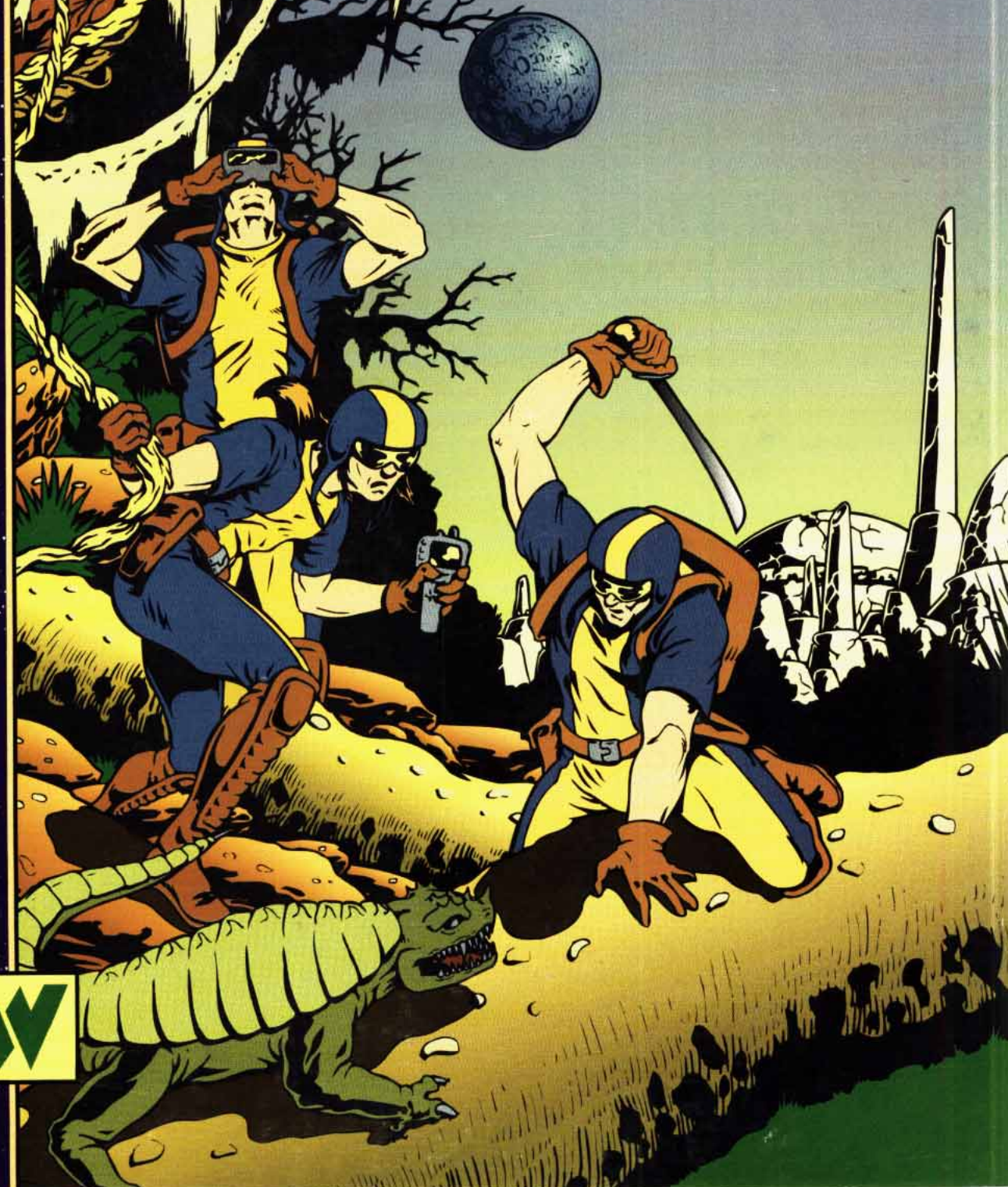
Science Fiction Roleplaying Game

TRAVELLER®

The New Era

0311

WORLD TAMER'S™ HANDBOOK



GDW

To BUILD the future

To DARE greatly

To take one's PLACE in the arena



Life takes place against a grander tableau in the New Era. Without an omnipotent Imperium that has already imposed order on everything, the act of every man, woman, and child looms larger, has a greater impact. And when even seemingly small actions have large results, imagine the sort of effect a person can have when daring greatly. The course of civilizations can be changed.

In the New Era, entire worlds have died, or fallen back into barbarism. These worlds need people to come make them live again, and leaders to take them back into the light. Such people need to have a variety of skills: they must be explorers, they must be builders, they must be leaders. They must have the courage to take on the power of a raw world and emerge victorious. These explorers, these builders, these leaders have a name. They are called World Tamers.

The **World Tamers Handbook** brings to **Traveller®: The New Era** a new arena in which to adventure: the ragged border of civilization, the realm of the unknown on a thousand worlds that do not know the light of civilization. **World Tamers Handbook** provides material to create Survey campaigns in which characters push humanity's knowledge out into the Wilds, Bootstrap campaigns in which characters lift low-tech populations out of barbarism, and Colony campaigns in which characters found and lead expeditions to repopulate entire worlds.

In order to do this, World Tamers Handbook provides rules on colonial economics and infrastructure which allow players and referees alike to understand what makes a colony run, and what decisions need to be made to ensure success. These rules are not only useful for the campaigns in this book, but can be used to flesh out societies in any **Traveller: The New Era** campaign or adventure.

In addition, expanded rules on world generation allows referees to create the details needed by players conducting detailed survey operations in advance of the colony transports.

Finally, additional design sequences expand on the information contained in **Fire, Fusion, & Steel** to allow the design of black powder weapons, bow weapons, and low-technology ground transportation.

A world can be a big, rough, wild place, but no world is too big, too rough, or too wild for characters bold enough to be called world tamers.

WORLD TAMER'S™ HANDBOOK

Worlds to be found
Worlds to be won
Worlds to be tamed

Meet the challenge.

GDW: 0311 $14.00

0 86079 00311 1

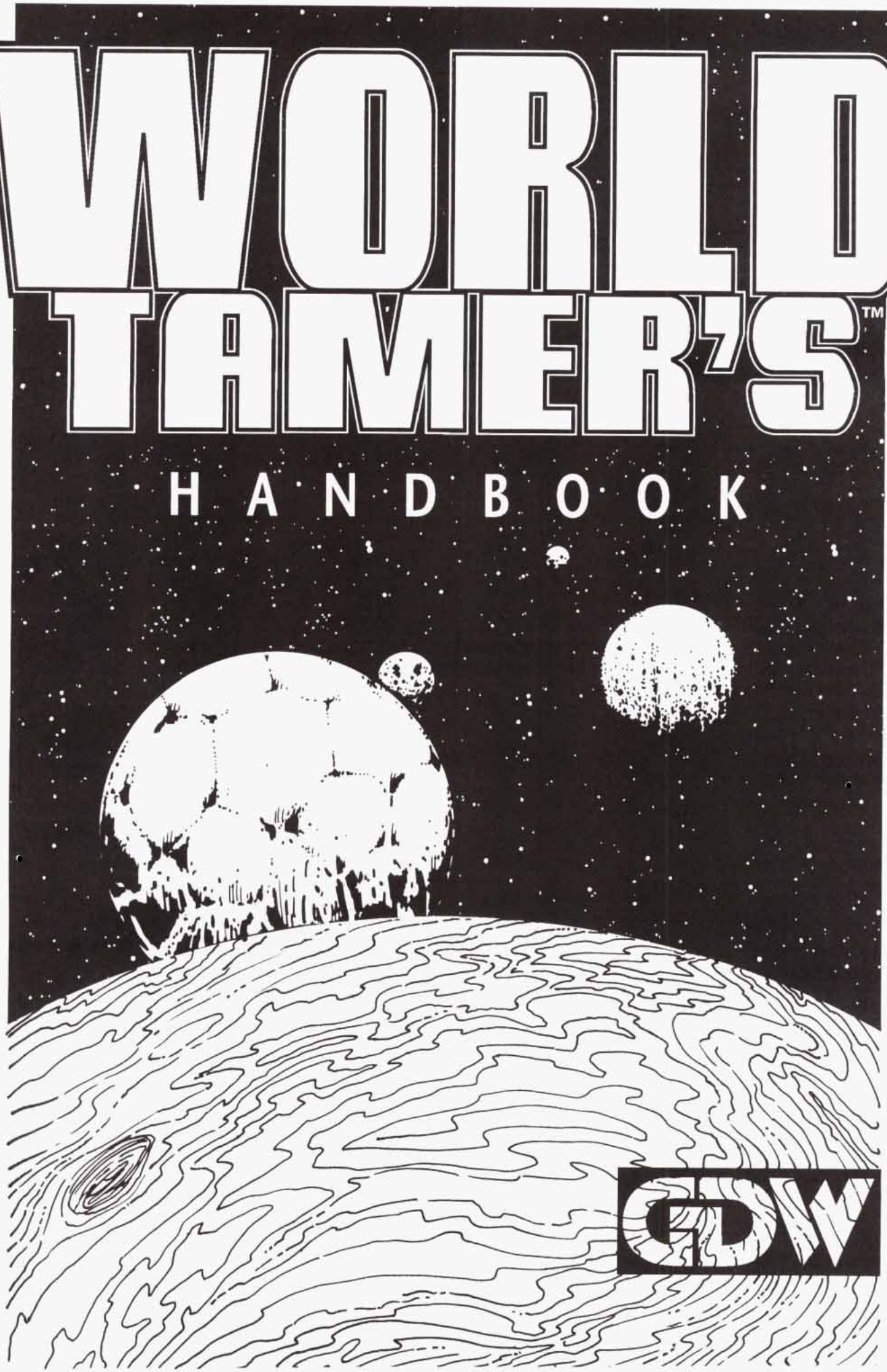
ISBN 1-55878-168-4

Traveller® is a registered trademark of GDW, Inc.
Copyright © 1994 GDW, Inc.
All rights reserved.
Made & printed in U.S.A.

