such as starships) to finance adventures which incidentally assist him in amassing even more wealth..

Investments and Speculation may manipulate large amounts of money, but benchmarks indicate amounts which a single individual can rationally expect to receive personally.

For example, the Starship Investment involves millions of credits, but for the characters involved the primary reason for the investment is access to a starship as a means of travel.

SALARIES AND WAGES

The charts provide standard salary levels and wage rates for characters.

Salaries. The Salaries table shows typical salary structures for various character or career types.

For example, a Citizen having served three terms can expect to earn a salary in the range of Cr750 per month (which, according to The Costs of Living table, is slightly more than a C6=Soc character needs to live).

For example, a Spectacular Entertainer with Fame-10 can expect to earn Cr240,000 per year.

Salaries are appropriate for Scholars, Entertainers, Scouts, Naval, and Military characters.

Wages. The Wages table shows typical hourly wage structures for various skill types. A character may decide to work for wages rather than salary if that is more advantageous.

For example, a character with Mechanical-4 can expect to earn Cr10 per hour (= Cr1750 per month). A good Fame-3 Entertainer (who can earn Cr300 per month) may want to work for wages (based on a good skill level) in addition to playing in clubs on weekends.

THE COSTS OF LIVING

The Costs of Living table shows the typical costs an individual expects to pay in the course of living.

INVESTMENTS

Investments focus primarily on creating income streams. Properly employed capital creates a steady stream of income. Contrast Investment with Speculation later.

Stocks and Bonds

Invested capital in relatively safe ventures produces a compounded annual return on investment of between 1% and 2%.

The benefit of a conservative investment is that its chance of loss is almost nil.

The Starship Investment

Bank financing is available to qualified individuals for the purchase of new commercial starships. After a down payment of 20% of the cash price of the starship is made, the shipyard will begin construction of a specific vessel. Upon completion, the vessel is delivered to the buyer, with the bank paying off the purchase price to the shipyard. Because the bank now holds title to the ship, the price must be paid off in a series of monthly payments to it. Standard terms involve the payment of 1/240th of the cash price each month for 480 months. In effect, interest and bank financing cost a simple 120% of the final cost of the ship, and the total financed price equals 220% of the cash purchase price, paid off over a period of 40 years.

In addition, the bank will insist that the purchaser submit an economic plan detailing the projected activity which will guarantee that monthly payments are made.

How Does This Work? Starships are built at shipyards associated with starports. The building process must be profitable, and it has been structured in the following way:

A new MCr10 starship requires an investment by the building shipyard of about MCr6, of which about half is hardware and half is labor. Starports build locally whatever the local economy supports (finely crafted interior finish; astronics, drives). The buyer down payment of 20% (=MCr2) covers most of the required hardware. The starport sells the remaining note (for Cr42,000 per month for 480 months) to a bank (or a Megacorporation) for an amount equal to its remaining costs and a modest profit (=MCr4 + MCr2). The MCr8 note carries a nominal interest rate of about 5.57%. The bank acquires the note for MCr6 and earns close to 8%.

SPECULATION

Speculation focuses on acquiring goods (manufactured goods, luxury goods, commodities) or rights (land grants, intellectual property rights, patents) and selling them within a short period for a profit.

Shopkeepers

Trade is a subset of Speculation: short term buying and selling, making a modest profit sufficient for the proprietor to make a decent living.

Shopkeepers add their labor and expertise to a modest investment in goods (shoes in a shoe store; rooms in a hotel; food in a restaurant; raw materials in a factory) which they resell to the public or to corporate or government clients. A relatively conservative but profitable shopkeeper produces income after expenses.

Rarely does a shopkeeper get rich; most live comfortably off the modest profits of their profession.

Speculators

A speculator buys goods in the expectation that they can be sold at a profit later (and usually on another world). A speculator does not necessarily operate a cargo-carrying starship; a speculator may ship its cargo as freight and pay standard freight rates in order to transport the goods to a profitable market.

Merchant Speculators. A merchant ship crew evaluates trade goods it encounters during its travels, buys those it thinks have merit, and transports them to other worlds in an expectation of selling them at a considerable higher price.

The Land Grant Speculation

Land has no value unless it can be exploited: a process that involves increasing its population and infrastructure (roads, bridges, transportation, factories, an educational system, and government). A long-term land investor can increase his return (his stream of income) from land by developing it.

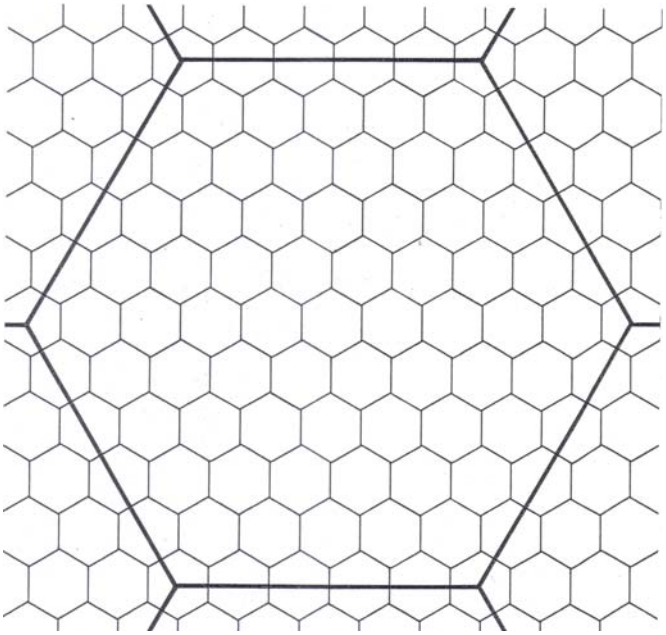
A **Land Grant** differs from actual ownership of land; it confers specific rights and privileges on its holder. These rights include

An **income** based on a nominal portion of the taxes and income that the land produces, escalating as the land is improved.

A **title** (Lord) reflecting possession of the land, and accompanying responsibilities as the final authority to which locals may appeal for the righting of injustice (this authority may be locally delegated).

Outright **land ownership** of one terrain hex (approximately 60 km square).

The Territory. A **land grant** is a gift of real estate- land or privileges - made by the government or other authority as a reward for services to an individual, especially as a reward for service or accomplishment, or as an incentive to develop the land.



A typical Planetary hex is 1000 km in diameter, and consists of 76 smaller terrain or Local hexes. The Planetary hex is 10 Local hexes wide (measured vertex to vertex; each 60 km).

THE SHIP'S ACCOUNT

Each adventuring ship has a continuing need for money to pay expenses such as crew salary, maintenance, life support, and other supplies. The accounting for this cash flow is handled through the Ship's Account.

The ship owner is responsible for maintaining the Ship's Account. In its simplest form, it is a running total all income the ship receives minus all costs the ship incurs.

VALUE, COST, AND PRICE

For any object or thing with a value,

Cost is the amount of money required to produce it

Cost is the wholesale price of the object. Cost Modifiers can change this amount based on Flux, or on specific features.

The Cost to a manufacturer can be reduced based on volume production. A factory spends much less than the wholesale cost by producing in volume.

For example, Dran Corp sells vehicle parts. It buys them from various factories at wholesale. A major part (a Gravitic Translimiter) has a benchmark Value of 3 = Cr10,000, which is what Dran pays for it.

Dran sells Gravitic Translimiters based on supply and demand. This year the supply is (Flux = Quite Common = x 0.8 x 10,000) = Cr8,000. Demand is (Flux = Good = x 1.2 x 10,000) = Cr12,000 each. They make a profit of about Cr4,000 for each one they sell.

Meanwhile, Acme Gravitic Translimiters Corporation manufactures the devices. They produce them in volume (= Value / 10) = Cr1,000 each. They want to sell them for Cr10,000 each, but there is currently an oversupply, so they only sell for Cr8,000 to distributors like Dran Corp.

Cost Modifiers do not usually affect player characters unless they are buying in volume or creating a factory.

Price is the amount of money required to buy it

An ordinary person who needs an object usually goes to a store to buy it. Price Modifiers can change this amount based on Flux, or on specific circumstances.

For example, Eneri Dinsha needs a Gravitic Translimiter for a repair he is making. He goes to the local Dran Corp outlet and sees one on the shelf.

The referee determines (by Flux, or by a decision) that Demand is Good (taken from the example above) so the price is (Value x 1.2 =) Cr12,000.

Price Modifiers can be applied to most items a player character tries to buy. Price Modifiers provide temporary benefits (or obstacles).

Moderation should be used with Price Modifiers; not every object needs to sell for more or less than its Value.

OBJECT SIZE

Benchmark object sizes are expressed in single digits. Special digits R and T correspond to object sizes smaller than 1.

Benchmark sizes show the relative (and approximate) dimensions of objects. Benchmark sizes allow comparisons of different objects, and provide an understanding of overall size.

Benchmark Sizes. The Benchmark Sizes are used with the senses and in combat, and they give players information about carrying or moving objects.

Decimal Sizes

Decimal sizes are typical technological device outputs. For example, a human sees an object in the distance and identifies it as Size 5 (person-sized; about 1.5 meters). A technological device (a range finder; a visual sensor; a sonic detector) provides a more detailed reading as Size 5.3 (person-sized; about 1.8 meters).

Robots. Most robots give their estimates of size in decimal.

How Big Is It Really?

Many objects vary somewhat from the standard size values. The HBIIR? Table allows determination of a more specific size of an object. The result can be translated into decimal size or true units.

Orbital Distances

Orbits are standardized on the traditional Titus-Bode Relation distances primarily for ease of use.