GDW
P.O. Box 1646
Bloomington, IL 61702-1646

WORLD TAMER'S™

HANDBOOK



GDW

For RoseMarie and Devon. If we had whole worlds to give them, we would.

Design: Terry McInnes and David Nilsen
Additional Design and Development: Frank Chadwick and Loren Wiseman
Material from MegaTraveller World Builder's Handbook by: Joe D. Fugate, Sr., J. Andrew Keith, and Gary L. Thomas, with additional design by Robert Parker, Nancy Parker, James Holden, Rob Caswell, and Ed Edwards
Typesetting and Proofreading: Eric Vance Curl
Art Direction: Kirk Wescom
Cover: Kirk Wescom
Graphic Design and Production: Kirk Wescom and Bradley K. McDevitt
Interior Art: Bradley K. McDevitt and Kirk Wescom

World Tamers Handbook™
Copyright © 1994, GDW, Inc.

World Tamers Handbook™ is GDW's trademark for its world and colony design sourcebook set in the **Traveller®** universe. **Traveller®** is GDW's registered trademark for its science-fiction roleplaying game.

Made in USA. Printed in USA. All rights reserved.
ISBN 1-55878-168-4



P.O. Box 1646
Bloomington, IL 61702-1646

Table of Contents

1: Introduction 4

2: Organizing Your Campaign 5

3: Survey 7
- Starting Out 8
- Star System Exploration 9
- First Landing 10
- General Survey Tasks 10
  - Atmospheric Pressure 11
  - Atmospheric Taint 15
  - Planetary Density & Gravity 17
  - Temperature & Weather 17
  - Environmental Research and Testing 17
- Goal-Oriented Survey Tasks 18
  - Hex Scale 19
  - Terrain Types 19
  - The Goal-Oriented Survey Task 20
  - Agricultural Capacity 20
  - Raw Materials Capacity 21
  - Extractable Hydro Power 21
  - Extractable Wind Power 22
  - Compile Economic Model Data 23
- Survey as Adventure 23
  - Mapping 23
  - Weather 23
  - Animals 24
  - Inhabitants 24
  - Diseases 24

4: Colonial Economics & Infrastructure 26
- Running a Colony 26
- The Colonial Economic Model 27
  - Basic Structure 27
  - Agriculture 27
  - Industrial Production 28
  - Materials Industry 30
  - Power 30
  - Infrastructure 31
  - Armed Forces 33
  - Maintenance 35
  - Off-World Trade 35
  - Set-up Procedures 36
  - Acclimatization 36
- Playing the Colonial Economic Model 36
  - Annual Considerations 36
  - Random Events 36
  - Standard of Nutrition 37
  - The Monthly Turn 38
  - Standard of Shelter 39
  - Standard of Living 39
  - Political Roll 40
  - Using Persuasion and Leadership 41
  - The Output Roll 41

5: Mass Combat System 42
- Scale 43
- Turns 43
- Rating Units 43
- Mobility 43
- Detection 44
- Blocking Movement 45
- Withdraw Before Combat 45
- Combat 45
- Hit and Run 45
- Morale 45
- Fatigue 46
- Supply 46
- Terrain Effects Chart 47

6: Bootstrap 48
- Hiring On 49
- Referee's Section 49
- Recruiting 51
- Transit 52
- Planetfall 53
- The Mission 55
- Players' Handouts 57
- Integrating PCs with the Mass Combat System 63
- Using the Economic Model 64
- Random Events 64
- Animal Encounter Tables 66

7: Colony 68
- The Venture 69
- Referee's Notes 69
- Getting There 70
- Colonists 70
- The Colony 72
- The First Year 72
  - *Template NPCs* 73
- Subsequent Years 76
- Players' Handouts 77
- Animal Encounter Tables 80

8: Stars & Planets 82
- Detailing Planets 83
  - Years and Days 83
  - Base Mean Surface Temperature and Variation 84
  - Seasons 85
  - Day/Night Temperature Variation 85
  - Axial Tilt Effects 85
  - Temperature Worksheet 86
  - Temperature on Tidally Locked Worlds 86
  - Density & Gravity 87
  - World Mass 87
- Mapping a World 88
- Atmospheric Composition 90

9: Design Sequences 92
- Black Powder Firearm Design 92
- Wagons 95
- Bow Weapon Design 96
- Black Powder Cannon Design 97

10: Equipment 100
- Smoothbore Flintlock Musket & Rifled Musket 101
- Blunderbuss & Double Blunderbuss 102
- Blunderbuss Pistol & Horse Pistol 103
- Wall Gun & Flintlock Rifle-Musket 104
- 13.5cm & 9.5cm Field Guns 105
- 7.5cm Rifled Field Gun & 12cm Howitzer 106
- Tukera Freighter 107
- *Hercules*-class Bulk Carrier 108
- Frontier Transport 109



CHAPTER 1: INTRODUCTION



World Tamer *('wərld tām-ər) 1. A member of a team of professional explorers, technicians, and social engineers sent to a low-technology world with the mission of advancing the world's technological and productive capacities and reintegrating that world into the interstellar community. 2. A professional, experienced leader of a colonizing expedition sent to settle an unpopulated or very low population primitive world with colonists from a relatively high tech mother world. 3. Any individual working to uplift, colonize, or civilize an isolated, uninhabited, or primitive world.*

The **World Tamers Handbook** is a **Traveller: The New Era** sourcebook as well as several adventure campaigns built around the theme of rebuilding shattered worlds near the Reformation Coalition (or other surviving pockets of civilization). In either role, it is intended for use with GDW's **Traveller: The New Era** roleplaying rulebook. **Traveller: The New Era** is referred to as "**TNE**" for simplicity throughout this book. Other required materials are at least one 10-sided die, at least two six-sided dice, and pencils and paper. A calculator is highly recommended. The **Fire, Fusion, and Steel** technical architecture sourcebook will also be necessary in conjunction with some of the design sequences in this book. **Brilliant Lances**, the **TNE** starship combat boardgame, may also be used to resolve space combat scenarios fought during the adventure campaign.

Source Book

As a source book, **World Tamers Handbook (WTH)** provides referees with expanded or new information on the following subjects:

- A playable planetary economic model, including agricultural, raw materials, and industrial components, fully interlinked with the characteristics of planetary environment
- Star and planetary system generation and detailing
- Expanded planetary survey rules that mate with the planetary economic model, allowing players to seek out worlds suited for habitation and development
- Rules for acclimatization to new environments
- Battalion-level mass combat rules, allowing the resolution of large-scale combat in **Traveller**
- Archaic weapons design sequences including black powder small arms, black powder cannons, and bows
- New equipment based on the new design sequences plus three new starships suited for colonization missions

As a sourcebook, **World Tamers Handbook** allows you to create a world and build a civilization on it from scratch.

Campaigns

World taming is a big, complex topic for a **TNE** campaign. Your players will be shaping the destiny of a world as they interact with local NPCs and try to convince them of the benefits of civilization, or as they lead a group of colonists on a raw frontier world. World tamer campaigns can be played on various levels of detail, from high-level planning and decision-making to low-level roleplaying. Often, a given campaign will shift from level to level as the situation and the players' interests warrant. For example, worlds will be surveyed and the world tamer team can meet and interact with animals or indigenous inhabitants on a day-to-day, one-on-one basis. This low level campaign action may shift to a higher level with progress occurring month to month as the players administer the world-taming effort as the leaders of a colonization team. However, sudden events, such as an attack by a hostile power, political unrest, or natural disasters, may shift the campaign focus back to the low, person-to-person level as a crisis is resolved with work, negotiation, or combat.