Orbits

5 ORBITAL DISTANCES

	S=	O=	AU	Million km	Light-		Surface of Star inside this Orbit Ia	Ib	II	III
Inner System	10	0	0.2	30	100 ls				A0-F5	A0-K0
		1	0.4	60	200 ls			A0	G0-G5	K5
		2	0.7	105	350 ls			A5-G0	K0	M0
	11	3	1	150	8 lm					
		4	1.6	240	13 lm		A0-F5	G5	K5	
	12	5	2.8	420	30 lm		G0	K0	M0	M5
Outer System		6	5.2	780	43 lm		G5-K0	K5	M5	M9
		7	10	1,500	83 lm		K5	M0	M9	
		8	20	3,000	3 lh		M0	M5-M9		
		9	40	6,000	5 lh		M5-M9			
		10	77	11,550	10 lh	Kuiper Belt				
		11	154	23,100	21 lh	Kuiper Belt				
		12	308	46,200	42 lh					
Remote System		13	615	92,250	3 ld					
		14	1,230	184,500	7 ld					
		15	2,458	368,700	14 ld					
		16	4,916	737,400	4 lw					
		17	9,830	1,474,500	8 lw					
		18	19,500	2,925,000	16 lw					
		19	39,500	5,925,000	32 lw	Oort Cloud				
		20	78,700	11,805,000	1 ly	Oort Cloud				

O= Orbit =

Stars shown physically occupy the orbits shown.

THE 10D GRAVITIC DRIVE LIMIT

	Ia	Ib	II	III	IV	V	VI	D
A0	7	5	4	1	1	0	*	*
A5	7	5	3	1	0	*	*	*
F0	7	6	3	1	0	*	*	*
F5	7	6	4	1	0	*	*	*
G0	8	6	4	1	0	*	*	*
G5	9	7	5	3	0	*	*	*
K0	10	7	6	3	0	*	*	*
K5	10	8	7	5		*	*	*
M0	11	10	8	6		*	*	*
M5	11	11	9	8		*	*	*
M9	12	11	10	8		*	*	*

G-Drives inoperable outside this orbit.

THE 100D JUMP DRIVE LIMIT

	Ia	Ib	II	III	IV	V	VI	D
A0	10	9	7	6	5	5		*
A5	10	9	7	5	4	4		*
F0	11	9	7	5	4	3		*
F5	11	9	7	5	4	3	3	*
G0	11	10	8	6	4	2	2	*
G5	12	10	8	7	4	2	1	*
K0	12	11	9	7	5	2	0	*
K5	13	12	10	9		1	0	*
M0	14	13	11	9		1	0	*
M5	15	14	13	11		0	*	*
M9	15	15	13	12		*	*	*

J-Drives inoperable within this orbit.

THE 1000D MANEUVER DRIVE LIMIT

	Ia	Ib	II	III	IV	V	VI	D
A0	13	12	11	9	9	8		*
A5	14	12	10	9	8	7		*
F0	14	12	10	9	8	7		*
F5	14	12	11	9	8	7	7	*
G0	15	13	11	9	8	6	6	*
G5	15	14	12	10	8	6	5	*
K0	16	14	12	10	8	6	5	*
K5	16	15	13	12		6	5	*
M0	17	16	14	12		5	4	*
M5	18	17	16	14		5	2	*
M9	18	18	16	15		4	1	*

M-Drives inoperable outside this orbit.

Limit shown is beyond (within for Jump) the Orbit Number shown. ***** = inside Orbit 0. Blank = Not possible.

Orbital Distances

Orbits are standardized on the traditional Titus-Bode Relation distances primarily for ease of use.

Orbits

5a ORBITAL DISTANCES

Surface of Star is just inside this Orbit

	S=	O=	AU	Million km	Light-		Sub Orbits	Ia	Ib	II	III
Inner System	10	0	0.2	30	100 ls		no			A0-F5	A0-K0
		1	0.4	60	200 ls	Mercury	no		A0	G0-G5	K5
		2	0.7	105	350 ls	Venus	0		A5-G0	K0	M0
	11	3	1	150	8 lm	Terra	0				
		4	1.6	240	13 lm	Mars	0-1	A0-F5	G5	K5	
	12	5	2.8	420	30 lm	Asteroid Belt	0-2	G0	K0	M0	M5
Outer System		6	5.2	780	43 lm	Jupiter	0-3	G5-K0	K5	M5	M9
		7	10	1,500	83 lm	Saturn	0-4	K5	M0	M9	
		8	20	3,000	3 lh	Uranus	0-5	M0	M5-M9		
		9	40	6,000	5 lh	Neptune	0-6	M5-M9			
		10	77	11,550	10 lh	Kuiper Belt	0-7				
		11	154	23,100	21 lh	Kuiper Belt	0-8				
		12	308	46,200	42 lh		0-9				
Remote System		13	615	92,250	3 ld		0-10				
		14	1,230	184,500	7 ld		0-11				
		15	2,458	368,700	14 ld		0-12				
		16	4,916	737,400	4 lw		0-13				
		17	9,830	1,474,500	8 lw		0-14				
		18	19,500	2,925,000	16 lw		0-15				
		19	39,500	5,925,000	32 lw	Oort Cloud	0-16				
		20	78,700	11,805,000	1 ly	Oort Cloud					

O= Orbit No.

ls= light-second
lh= light hour
lw= light week.
lm= light minute.
ld= light-day

Stars shown physically occupy the orbits shown.

THE 10D GRAVITIC DRIVE LIMIT

	Ia	Ib	II	III	IV	V	VI	D
A0	7	5	4	1	1	0	*	*
A5	7	5	3	1	0	*	*	*
F0	7	6	3	1	0	*	*	*
F5	7	6	4	1	0	*	*	*
G0	8	6	4	1	0	*	*	*
G5	9	7	5	3	0	*	*	*
K0	10	7	6	3	0	*	*	*
K5	10	8	7	5		*	*	*
M0	11	10	8	6		*	*	*
M5	11	11	9	8		*	*	*
M9	12	11	10	8		*	*	*

G-Drives inoperable outside this orbit.

THE 100D JUMP DRIVE LIMIT

	Ia	Ib	II	III	IV	V	VI	D
A0	10	9	7	6	5	5		*
A5	10	9	7	5	4	4		*
F0	11	9	7	5	4	3		*
F5	11	9	7	5	4	3	3	*
G0	11	10	8	6	4	2	2	*
G5	12	10	8	7	4	2	1	*
K0	12	11	9	7	5	2	0	*
K5	13	12	10	9		1	0	*
M0	14	13	11	9		1	0	*
M5	15	14	13	11		0	*	*
M9	15	15	13	12		*	*	*

J-Drives inoperable within this orbit.

THE 1000D MANEUVER DRIVE LIMIT

	Ia	Ib	II	III	IV	V	VI	D
A0	13	12	11	9	9	8		*
A5	14	12	10	9	8	7		*
F0	14	12	10	9	8	7		*
F5	14	12	11	9	8	7	7	*
G0	15	13	11	9	8	6	6	*
G5	15	14	12	10	8	6	5	*
K0	16	14	12	10	8	6	5	*
K5	16	15	13	12		6	5	*
M0	17	16	14	12		5	4	*
M5	18	17	16	14		5	2	*
M9	18	18	16	15		4	1	*

M-Drives inoperable outside this orbit.

Limit shown is beyond (within for Jump) the Orbit Number shown. * = inside Orbit 0. Blank = Not possible.

Orbital Distances

Orbits are standardized on the traditional Titus-Bode Relation distances primarily for ease of use.

HZ

5b HABITABLE ZONES

Habitable Zones for Stars of the Spectral Type and Size Shown.

	S=	O=	AU	Million km	Light-	Ia	Ib	II	III	IV	V	VI	D
Inner System	10	0	0.2	30	100 ls						K9-M9	K4-M9	A0-M9
		1	0.4	60	200 ls							G9-K3	
		2	0.7	105	350 ls						G9-K8	G2-G8	
	11	3	1	150	8 lm						G2-G8	F2-G1	
		4	1.6	240	13 lm						F7-G1		
	12	5	2.8	420	30 lm					F7-K3	F2-F6		
Outer System		6	5.2	780	43 lm				F2-G8	A9-F6	A9-F1		
		7	10	1,500	83 lm				G9-K8*	A0-A8	A0-A8		
		8	20	3,000	3 lh			A9-K3	K9-M8*				
		9	40	6,000	5 lh			K4-M3*	M9				
		10	77	11,550	10 lh		A9-M3	M4-M8					
		11	154	23,100	21 lh	F7-G1	M4-M9*	M9					
		12	308	46,200	42 lh	G2-M9*							

Orbit No.

***Complexities:** Size Ia Orbit 12 also includes A0-F6.
Size Ib Orbit 11 also includes A0-A8.
Size II Orbit 9 also includes A0-A8.
Size III Orbit 7 also includes A9-F1.
Size III Orbit 8 also includes A0-A8.

5c SATELLITE ORBITS-1

	S=	O=	Multiplier	
Locked to the Primary	3	Ay	1	Ring System
	4	Bee	2	Ring System
		Cee	3	Ring System
		Dee	4	
		Ee	5	
		Eff	6	
	5	Gee	8	
		Aitch	10	
		Eye	20	
		Jay	30	
		Kay	40	
	6	Ell	50	
		Em	60	

5c SATELLITE ORBITS-2

	S=	O=	Multiplier
Not Locked		En	70
		Oh	80
		Pee	100
	7	Que	150
		Arr	200
		Ess	250
		Tee	300
		Yu	400
	8	Vee	500
		Dub	600
		Ex	700
	9	Wye	800
		Zee	1000

S= is an approximation. Calculate Orbit radius for a definitive S=.

Satellite Orbit radius varies with the gas giant or planet. Calculate Satellite Orbit Radius = Multiplier (GG x or World x) times Primary World Size (use Ehex) for a result in thousands of km.

For example, Luna is orbit Ell around Terra. Terra is World Size 8. Luna orbits Terra at 50 x 8 = 400 thousand km. Titan is orbit Ell around Saturn. Saturn is World Size = S (Ehex = 26). Titan orbits Saturn at 50 x 26 = 1,300 thousand km.

Money

The standard by which the value of objects and labor is measured is called Money. The varied systems of money in use across the universe allow individuals to buy and sell, to accumulate wealth, to settle debts, and to acquire objects.