World Tamers Handbook offers three campaign scenarios and material to create a myriad of others. The three scenarios are the Survey adventure, Bootstrap campaign, and Colony campaign. These scenarios use different combinations of the material presented in the **World Tamers Handbook**, and referees will need to make a number of decisions before beginning play. Depending on the desired mix of high and low level play and the amount of pre-generated background that will be needed, referees will use this handbook in one of several ways. This organizational material is presented, broken down by scenario type, beginning at the top of the facing page.



CHAPTER 2: ORGANIZING YOUR CAMPAIGN

Campaign (kam 'pān) n. 1. A series of military operations with a particular objective in a war. 2. A series of organized, planned actions for a particular purpose.

CHOICES

Before beginning your World Tamers adventure you must make a number of choices to set a background tone. The choices you make depend on your experience as a **Traveller** referee and the experience and interests of your players. Are the members of your group novices interested in both learning the **Traveller** roleplaying game system and having a rousing good time? Then hire them on as security specialists for a bootstrap or colony expedition. Are your **Traveller** players really experienced and the kind that would rather use Persuasion, Act/Bluff, and other Charisma-related skills to convince low tech indigenous farmers that it's better to use an iron plow to till a field than an iron spear to kill a man? Then have them lead a bootstrap expedition into the Primary AO, uplift friendly primitives, and help them protect themselves from hostile neighbors.

Read the campaign possibilities in this book and weigh them against the interests of your players. Many of the campaign themes are fairly cerebral, with such mundane but important activities as establishing a local economy or determining whether available food supplies will last until the next crop comes in, and if not, what to do about it. Not as glamorous as a firefight, but just as much a matter of life and death. More advanced players might prefer playing this type of role. Other players, however, might prefer playing the cops on a colonial expedition who keep order and solve crimes on the wild frontier.

LEVELS

The term "levels" describes the degree of involvement of players with NPCs in a campaign. There are basically two approaches to playing a world tamer campaign (or, indeed, any roleplaying campaign): low level and high level, but by combining elements of these two approaches, a referee can establish any level in between, based on the needs of the campaign action and the interests of the players.

Low: Low-level roleplaying places the players down in the campaign interacting with NPCs and the referee in "real time," one-on-one. Time is measured in seconds in a firefight, minutes during personal interaction or perhaps in four-hour increments if the players are travelling overland. In a high-level campaign, player characters may order their troops into battle, but in a low-level campaign, the PCs are the ones pulling the triggers.

High: High-level roleplaying pulls players back from direct interaction on a roleplaying level. The players are are high-level decisionmakers, and the time scale is often stretched out into weekly or monthly increments. For example, players examining the resources of a world to determine how best to create a productive society there are engaged in high-level roleplaying. Or, in another vein, in a low-level campaign, the PCs are concerned about surviving through the current firefight. In a high-level campaign, the PCs are concerned about planning and supplying campaigns, where to send the army next if the battle is won, or what to do if it loses? Which of these levels is most interesting? That depends on the interests of the players.

	Low Level	*High Level*
Game Time Increments	Daily, Hourly	Monthly
Character Involvement	Personal	Abstract
Characters	Hired Tech/Security	Team Leaders/Technical Experts
Suited For	Action/Adventure/Quick Rewards	Planning/Analysis/Long Term Results
Player Experience	Novice to Experienced	Experienced to Expert
Referee Experience	Novice to Experienced	Expert

High-Low Interface: Both levels of roleplaying are found in many campaigns, and this presents a challenge to the referee. Even the most cerebral colony campaign can be punctuated by low-level play as unexpected events happen and crises have to be handled. In a sense, a high-level campaign can be thought of as a "scenario generator" for low-level roleplaying as important decision points occur.

The challenge to the referee is to be able to shift rapidly from the general, in which the players manipulate economic inputs on a monthly basis, to the specific, in which they could use their skills to stop a disease, persuade an unruly rebel, or defeat an invading enemy army. This requires the referee to have a clear understanding of the world that is being modelled: what individual-level, one-on-one adventures will have an input visible up at the high level?

This is easiest if the referee has planned when to shift the campaign from high to low level, but there may also come times when the players decide that they want to "get their hands dirty" and go out and do some world taming on their own.

Perhaps this involves appearing before a gathering of disgruntled citizens and attempting to persuade them to work a little harder, even though there's not much food right now. Perhaps it means hunting down and killing a dangerous local animal that has been preying on livestock. These details will be related to rolls on the various random events tables, and to the referee's vision for the course of the campaign, but these high-low transitions will clearly require a deft and skillful touch by the referee. Details and suggestions for these transitions are presented in the Bootstrap and Colony chapters.

CAMPAIGNS

The three adventure/campaigns presented in this book focus on different activities, high/low level flavor, and material elsewhere in this book that they will draw on.

Survey

Surveying worlds near the Reformation Coalition is usually the responsibility of the Reformation Coalition Exploratory Service, which provides data used to plan bootstrap and colony operations. However, the RCES often uses free-lancers for survey and intelligence gathering missions, and here is where the PCs come in. RCES may recruit them to survey one or more star systems and their planets. Or, they may independently find a world suitable for a bootstrap operation or colonization, survey it, and sell the information to the RCES. A survey can be an adventure in itself, or it can be the beginning phase of a long-term bootstrap or colonization campaign.

If the survey is leading up to a bootstrap campaign, much may already be known about the target world. However, detailed maps of the world's features and studies of the world's weather and climate need to be made, as well as ground surveys of its agricultural and mineral resources. In this case, skip the star system details and go to page 9 of the Survey chapter.

If the survey is leading up to a colonization campaign, the survey may well be dealing with a world and star system that are



mostly unknown. A survey begins the moment the survey ship breaks out of jump space. The survey team uses their Astrogation skills to make sure they are in the right place, and how to find their way home. Then they search for the system's habitable planet and determine the system's features using the Stars & Planets chapter of this handbook. In this case, go to page 9 of the Survey chapter.

Once the target planet is located, the surveyors take their ship in for a closer look, mapping the planet and studying its weather. If it still seems to be a good place for a colony, ground survey teams are landed. These teams analyze the soil for fertility, probe for potential mineral deposits, check the atmosphere for all kinds of contaminants, and so on.

A survey mission intended as a stand-alone adventure provides plenty of potential action, too: contact with indigenous peoples or dangerous animals is always a possibility. This is a relatively short term operation, and with some preparation can be easily used for low-level day-to-day wilderness adventuring; see page 23 of the Survey chapter. If refereed with imagination, it can be a great adventure used to introduce the novice player to **Traveller** role playing and to the New Era.

Bootstrap

Bootstrap operations involve sending small teams to friendly worlds or friendly nations on balkanized worlds near the Reformation Coalition, and uplifting friendly indigenous peoples into partnership with the RC. These teams include diplomatic, agricultural, geological, civil engineering, medical, industrial technology, communications, and military specialists. They establish friendly relations with the local government, dispense medical care to the local population, help local farmers improve the yield and diversity of their crops, and help establish local industries that use indigenous resources to improve the area's technology. Because teams are often inserted in hostile territory, they include military specialists that help provide security for the team's civic action personnel. When a bootstrap team is working with a friendly government on a balkanized world, the military specialists also work as military advisors to their host governments. They help train indigenous troops to defend themselves and the civic action teams from attacks by hostile forces. The bootstrap concept is not new to the Coalition. It is an age-old idea that a nation can win over the "hearts and minds" of a less advantaged people by showing them the tangible benefits of allying with the more advantaged nation.

Bootstrap campaigns are likely to begin with low-level roleplaying as the team becomes established. It will probably shift to high level as on-going survey, education, and industrialization work begins. Here, the players will plan and monitor the results of their work in their specialties. Crises will erupt, however, demanding the return to low-level roleplaying—often at unexpected times.

Referees can tailor a bootstrap campaign to their own and their players' interests and abilities by assigning players to appropriate characters and roles. Players interested in a campaign emphasizing high-level roleplaying can be the team leaders, or agricultural or technological advisors. A bootstrap campaign involving more one-on-one low-level play can revolve around characters playing medics or explorers gathering resource and social data in the countryside around the team site. Action/adventure players can participate as military specialists providing security for the team or military advice to indigenous forces.

A bootstrap campaign is a long term campaign lasting a year or more in game time. Your players, especially action/adventure types, may not want to wait that long for their rewards. To get around this, limit their service with the team to a specific length of time and move them on to another campaign scenario, either on the same world or elsewhere. More patient characters who stay for the full campaign will earn greater rewards than a mere salary.

If the players are to be team leaders or specialists that expect to play the full campaign, go to page 48 of Chapter 6 Bootstrap. If no system survey data is available, go to page 9 of the Survey chapter. If the players expect to play a short-term campaign with a specific specialty and purpose, go to page 61 of the Bootstrap chapter. In order to run a bootstrap campaign, the referee must be familiar with the mechanics of Chapters 4, Colonial Economies and Infrastructure, and 5, the Mass Combat system.

Colony

In this campaign, your characters are hired by the Reformation Coalition world of Baldur to lead the colonization of a world just outside the RC. Baldur, a water world with a poisonous atmosphere, is one of the rare worlds to survive into the new era which cannot support human life without technological assistance. It is one of the most pragmatic supporters of the Coalition's charter to rebuild interstellar civilization and is willing to "go it alone" if necessary. Not only will Balduri-colonized worlds add to the growth of the Coalition, they will also enhance Baldur's economic weight within the Coalition by broadening its markets and expanding its variety of exports. Unlike the mother world, however, all of the Balduri colonies are to be created on habitable worlds for simplicity and to avoid dependence on external sources of technology.

If no current survey data is available, your players should begin by flying a survey mission to the target world and determine if it will support a colony. If not, they may want to continue exploring nearby worlds until a suitable planet is found. In these cases, start your adventure with page 69 of Chapter 7, Colony, for players' information and then go to page 9 of the Survey chapter. As the colony adventure focuses on economic leadership and administration, the referee must be fully conversant with Chapter 4, Colonial Economies and Infrastructure.

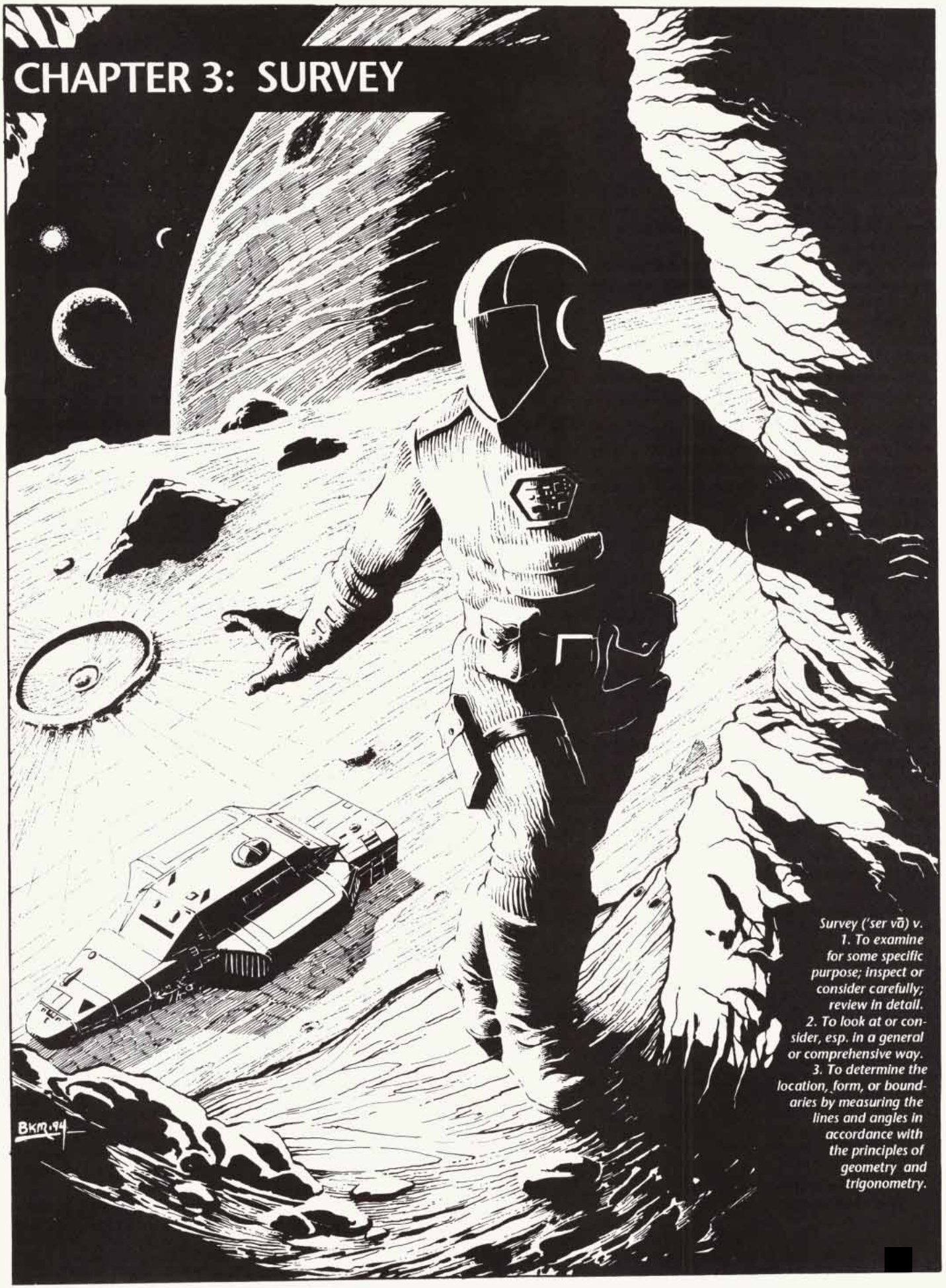
The next step of the colony campaign is to recruit colonists. If the players and referees intend to have the option for low-level play, this step will involve the players personally interviewing key professionals and technicians. Then a transport will take the players and colonists to their new world where they will establish a settlement on a lightly or totally uninhabited continent. Here they will make crucial decisions determining the allocation of limited resources to get the colony started out, and build it into a self-sustaining economy with off-world trade.

A colony campaign has both high and low-level role-playing, much like the bootstrap campaign. However, the circumstances and feel of the campaign are much different. Instead of dealing with a primitive native population and the dynamics of existing governments, your players are, for the most part, dealing with people from a settled world suddenly dumped on their own into the wild frontier. They must rely totally on what they carry with them to the new world. Careful planning is essential as they determine how many people to devote to agriculture and how many others to produce materials and develop industry in the colony. Although crises will occur and there will be opportunity for one-on-one adventure, a colony campaign is probably more suited to referees and players who like a more analytical game.

Other Worlds

The use of this book is not limited to the above campaigns; these are examples only. By mixing and matching portions of this book, and by creating new situations and environments, **World Tamers Handbook** provides a springboard for an infinite variety of adventures on frontier worlds. Leap backward into ancient history and begin on Earth, colonizing a world orbiting Alpha Centauri as the Terran Confederation begins to reach out into interstellar space. Or, in the New Era, begin in a Pocket Empire that is beginning to expand to its neighboring stars, or start the re-expansion of the Regency as it works to rebuild the glorious fallen Imperium. You are limited only by your imagination.

CHAPTER 3: SURVEY



Survey ('ser vā) v.
1. To examine for some specific purpose; inspect or consider carefully; review in detail.
2. To look at or consider, esp. in a general or comprehensive way.
3. To determine the location, form, or boundaries by measuring the lines and angles in accordance with the principles of geometry and trigonometry.



REFEREE'S INTRODUCTION



The survey chapter is provided as an adventure to let your players gather star system and planetary information either as a stand-alone mission or as a prelude to bootstrap or colony campaigns. It is to be used along with the Stars & Planets chapter, which contains TNE's detailed star system and planetary generation rules.

This chapter is not mandatory if your players are interested in the bootstrap or colony campaigns. The RCES may have already surveyed target worlds and their systems, and have compiled briefing sheets for some worlds. These are available in the Bootstrap and Colony chapters. On the other hand, your characters may know of an interesting world and have hired on as free lancers for RCES to map and survey that world in detail.

If you use the briefing sheets, you may want to reveal some or all of the information to your players at the beginning of the campaign. This would eliminate the need for a survey mission. However, if they want to fly a survey mission, you can then use the information in the sheets as the results of their survey work, revealing it in small bits as the players perform their survey tasks.

For an even greater sense of exploration if the player characters are heading into the virtually uncharted Wilds, use the rules in this and the Stars & Planets chapter to create a star system from scratch. You can create your own planetary maps using the mapping guidelines found at the end of Stars & Planets.

The Exploration section in the basic TNE rulebook should also be consulted for additional details and considerations.

STARTING OUT

Characters hiring on for a survey mission as a prelude to both the bootstrap and colony campaigns will be hired on at Baldur, also the starting point for both these campaigns. Stand-alone survey missions may begin at any major Reformation Coalition world including Oriflamme, Aubaine, Aurora, or Nike Nimbus. However, the traditional starting point of RCES missions spinward into the Wilds is Dawn Base on Trybec.

If the survey mission is part of a colony campaign set elsewhere than the RC, they should start the mission at the sponsoring world of the colonization campaign. This may be in a pocket empire, somewhere near Terra, or even in or near the Regency.

Survey Ships

No matter where they start, the characters will need a survey ship for their mission. In an RC campaign, they may be aboard a Coalition ship with other free-lancers or RCES members. Or, the RCES may loan them a ship. Elsewhere, the sponsoring world government will loan them a survey vessel.