Understanding money allows characters to effectively participate in economic activity.

THE THREE LEVELS OF MONEY

Money is accounted for in three distinct levels, each with its own purpose and level of efficiency.

Cr Credits

The basic personal form of money is the Credit. Prices for most goods are expressed in Credits.

One **Credit** is roughly the value of a short period (a quarter hour) of unskilled labor.

For example, a down-and-out spacer, stranded on a frontier world, does odd jobs for the owner of the Lone Star: he is paid several credits for an hour of work.

Credits are available in several forms: coins, currency, precious, or electrons.

KiloCredits. Credits may be expressed in KCr Kilocredits (which is thouands of Credits).

MCr MegaCredits

The basic corporate form of money is the MegaCredit, equal to one million Credits. Accounting for large scale transactions, construction of starships, or budgeting for corporate operations is best undertaken in MegaCredits.

One **MegaCredit** is roughly the value of one day of operations by a typical business corporation.

For example, the Dnar Corporation on Querion operates a series of distribution warehouses. It has annual sales of about MCr 350, or MCr1 per day.

By extension, Dnar Corp probably buys MCr175 in goods annually and sells them for MCr350. It spends the difference on warehouses, trucks, and employees. If it can keep its expenses down to MCr150, the remainder is an annual profit of MCr25 distributed to its various shareholders.

RU Resource Units (RU or Aryu)

The basic governmental form of money is the Resource Unit. The RU is a relative unit of value useful for comparison of different governments. The RU is also used in accounting by MegaCorporations.

Calculated Using The Ex. The Economic Extension provides the basis for calculating RU for a world.

RU

Resource Units = R * L * I * (5 - B)

If any value = 0, use 1 (to avoid multiplying by zero).

The Economic Extension in WorldGen explains RU.

There is no direct correlation between **Resource Units** and Credits or MegaCredits.

Aryu Means Wealth Beyond Imagining. When characters gather to discuss the schemes of plans, the term “aryu” (as in “an aryu scheme,” or “this is worth aryu.”) means Wealth Beyond Imagining.

BARTER

Barter is direct transactions without the use of money. They directly trade one type of goods for another; each participant acquires the specific goods he wants in a quantity that makes each side equal.

The Frontier Trader’s Ramp

When a trader lands on a frontier world, he can try to barter with the natives using the well-established ramp market technique.

The trader lays out goods he wants to trade: textiles, trinkets, tools, small devices, or other goods he feels will be attractive to the natives.

The natives, in response, lay out goods that they think may be attractive to the trader: woven baskets, carves wood totems, pieces of shiny rock, artifacts, gold nuggets, or whatever they have on hand.

Each side then positions its goods across from goods they want. When each is satisfied with what the other has to offer, they nod, or slap the ground, or otherwise signal acceptance, and the participants gather up their newly acquired goods.

IN KIND

In Kind transactions pay for goods or services with something other than money, often for the convenience of the participants. Scouts, Merchants, Spacers, Soldiers, and Elites are provided housing and meals in addition to their ordinary wages. Such an arrangement is more convenient for both sides: the employer avoids some level of money payment, and also avoids charging the employee for meals or quarters. Both sides have the luxury of avoiding the accounting details.

THE ELEMENTS TRAVELLER IGNORES

Among the elements ignored in the course of play are:

Taxes. It is assumed that taxes on goods and income are paid as part of the price or the paycheck. Perhaps they are an included Valued Added tax or an incorporated sales tax.

Inflation. It is assumed that the rate of inflation is low and constant and that it can be ignored for most purposes.

Benchmark Costs

Benchmark costs provide a standard against which players and referees can understand the value of money in **Traveller**.

Benchmark
Costs

THE COSTS OF LIVING

Person		Annual	Month	=30% Housing	=40% Meals	=15% Support	=15% Leisure
Poor Person	Soc = 2	2400	200	60	80	30	30
Average Person	Soc = 7	8400	700	210	280	105	105
Rich Person	Soc = C	14400	1200	360	480	180	180

Each Additional Adult plus 75%.
Each Additional Child plus 50%.
If C6= Charisma, use Charisma.
If C6= Caste, use Caste/2.

Basic Formula: Cost of Living = Soc * Cr100 per month.

SALARIES

Occupation	Monthly Salary	Annual Salary
Citizen	250* Terms	3000* Terms
Scholar (no rank/ part time)	100	1200
Scholar	400* Rank	4800* Rank
Entertainer (ordinary)	25* Fame 1-9.	300* Fame 1- 9.
Entertainer (good)	100* Fame 1-9.	1200* Fame 1- 9.
Entertainer (spectacular)	200* Fame 1-9.	2400* Fame 1- 9.
Entertainer (ordinary)	125* Fame 10-16.	1500* Fame 10-16.
Entertainer (good)	500* Fame 10-16.	6000* Fame 10-16.
Entertainer (spectacular)	2000* Fame 10-16.	24000* Fame 10-16.
Entertainer (ordinary)	250* Fame 17+.	3000* Fame 17+.
Entertainer (good)	1000* Fame 17+.	12000* Fame 17+.
Entertainer (spectacular)	4000* Fame 17+.	48000* Fame 17+.
Scout	200* Term	2400* Term
Merchant (no rank)	100	1200
Merchant Officer	100* Rank	1200* Rank
Spacer	100* Rank	1200* Rank
Spacer Officer	200* Rank	2400* Rank
Soldier	100* Rank	1200* Rank
Soldier Officer	200* Rank	2400* Rank
Elite	200* Rank	2400* Rank
Elite Officer	400* Rank	4800* Rank
Functionary	500* Term	6000* Term

Term is the number of terms spent in the career.