To determine the exact type of ship the group receives, roll 2D6 on the Recon Ship Table. One of four types may available:

RECON SHIP TABLE

2D6	*Ship*
2	Survey Ship
3	Lab Ship
4	Scout
5	Scout
6	Far Trader
7	Scout
8	Far Trader
9	Scout
10	Far Trader
11	Far Trader
12	Lab Ship

(See TNE pages 366-379 or the **Brilliant Lances Technical Booklet** for technical descriptions of these ships.)

Survey Ship: A *Donosev*-class survey ship originally built for the Last Imperium as one of a fleet for the Imperial Second Survey. Although it has deteriorated since it was built nearly 100 years ago, the *Donosev* class has the best suite of survey and detection instruments available. This vessel also has an excellent laboratory aboard. She is capable of Maneuver 2 and Jump 3, and includes a 50-ton modular cutter and three air rafts as subordinate craft for close-in survey work and refueling operations. Drawbacks: a small PC group would be hard pressed to crew this large vessel. And it is probably the ugliest ship in the sky.

Lab Ship: Originally designed as a mobile base for scientific studies, the lab ship is the next best choice to the survey ship. She contains good quality survey instruments and a laboratory. She also has roomy accommodations and can carry a survey team of up to 20 members as well as five crew members. The lab ship is designed to be on station at a world under study for long periods. Consequently, she is ring-shaped and can be spun about her fore and aft axis to produce artificial gravity without using ship's power.

The lab ship has a 10-ton launch for use as a close-in survey and landing vehicle. The lab ship is capable of Maneuver 1 and Jump 2.

Scout Ship: A pre-Collapse scout ship, this vessel has barely adequate survey and detection gear. Accommodations are also cramped, especially for a long voyage. The ship has also been overhauled many times with non-standard components, and should be treated as having a wear value of 8 (see TNE pages 241-244). The scout is capable of Maneuver 2 and Jump 2. This ship has one advantage, it can land on planets with atmospheres.

Far Trader: This is a tramp cargo vessel capable of Maneuver 1 and Jump 2, when it works right. This decrepit starship may suffer a breakdown at any moment. The hull and engineering systems are held together with rust, spit, and bailing wire. The survey instruments and detection gear are whatever the characters can hang on her hull. She can land in atmosphere, though. A rudimentary lab can be installed in her cargo hold. The same engineering conditions found in the scout are found aboard the far trader.

Note that densitometers are available only on a Survey Ship or Lab Ship. Scouts and Far Traders only have passive EMS, active EMS, and optical survey equipment.



STAR SYSTEM EXPLORATION

If your players are entering an unknown system, they need to find out what stars are there. To generate star systems at random, see the "Stars" section on page 82 of the Stars & Planets chapter later in this book.

Then, develop the star system's planets using the procedure in the "Planets" section of that chapter. Note that the most likely colony sites will be found orbiting type F, G, and K stars. See the "Stars" section for a detailed discussion of stellar spectral types.

Where Are We?

Her body seemed to turn inside out then right side in again as the scout ship Skylark *stepped out of jump space. Everything seemed totally muddled for a minute, and then became really confused as Lane realized the stars were not in their expected locations.*

Lane leaped to the astrogator's panel as soon as jump shock started to wear off. After a couple of fumbling tries, she zeroed the computer-linked astrogation telescopes to three reference stars and ran the astrogation program. She swore softly, rechecking the numbers. "Captain, we're ten degrees above the ecliptic, and 20 degrees rimward of where we should be. Captain, our exit point was perfect, but the system's moved!"

"Then you better be damn careful about plotting breakout, Lane. You foul this up and we'll never get home. The charts of this system haven't been updated in nearly 100 years—you have to expect the system to move. Why do you think the Imperium ran surveys? To keep some bureaucrats busy?"

The Captain swiveled around to his computer console and pulled up the local ephemeris from Skylark's *database. He slaved the ship's main telescope to the computer, which pointed the 'scope toward where the system's life zone planet should be. "Now lets see... Let's see if Beta is where she should be.. and do we have a week, a day, a month, before we can get to her? Too bad the densitometer's down. We'll just have to do this the old fashioned way."*

Breaking out of jump space is nearly always disorienting; it's even more so in the New Era. Minds are muddled and there's a period of confusion while the starship crew tries to plot its location. These days, there are no friendly beacons broadcasting the system's coordinates and the maneuver vectors to the main world, and 80 years of stellar motion has resulted in star systems that have shifted relative to each other, meaning that arrival in a star system will not always be where the crews expect.

With luck and a Survey or Lab Ship, your crew will have a working densitometer to find the system's worlds. Usually, however, they'll only have a telescope (included in all starship avionics suites); a device needed for two critical tasks.

First, the adventurers have to confirm they've arrived at their intended destination, and compute the difference from their expected destination. They do this by determining the angles of three or more reference stars relative to the galactic center (Difficult: Astrogation).

Second, they must refine this data relative to the system's main star to determine exactly where they have broken out of jump space (Difficult: Astrogation) in order to find their way to worlds or refueling points in the system.

These calculations are necessary when jumping back out of the system to correct for the system's motion to allow arrival at the desired point in the destination system. Failure to properly calculate these changes can cause a ship to be lost, as it may find itself out of position relative to a refueling source or destination world, and have insufficient fuel to make the course corrections to make it there. Such a ship will simply pass right through the destination system and coast off into the interstellar void.

Systems that have been visited and surveyed in the New Era do not present this problem, but whenever a ship attempts jump to a system which has not been visited since the Collapse there will be difficulties with computing the correct jump to arrive in that system in its new location relative to the departure point.

What's Here?

The players' next job is to determine the number of planets in the system, their type and location, and which—if any—may be habitable. To do this, follow the procedure in the "Planets" section. Because the characters won't want to waste resources surveying a world outside the life zone, just note these planets for future reference. Planets in the habitable zone can then be analyzed for their suitability as colony sites. Planets with no water, extreme atmosphere types or atmospheric taints may be eliminated early, but other worlds will require more detailed analysis to determine the complex interplay of their characteristics.

Is Anybody Home?

With passive sensors operating, the PCs take their ship into far orbit around the target planet. Meanwhile, if the planet is not a published or pre-generated world, the referee must secretly roll the characteristics of the target planet including population and technology levels. When in far orbit, the characters check for radio wave emissions and distinctive unnatural patterns of infrared radiation, as well as visible light from the night side of the target world (Difficult: Sensors, uncertain). Radio and infrared, and extensive visible light, indicates that an established pre-industrial or higher civilization already occupies the world. Unless all of the above come from a limited region, such as a single continent, these would rule out the target world as a colony home. However, it might be ideal for a bootstrap operation, and indicate possible points of contact.

With the ship's active and passive EMS arrays, the players should determine the planet's size (Average: Survey), the atmospheric composition and whether water vapor is present (Difficult: Sensors, uncertain), and the world's axial tilt (Average: Sensors, see page 85). If they have a working densitometer, they can determine the planet's density and its expected gravity based on its size. (Use the World Density and World Gravity tables on page 87.) They can use the ship's visual systems (part of the ship's astrogation and avionics package or its passive EMS array) to determine the presence of any large bodies of free water on the planet (Average: Survey). As they perform these tasks, the referee should give them approximate answers based on the secret rolls or the pre-generated world data.

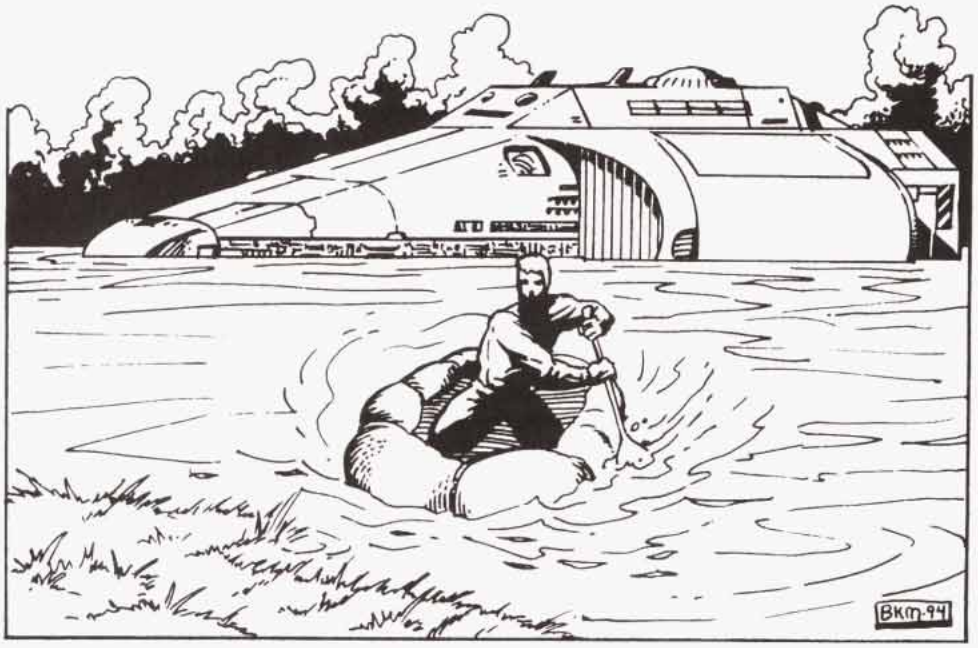
If the planet appears unoccupied, and the world has water and a breathable atmosphere, the world would be a strong candidate for a colony. If there appears to be a low-tech civilization, without one or more nodes of relatively higher technology which would indicated the presence of a TED, the world might be a good candidate for a bootstrap operation. In either case, the players should move their ship into close orbit and begin orbital scanning and mapping.