Housing and meals are provided at no cost for Scout, Merchant, Spacer, Soldier, and Elite.

For Entertainers, ordinary/good/spectacular = quality of performance.

WAGES

Skill Level	Annual	Month	Hour
Unskilled Skill 0-1	8,400	700	Cr 4
Novice Skill 1-3	12,600	1050	Cr 6
Competent Skill 3-5	21,000	1750	Cr10
Master Skill 5+	29.400	2450	Cr14

Wages are based on 40 hours per week. 2000 hours per year. 175 hours per month.

Rich World: Increase by 20%.

Poor World: Decrease by 20%.

Industrial World: Increase by 40% (as overtime pay [2 hours per day]).

Professionals: Advocate, Medical, Counsellor earn double the stated rate.

Craftsman: Also earn Cr2 per level of Craftman.

Hellworld (if not a Mainworld): Pay is doubled for a one-year contract.

LAND GRANTS

An unimproved Land Grant generates income based on the Trade Classifications of the world and equal to Cr10,000 per TC annually (Cr5,000 if there are no TCs).

NOBLE LAND GRANTS

Noble Rank	Soc	Hexes	Non-MW	Where?	Preferred World
Gentleman	A		1	any	any
Knight	B	1	1	homeworld.	any
Baronet	c	2	2	one system	Pre-Ag or Pre-Ri
Baron	C	4	4	one system.	Ag or Ri
Marquis	D	8	8	one subsector	Pre-Ind
Viscount	e	16	16	one subsector	Pre-Hi
Count	E	32	32	one sector	Hi
Duke	F	64	64	one sector	any
Duke	F	128	128	one sector	any
Archduke	G	256	256	one domain	any

Nobles receive Land Grants on the worlds on which they hold fiefs.

Each Hex generates a profit equal to Cr10,000 per Trade Classification per year. A Hex with no TC generates Cr5,000 annually.

Noble Land Grants are cumulative. Each title confers its own Land Grant.

The first hex in any grant is on the noble's homeworld. All subsequent hexes are randomly allocated. For each hex on a mainworld, a noble is also granted one hex on a non-mainworld in the same system.

MERCHANT PROFIT SHARING

Merchant ships maintain profit sharing for their officer crew. The Plan consists of a total of 20 shares. Each crew officer receives one share per level of Rank.

4th Officer	= 1 share.
3rd Officer	= 2 shares.
2nd Officer	= 3 shares.
1st Officer	= 4 shares.
Captain	= 5 shares.

The pool receives 10% of the profits of the ship's operations.

Annual Payouts. Shares are paid out annually before annual maintenance.

Value, Cost, and Price

Every object has a value, a price, and a cost. It is important to be able to differentiate between the three concepts.

Value

THE WORTH OF THINGS

An object has a value to an individual based on how the object is. Value is defined in money terms, but often evaluated in other than money (a treasured picture of a parent may be worth a great deal to a son, and nothing at all to a stranger).

Cost refers to production. A manufacturer who creates an object encounters a cost in money based on the elements put into the object, the labor required, and a suitable allowance for overhead.

Price refers to sales. The amount for which an object is sold to the consumer is the price.

Value is relative. Somewhere between an object's cost to make and its sale price is its value.

Buying and Selling is a win-win situation. The Seller wants to sell for more than his cost. The Buyer wants to pay less than (or equal to) an object's value. When a buyer and seller make a transaction, both can win.

THE VALUE RULE

The table shows Values. A manufacturer or producer can usually make these goods (in quantity) paying less than Value. A buyer can usually buy these goods individually for Value or slightly more.

> Benchmark										
Typical		Snack	Meal	Clothes	Device	Major Part	ATV	Small Craft	Starship	Large Starship
Salary			1 hr		1 mo	1 yr				
Value		**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Credits		<1	10	100	1,000	10,000	100,000	MCr1	MCr10	MCr100

VALUES FOR OBJECTS

Values are coded as orders of magnitude and help in estimating object costs and prices through simple logic.

Base Value. Base Value is a very rough indication of the worth of an object.

A good meal is worth about Cr10. A cook could pay a grocery cost of Cr5, prepare a meal, and price it at Cr10.

Cost Modifications

The cost (manufacturing cost, production cost, wholesale cost) is a fraction of the Base Value taking into account volume production, production difficulty, resource availability, and technology.

Volume Production. An enterprise can manufacture a quantity of objects at a cost less than their final value.