What's On the Ground?

This is where the real survey work begins. The ship's cameras and imaging EMS array begin examining the world from close orbit and producing maps of the world's oceans and continents including major terrain features such as mountain ranges, rivers, bays, forests, grasslands, and deserts. This examination can also spot any signs of previous or current habitation (Difficult: Survey, or Formidable if local technology level is 1 or lower). Imaging EMS can produce maps of surface features scanned through cloud cover.

This information can be gradually revealed to the players either from the maps provided with RCES briefing sheets.





This should take a number of hours equal to 1D6 times world's UWP size digit; e.g., a size 7 world takes 7D6 days to map. At the same time, infrared visual and radio frequency scanners are passively looking for signs of technology below that may have been missed from far orbit (Difficult: Survey and Sensors, Formidable if local technology level is 1 or lower).The referee should reveal full information about the planet's size and hydrographic percentage, and the population and technology level if the detecting signs of habitation task succeeds. Once the relative percentages of land and ocean area are known, The referee and players should begin developing a map of the planet .

The players should also note the planet's cloud cover and weather, and while in orbit , determine if any violent weather systems are at or near proposed landing sites. If the ship has a working densitometer, this instrument can be used to detect large mineral deposits (Difficult: Sensors). However, core samples will need to be taken to determine the type of mineral in each deposit. See the basic **TNE** Exploration rules (pages 205-206) for additional details.

FIRST LANDING

The planet rolled beneath the lab ship, blue, green, and lovely; a world virtually unscarred except for the glassy crater where the naval base had been located nearly a century ago and the ruins of a city nearby. A large island just offshore of the northern continent's east coast looked like a strong candidate for a landing site. It was on the opposite side of the continent from the ruins. If there were any indigenous survivors that had been blasted back to the stone age, the continent's central mountain range should keep them away from the colony site. A semi-circular bay opposite the mainland promised calm waters and the river delta feeding into the bay would supply both fresh water and fertile soil.

Lane fired the boat's thrusters and the small vessel dropped away from the mother ship. She always trusted the small craft's wings much more than the rather decrepit grav units, so Lane decided to make an aerodynamic approach and a water landing in the bay. High altitude turbulence rocked the boat hard as Lane circled the island to kill off entry velocity, but calmed as she turned on final approach to the bay. Clouds of steam exploded off the hot hull as she splashed down onto the bay waters and taxied toward the shoreline. The boat lurched gently as she touched the beach. Meanwhile in the rear compartment Harley was working the atmosphere tester. "It looks clean, Lane. We got a green light. No bios, no pollutants, no nothing; just fresh clean air."

"OK Harley, I hope you're right."

Seals popped and air hissed as pressure equalized in the airlock. Clad in her vac suit, Lane stepped onto the beach and moved inland toward rolling dunes covered with gray-green grass. Blue mountains and their upland valleys shimmered in the heat haze beyond. A river in spring flood flowed into the bay on her left.

The atmosphere tester's telltale light still glowed green. Lane opened her helmet seal and breathed free air for the first time in six weeks. The air smelled sweet, of sea salt, warm earth, and waving grasses. No ozone, no plastic fumes, no nitrogen toxins; just sweet, clean air.

"Harley," she called into her communicator. "Radio the captain. Tell him this is the place."

The characters will spend a fair amount of time exploring several sites as potential locations for their colony. These sites should have the potential for fertile farm and grazing land, and/or be close to potential mines for metals or fuels. If the terrain is mountainous or heavily forested, and no flat open landing areas are available, the characters should be able to set their landing craft or starship down on a lake or bay (Average: Pilot [Interface/Grav]).

In the following passages, there are guidelines for two broad types of Survey tasks: *General* and *Goal-Oriented Survey tasks*. These two categories are separated into two sections, below.

General survey tasks are those which establish the specific nature and details of the world according to standard categories and classifications. The results of these tasks constitute the bulk of data which will make up the standard planetary survey report.

Goal-oriented survey tasks are more specific in nature, in that they go beyond the standard report of what the planet is like, and seek to identify particular sites on the world which are suited to various types of exploitation. The prime example of such sites would be projected colony locations, possessing good arable land but situated near potential sources of minerals, etc.

GENERAL SURVEY TASKS

General survey tasks begin with determination of the qualities of the world's atmosphere: its pressure and its composition. For the purpose of finding suitable colony worlds, atmospheres with exotic compositions (codes A-C) and atmospheres too thin to breathe (0-3) are not really dealt with here. Rather, worlds of a basically earth-like composition at pressures varying from thin to dense will be looked at. In addition to their pressure-related



Uncertain Tasks

The principles of uncertain tasks are explained on TNE page 111, and are very important when conducting planetary surveys. Referees should treat most any task in a survey mission as an uncertain task, because the PCs will be attempting to determine the absolute truth about the nature of a world, and such information is not always available as the result of a single test.

This fact will encourage the PCs to conduct certain survey tasks more than once, to decrease the likelihood of undetected error. Each such repeated task should have its difficulty reduced by one level to reflect the greater certainty obtained by multiple investigations. Players may also think to conduct the same survey tasks at a variety of widely-separated locations, rather than just in one location where they could be fooled by unique local conditions, and referees may decide to reward such forethought by further bonuses.

It is always possible that the hidden result of a failed uncertain survey task could be the difference between life and death for a shipload of colonists. Referees must be careful to secretly record all true data that is unknown to the survey team, so that its consequences can be implemented at the proper time. This is the best way to ensure that a PC survey team takes its responsibilities seriously.

qualities, these atmospheres might also have significant additional components which will affect their suitability for habitation.

Atmospheric Pressure

Within the range of breathable atmospheric codes (code 4-9 on the Universal World Profile), **Traveller** treats worlds as having a basically earth-like oxygen-nitrogen mix (approximately 20% and 80%, respectively). This means that these atmospheres are basically breathable by humans. However, there is variation from earth norms in certain details, such as atmospheric pressure (other variations are dealt with below).

There are three basic levels of atmospheric density where humans can breath without assistance: Thin (codes 4 and 5), Standard (codes 6 and 7), and Dense (codes 8 and 9). Each density level has its own particular details. (For this discussion of density, the tainted and untainted versions of each density level are treated as being the same.)

The material below includes fairly detailed guidelines for handling the physiological effects of differing atmospheric pressures. These guidelines are presented for referees to use *where appropriate*, and are not required rules that must be slavishly adhered to at all times.

For example, if the PCs' ship lands on a world and the crew merely engages in routine trading and then departs, there is little need for the referee or players to worry about the effects of differing atmospheric pressures. If, however, the crew gets involved in a lengthy, strenuous barroom brawl, the effects of a thin atmosphere may be significant. And if the PCs are a mercenary unit intending to become involved in a lengthy military campaign, the rules below on acclimatization and physiological effects will loom very large indeed.

Thin: Thin atmospheres range in pressure from 0.43 to 0.70 standard atmospheres (where a standard atmosphere has a pressure of approximately 1 kilogram per cm^2). For simplicity, **Traveller** treats all atmospheres within this range as functionally equivalent. See the "Physiological Effects" section below for potential physiological effects of standard atmospheres on characters not accustomed to them.

Aerodynamic aircraft (fixed- and rotary-wing) also have their performance affected in thin atmospheres, see the "Aerodynamic Aircraft in Thin and Dense Atmospheres" sidebar on page 15.

Detailed Atmospheric Pressure: If referees or players desire greater detail in the atmospheric description, the referee may roll 1D10 (or, for more detail, D100) and express the result as a decimal (i.e., 4 becomes 0.4). Multiply this decimal by 0.27 and add the result to 0.43. The result is the atmospheric pressure in standard atmospheres. However, these rules will not stipulate any additional effects for a thin atmosphere of 0.43 atmospheres as compared to a thin atmosphere of 0.7 atmospheres. In **Traveller**, all thin atmospheres are treated as broadly equivalent, rather than requiring harried referees to treat each planetary atmosphere as unique. Experienced referees and players are free to do so, but in deference to the majority of players and referees who do not wish this burden, the **Traveller** rules will not address this issue in detail.