Very Efficient Production Cost	= Value / 10
Mass Production Cost	= Value / 5
Small Manufacturer 100 item Cost	= Value / 3
Individual Assembler 20 Item Cost	= Value / 2

Price Modifications

The price for an object may be influenced by Supply and Demand.

Price may also be influenced by QREBS

TYPICAL COST MODIFIERS

Flux	Description	Cost	Comment
- 5	Experimental	4.0 x	Before substantial testing.
- 4	Prototype	3.0 x	Handmade sample.
- 3	Early	1.2 x	Preliminary.
- 2	Basic	0.7 x	Elementary. Unenhanced.
- 1	Standard	1.0 x	Normal. Ordinary.
0	(blank)	1.0 x	Normal. Ordinary.
+1	Alternate	1.1 x	Nonstandard performance
+2	Modified	1.2 x	Changed, New features.
+3	Improved	1.1 x	Updated.
+4	Advanced	2.0 x	Multiple new features.
+5	Obsolete	0.5 x	Out of date.

PRICE MODIFICATIONS

Flux	Supply	Mod	Demand	Mod
-5	Ubiquitous	0.5 x	Very Low	0.5 x
-4	Abundant	0.6 x	Quite Low	0.6 x
-3	Very Common	0.7 x	Low	0.7 x
-2	Quite Common	0.8 x	Weak	0.8 x
-1	Common	0.9 x	Less Ordinary	0.9 x
0	Typical		Ordinary	1.0 x
1	Uncommon	1.2 x	Good	1.2 x
2	Scarce	1.4 x	Strong	1.4 x
3	Rare	1.6 x	High	1.6 x
4	Quite Rare	1.8 x	Quite High	1.8 x
5	Very Rare	2.0 x	Very High	2.0 x

Price Modification can be used in two different ways:

Ordinary Objects. Roll for Demand only.

Special Objects. Roll for both Supply and Demand and combine them.

Object Size

Objects can be identified with specific dimensions, but for many, it is more convenient to describe them with a Size: a general description of its bulk or volume. Size corresponds to the Benchmark objects used with the Senses and with Sensors.

Size

UNDERSTANDING SIZE

Size indicates the approximate size or dimensions of an object.

The chart shows the basic benchmark sizes. For example, the referee may say,

"You see a Person-Size something in the distance."
"You see a Size-5 object on the starport tarmac."
"Sensors pick up a Missile-Size object at separating from that ship."

Size covers a broad descriptive range, and includes some overlap. Person-Size may indicate anything larger than a suitcase and smaller than a truck. Suitcase may indicate anything larger than a book and smaller than a person.

Sizes can be decimal. An object slightly smaller than Size-6 is Size 5.9; a slightly larger object is Size 6.1.

Carrying and Using. A Size-N sophont can typically carry and use any object less than its own Size. For example, a Size 5 Sophont can carry and use a Size 4 Object. A Size-6 truck can carry many Size-5 objects.

Size and World Range (or Distance) are related. A person with ordinary vision usually see an object of Size-N or larger at Range-N or less.

SIZES AT WORLD RANGES

> Benchmark										
		Wire	Word	Bullet	Card	Book	Suitcase	Person	Truck	Tower
Size		1 mm thin	2 mm 10 point	7 mm 0.3 inch	75 mm 3 inches	200 mm 8 inches	750 mm 30 inches	1.5 m 5 feet	7.5 m 25 feet	75 m 250 feet
Size	**0**	**R**	**T**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Distance	Contact	.5m	1.5m	5m	50m	150m	500m	1000m	5km	50km
Weapon			Serial No.	Bullet	Snub	Pistol	Rifle	Person	Vehicle	
Vehicle		Crack	Seam	Bolt				Person	Truck	SC
Device		Wire					Fusion+	Person		

Size= approximately the width of 5 minutes of angle at the range shown.

DECIMAL SIZES

Length			1.0 mm	2.0 mm	7 mm	7.5 cm	20 cm	7.5 m	1.5 m	7.5 m	75 m
1	.1	.1 mm	1.1 mm	2.5 mm	8 mm	8 cm	25 cm	.8 m	1.6 m	8 m	80 m
2	.2	.2 mm	1.2 mm	3.0 mm	9 mm	9 cm	30 cm	.9 m	1.7 m	9 m	90 m
3	.3	.3 mm	1.3 mm	3.5 mm	10 mm	10 cm	35 cm	1.0 m	1.8 m	10 m	100 m
4	.4	.4 mm	1.4 mm	4.0 mm	11 mm	11 cm	40 cm	1.1 m	1.9 m	11 m	110 m
5	.5	.5 mm	1.5 mm	4.5 mm	45 mm	15 cm	45 cm	1.0 m	2.0 m	45 m	450 m
6	.6	.6 mm	1.6 mm	5.0 mm	50 mm	16 cm	50 cm	1.1 m	5.0 m	50 m	500 m
7	.7	.7 mm	1.7 mm	5.5 mm	55 mm	17 cm	55 cm	1.2 m	5.5 m	55 m	550 m
8	.8	.8 mm	1.8 mm	6.0 mm	60 mm	18 cm	60 cm	1.3 m	6.0 m	60 m	600 m
9	.9	.9 mm	1.9 mm	6.5 mm	65 mm	19 cm	65 cm	1.4 m	6.5 m	65 m	650 m

HOW BIG IS IT REALLY?