Standard: Standard atmospheres range in pressure from 0.71 to 1.49 atmospheres. As with thin atmospheres above, **Traveller** treats all atmospheres in this range as functionally equivalent. See the "Physiological Effects" section below for potential physiological effects of standard atmospheres on characters not accustomed to them.

Detailed Atmospheric Pressure: If referees or players desire greater detail in the atmospheric description, the referee may roll 1D10 (or, for more detail, D100) and express the result as a decimal (i.e., 4 becomes 0.4). Multiply this decimal by 0.78 and add the result to 0.71. The result is the atmospheric pressure in standard atmospheres. However, these rules will not stipulate any additional effects for the difference between an atmosphere of 0.71 atmospheres and an atmosphere of 1.49 atmospheres. See this section under Thin atmospheres above for further discussion.

Dense: Dense atmospheres range in pressure from 1.50 to 2.49 atmospheres. As with thin atmospheres above, **Traveller** treats all atmospheres in this range as functionally equivalent. See the "Physiological Effects" section below for potential physiological effects of dense atmospheres on characters.

Aerodynamic aircraft (fixed- and rotary-wing) also have their performance affected in dense atmospheres, see the "Aerodynamic Aircraft in Thin and Dense Atmospheres" sidebar on page 15.

Detailed Atmospheric Pressure: If referees or players desire greater detail in the atmospheric description, the referee may roll 1D10 (or, for more detail, D100) and express the result as a decimal (i.e., 4 becomes 0.4). Multiply this decimal by 0.99 and add the result to 1.50. The result is the atmospheric pressure in standard atmospheres. However, these rules will not stipulate any additional effects for the difference between an atmosphere of 1.50 atmospheres and an atmosphere of 2.49 atmospheres. See this section under Thin atmospheres above for further discussion.

Physiological Effects: There are two types of atmospheric pressure adjustments: "going up" from a lower pressure (thinner) atmosphere to a higher pressure (denser) atmosphere, or "going down" from a higher pressure to a lower pressure atmosphere. Thinner atmospheres do not typically provide as much oxygen as denser atmospheres, and denser atmospheres typically provide too much oxygen as well as other, inert, gases. Either of these conditions may adversely affect characters adapted to other atmospheres until they become acclimatized to the new atmosphere (see the "Atmospheric Adaptation and Acclimatization" section below for details).

Referee's Note: Remember that the purpose behind these rules is not to bog down play whenever the PCs journey from one atmospheric

Physiological Difficulties from Atmospheric Pressures

Because **World Tamers Handbook** is about building societies on habitable worlds, it does not deal with the obvious difficulties of attempting to breathe ammonia, for example. The atmospheric variations dealt with in **WTH** are mostly limited to atmospheres of a basically Terran composition (approximately 20% oxygen, 80% nitrogen, plus other trace gases) but which exist at different pressures. As it turns out, simple differences in pressures are sufficient to provide significant physiological difficulties.

Insufficient Oxygen: This is perhaps the most obvious effect. A partial pressure of oxygen of less than 0.1 atmosphere will not sustain life. Any combination of low atmospheric pressure and low concentration of oxygen can create this condition which is obviously quite fatal. Compressor masks (which collect oxygen from low-pressure atmospheres and compress it to breathable concentrations) are a simple and reliable antidote to this problem, fortunately.

A less severe variation of this is that on worlds with a lower than accustomed partial pressure of oxygen, persons will have a hard time with strenuous activities and will tire out more quickly, as their bodies have difficulty getting enough oxygen to sustain their activities. Fortunately most people can adapt to these situations over time, particularly with the benefit of medical attention. See the Acclimatization section.

Oxygen Poisoning: One more bit of proof of the wisdom of observing moderation in all things: too much oxygen will kill you as surely as too little. There are two main types of oxygen poisoning: chronic and acute.

Chronic oxygen poisoning is the more common of the two, and is seen at partial pressures of oxygen (PO_2) of 0.6-2 atmospheres, or 3-10 atmospheres total pressure assuming 20% oxygen as in the Terran-type atmospheres. Because this pressure is above the 2.5 atmosphere upper limit for dense atmospheres, this is typically not a problem, but higher than usual oxygen concentrations in a dense atmosphere can create the circumstances for this problem. Chronic oxygen poisoning causes inflammation, congestion, and hemorrhaging of lung and pulmonary tissues, and is manifested by shortness of breath, dry cough, and fatigue. Fortunately most humans can adapt to these conditions, and the symptoms will eventually reverse themselves (see the Acclimatization section).

Acute oxygen poisoning is fortunately only encountered when PO_2 is above 1.8 atmospheres (9 atmospheres assuming a 20% oxygen mix), and would therefore require a dense atmosphere which was almost pure oxygen, an unlikely circumstance to be sure. Acute oxygen poisoning affects the nervous system, and is manifested by such symptoms as nausea, muscular twitching, dizziness, choking, and convulsions followed by a loss of conciousness.

Inert Gas Narcosis (IGN): On Terran-type worlds this is typically known as nitrogen narcosis, as nitrogen is the most prevalent atmospheric inert gas. However, the gas need not be nitrogen, as any inert substance will create a depressant effect on the nervous system if enough of the substance goes into solution in the body's fatty tissues. IGN can be thought of as having an intoxicating effect and includes such symptoms as lightheadedness, loss of fine discrimination, euphoria, poor judgement, and slowed reflexes.

To provide an example, IGN caused by nitrogen at a partial pressure of 2.4 atmospheres has been shown to reduce reaction time by 20%, mechanical dexterity by 8%, and abstract reasoning by 33%.

Fortunately this phenomenon is associated with rather high atmospheric pressures: 3 atmospheres and above in the case of nitrogen, the predominant inert gas in Terran-type atmospheres. This means that the nitrogen form of IGN is not a problem in even dense atmospheres.

Inert Gas	*IGN Potency*
Nitrous Oxide	25.9
Krypton	7.2
Argon	2.2
Nitrogen	1
Hydrogen	0.7
Helium	0.2

However, it is significant to note that nitrogen is hardly the most dangerous inert gas for this purpose in humans. The table at right shows the relative potency of several inert atmospheric gases, with nitrogen set as the standard.

Thus, on a world where Argon or Krypton, rather than Nitrogen, was the dominant inert atmospheric gas (admittedly a rather unlikely circumstance), problems could develop at lower pressures. This potential is presented as food for thought for cruel and devious referees, and not as a common phenomenon.

Decompression Sickness: This is not a difficulty associated with a particular atmosphere type *per se*, but rather has to do with the act of transitioning from a more dense atmosphere type to a less dense atmosphere type. When living tissue exists within gas of a given pressure, some of that gas is absorbed into the tissue and held in solution. The amount of gas dissolved in the tissue is proportional to the pressure of the gas, so roughly twice as much gas would be absorbed in an atmosphere of twice the given pressure. The rate of absorption is limited by chemical functions such as solubility of the gas, and by biological functions, such as the rate of gas exchange in the lungs, the rate at which the blood moves the dissolved gases, rate of gas exchange between blood and tissue, etc. When remaining within an atmosphere of given pressure, the body attains gas equilibrium and will retain that equilibrium so long as it remains within the same atmospheric pressure.

If, however, the body is rapidly moved to an area of lower pressure, the tissue begins "degassing" to attain gas equilibrium at the new lower pressure. However, there are limitations as discussed above to the speed at which this can be done, and if the change in atmospheric pressure takes place more rapidly than the body can degas itself, the dissolved gas will come out of solution within the tissues and blood stream and form bubbles. The formation of these bubbles within various organs can cause serious physiological damage, and is known as decompression sickness.

Most symptoms of decompression sickness show up within an hour (and almost all of them within six), and these include neurological decompression sickness ("the staggers:" paralysis, dizziness, loss of muscular control, unconciousness, blurry vision, covulsion, numbness, weakness), joint involvement ("the bends:" pain and swelling in the joints), respiratory decompression sickness ("the chokes:" choking and burning sensation in the chest, shallow breathing, coughing, loss of conciousness, shock) and skin bends (rash and itching, not a real problem by itself).

One symptom which is not seen within the first few hours is one of the most crippling over the long term: aseptic bone necrosis, which can cause the destruction of joints, particularly those of the shoulders, hips, and knees. These symptoms can take from several months to as much as five years to manifest themselves, and can result from only very small changes in pressure which were accompanied by no other symptoms.