Roll Flux to randomly generate an object size.

Flux	x	R= **0**	**R**	**T**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
-5	0.5	--	0.5 mm	1.0 mm	2 mm	20 mm	10 cm	20 cm	1.0 m	3 m	20 m
-4	0.6	--	0.6 mm	1.2 mm	3 mm	30 mm	12 cm	30 cm	1.1 m	4 m	30 m
-3	0.7	--	0.7 mm	1.4 mm	4 mm	40 mm	14 cm	40 cm	1.2 m	5 m	40 m
-2	0.8	--	0.8 mm	1.6 mm	5 mm	50 mm	16 cm	50 cm	1.3 m	6 m	50 m
-1	0.9	--	0.9 mm	1.8 mm	6 mm	60 mm	18 cm	60 cm	1.4 m	7 m	60 m
0	**1.0**		**1.0 mm**	**2.0 mm**	**7 mm**	**75 mm**	**20 cm**	**75 cm**	**1.5 m**	**7.5 m**	**75 m**
+1	1.2	0.1 mm	1.2 mm	2.4 mm	8 mm	80 mm	30 cm	80 cm	2 m	10 m	80 m
+2	1.4	0.2 mm	1.4 mm	2.8 mm	9 mm	90 mm	40 cm	90 cm	3 m	20 m	90 m
+3	1.6	0.4 mm	1.6 mm	3.2 mm	10 mm	100 mm	50 cm	100 cm	4 m	30 m	100 m
+4	1.9	0.6 mm	1.8 mm	3.8 mm	11 mm	120 mm	60 cm	120 cm	5 m	40 m	110 m
+5	2.0	0.8 mm	1.9 mm	4.0 mm	12 mm	150 mm	70 cm	150 cm	6 m	50 m	120 m

Hot and Cold Benchmarks

Hot and Cold Impact

Na HOT AND COLD BENCHMARKS — In D

K	C	Hits		Descriptor
0	**-273**	**144**		Absolute Zero
25	**-250**	**121**		Hydrogen Ice
50	**-225**	**100**		Oxygen Ice
75	-200	**81**		Nitrogen Ice
100	-175	**64**		
125	-150	**49**	Cold	
150	-125	**36**		
175	-100	**25**		
200	-75	**16**		Radon Ice
225	-50	**9**		
250	-25	**4**		
275	0	**1**		Cold
300	25	**0**		Human Temperate
325	50	**1**		Hot
350	75	**4**		
375	100	**9**		Boiling Water
400	125	**16**		Sulfur melts
425	150	**25**		
450	175	**36**	Hot	
475	200	**49**		
500	225	**64**		Tin melts
525	250	**81**		Fire
550	275	**100**		
575	300	**121**		
675	400	**225**		
775	500	**361**		
875	600	**529**		
975	700	**729**		
1075	800	**961**		
1175	900	**1225**		
1275	1000	**1521**		
1375	1100	**1849**		
1475	1200	**2209**		
1875	1500	**3481**		

Hits per Round (= 1 minute)
Hits calculated based on (K= Kelvins):

Hits = ((K / 25) / 12) ^2

Nb IMPACT DAMAGE — In D

Speed	kph	Hits	Descriptor	Alt Descriptor
0	0	**0**	Still	Not Moving
1	5	**1**	Creep	Walking
2	10	**4**	Crawl	Running
3	20	**9**	Xslow	
4	30	**16**	Vslow	Sprint 100 m
5	50	**25**	Slow	Gallop (horse)
6	100	**36**	Standard	
7	300	**49**	Cruise	
8	500	**64**	Fast	
9	700	**81**	Vfast	
10	1000	**100**	Sonic	
11	2000	**121**	Supersonic	
12	3000	**144**	Hypersonic	
13	5000	**169**		
14	10000	**196**		
15	20000	**225**		
16	40000	**256**	Meteoric	
17		**289**		
18		**324**		
19		**361**		
20		**400**		

Hits upon impact.
Hits calculated based on (S= Speed):

Hits = S^2

Multiply by tons (or fractional Tons) of impacting object.
Space Combat uses Size instead of Tons.

INSULATION PROTECTION RANGES

In=	usually protects against		for absolute protection
510	-275	to 325	In= 810
430	-250	to 300	In= 730
360	-225	to 275	In= 610
290	-200	to 250	In= 490
230	-175	to 225	In= 390
180	-150	to 200	In= 300
130	-125	to 175	In= 220
90	-100	to 150	In= 160
60	-75	to 125	In= 100
40	-50	to 100	In= 60
20	-25	to 75	In= 30
10	0	to 50	In= 10

For Cold Protection, an On-Board Heater increases the Cold Protected temperature - 100 C.