In the **Traveller** universe, decompression is usually handled aboard starships when travelling from one star system to another, as the one week+ travel time is sufficient for these purposes (note that decompression is not the same as acclimatization—a character who has been safely decompressed to a new atmospheric pressure is *not* acclimated to that atmosphere). If the entire crew is moving from one atmosphere to the next, the ship's life support system can be set to use the entire ship's inhabited spaces as a decompression chamber for the entire crew, gradually reducing the ship's internal atmospheric pressure at a safe rate until the crew is decompressed to the pressure of the atmosphere at the ship's planned destination.

If only a few passengers require decompression, this is usually accomplished by having them suit up with vac suits before boarding the ship (thus retaining the original high pressure around their bodies), and then moving them to their staterooms. Ship's life support can control environment one stateroom at a time, allowing these passengers to remain sealed in their staterooms until they are safely decompressed.

Note that decompression is required for such acts as meteoric assaults onto a world with a thin atmosphere. All troops preparing for a meteoric assault undergo decompression to the target world's atmospheric pressure before entering their drop capsules, and are carefully screened for respiratory ailments which increase the risk of decompression sickness by interfering with the body's degassing processes.

Other conditions contribute to the chance of decompression sickness and are carefully controlled before a jump, which helps explain many of the pre-drop rituals of drop troops: no alcohol for 12 hours before a jump, no tobacco or similar substances for an hour, high-protein, low-fat meals, properly fitted suits, increased fluid intake, no exercise during decompression, and keeping the body warm.

And Now the Good News: In the future universe portrayed in **Traveller: The New Era**, mankind (and other starfaring races) have been dealing with the above phenomena for centuries, and they are not the problems they might otherwise be. Standard procedures for safe decompression and acclimatization have been used for so long that the average traveller scarcely even notices them, and simple, effective drugs to ease these adjustments are readily available and are administered expertly by the innumerable versions of flight surgeous, drop medics, ship's doctors, astrophysiologists, and the like.

The above details are presented primarily as part of the ongoing effort to keep the science in science fiction, and to provide details for referees who would like to be able to provide a little bit of color to remind their players that even in the future, things sometimes still go wrong.



type to another, but rather to demonstrate the complications faced by an interstellar society which encompasses a literally infinite variety of planetary environments. These effects are not necessarily felt by travellers casually visiting or trading among such worlds, but, for example, an invasion of a world by troops not adapted to its conditions would be very much affected by these physiological realities.

Since the symptoms of physiological difficulties of going up to higher oxygen concentrations and going down to lower oxygen concentrations are so similar (characterized by fatigue, shortness of breath, etc.), for simplicity the same procedure is used for both upward and downward adjustments. However, referees may feel free to customize the physiological effects somewhat to more precisely describe a certain ailment, using the Physiological Difficulties sidebar as a guideline.

Procedure: When attempting strenuous physical activities (referee's discretion, but this should include such activities as running, carrying heavy loads, cross-country hiking in hot weather), characters adapted to a different density of atmosphere than the one they currently inhabit will have to make a roll against their Constitution attributes to avoid adverse physiological affects due to the different atmospheres. (See section below, "Atmospheric Adaptation and Acclimatization," for discussion of atmospheric adaptation.)

The frequency of these rolls is also at the referee's discretion based on the nature of the activity and the level of detail being played. During combat these rolls might be made every five minutes, but if a character runs with a heavy pack for several turns in a row, the roll might be made immediately in response to these actions. During long-duration cross-country travel, the rolls might be made each hour or half hour.

The basic difficulty level of these rolls is Difficult, with the following difficulty modifiers. Diff Mods are cumulative, but the final difficulty level can be no greater than Impossible. If the referee is handling NPC groups, such rolls should only be made once per NPC *group* (not once per NPC) based on the experience level of the NPCs.

Success: Success indicates the character experiences no difficulty, and may go about his or her business without interruption until next required to make the roll. At the referee's discretion, Outstanding Success may allow the character to skip the next required physiological effects roll.

Failure: Failure indicates the need to immediately sit down and rest. While resting, a character's Initiative and Strength attribute are each reduced by 1, and the character may not conduct Aim, Crawl, Stand Up, Melee, Run, Trot, or Walk combat actions. At the end of every minute (12 combat turns) spent resting, the character makes a Difficult roll against Constitution. Success indicates that the character has rested sufficiently and returns to normal. Failure and Catastrophic Failure both indicate that the character must continue resting and roll again after another minute.

Catastrophic Failure: Catastrophic Failure indicates that the character has lost conciousness. Characters who lose conciousness in this way are treated the same as those who lose conciousness due to a serious wound (**TNE** page 288). Such characters make a Formidable roll against their Constitution every 30 seconds to attempt to regain conciousness. Once conciousness is regained, they are treated as resting (above).

Referees may grant longer periods between rolls or –Diff Mods for mitigating circumstances such as cool weather or air conditioning, use of powered armor (to reduce physical exertion), etc.

Atmospheric Adaptation and Acclimatization: The Physiological effects described above only apply to characters before they become *acclimatized* to the new atmosphere. Once a character is acclimatized according to the rules below, no more rolls for physiological effects are required, as the character has become completely physically accustomed to the new surroundings.

Characters who are not used to a given atmospheric density may have a hard time adjusting to the new conditions. For example, a character who has spent her entire life in a standard atmosphere will find it hard to function in a thin atmosphere, at least until she becomes acclimatized.

Atmospheric Adaptation: First, the referee must determine if a character is adapted to a certain atmospheric density. This is not as simple as determining the atmospheric density of the character's homeworld, as the character may have spent the last 10 years become used to an atmosphere with a different density and should be treated as adapted to this new atmosphere. Characters who have spent their lives living aboard a starship can become adapted to whatever conditions the ship's life support is set to. (For this reason, most Free Traders in the New Era have their shipboard environments set to 0.7 atmospheres, the borderline between thin and standard atmospheres, allowing their crews to be equally comfortable in either environment—this also provides a savings in life support usage and speeds the transition to battle stations.)

Once a character's adapted atmosphere is determined this is compared to the local atmosphere to see if acclimatization is required. All atmospheres of the same code are considered to be equivalent for purposes of the physiological effects and acclimatization rules. Thus a character from a world with atmosphere code 5 (thin) could travel to any other world with an atmosphere code of 5 without having to worry about rolling for physiological effects or acclimatization.

Acclimatization: From the moment a character arrives in a new atmosphere, his or her body will begin making the innumerable major and minor adjustments (most of which involve discomfort) to function efficiently in these new surroundings. This period can last for a long time or for a relatively short time, and is governed by a series of rolls against the character's Constitution attribute. One such roll is made at

DM's for Physiological Effects of Acclimatization

Diff Mod	*Circumstance*
+1 Diff Mod	if character is adapted to an atmosphere **two steps** away from the atmosphere currently occupied. For these purposes there are three steps of atmospheric density: thin, standard, and dense. From thin to dense or dense to thin is two steps, from thin or dense to standard or from standard to thin or dense is only one step.
+1 Diff Mod	if character is **burdened** or greater (see "Load," **TNE** page 35)
+1 Diff Mod	if character is **fatigued** (see "Fatigue," **TNE** page 198)
–1 Diff Mod	if character is **going up** from a thinner to a denser atmosphere
–1 Diff Mod	if character is **mostly acclimatized** (Stage 4, see Acclimatization section, below)
–1 Diff Mod	if character with **Medical skill** is in attendance. This is only possible when the characters are operating as a group, in surroundings where the medic is free to circulate among the characters to periodically examine them for signs of exhaustion, etc. This would not be possible, for example, if the characters were in combat, spread among a number of separate foxholes. Not more than 20 characters may receive this benefit from a medic (thus a group of 100 NPC troops should have five medics in order to receive this benefit).



the end of each week until four successful rolls have been made. Success at each roll allows the character to pass on to another stage, in which the penalties for not being adapted to the atmosphere become steadily less.

Stage 1: Stage 1 is the period from arrival in the new environment until success is acheived on the roll to pass into Stage 2. This roll has a base difficulty of Impossible vs. CON (see below for die modifiers and Diff Mods). While in Stage 1, rolls for physiological effects (as described in the section above) are required. Also, when using the fatigue rules (**TNE** pages 198-199), work which would normally be defined as easy work is treated as hard work, and work which would normally be treated as hard work yields two levels of fatigue instead of only one. When using the economic model (Chapter 4), an economic sector whose laborers are in this stage suffer a –4 DM on the monthly output roll. Military units whose personnel are at this stage have a constant 4 fatigue levels for purposes of the Mass Combat Rules, see page 46 for more details.



Stage 2: Stage 2 is the period after the first roll vs. CON is successfully made, but before the second roll is made to pass into Stage 3. The base roll to pass out of Stage 2 is Formidable vs. CON (see below for die modifiers and Diff Mods). While in Stage 2, rolls for physiological effects are required. Also, when using the fatigue rules, each period of hard work yields two fatigue levels instead of only one. When using the economic model (Chapter 4), an economic sector whose laborers are in this stage suffer a –3 DM on the monthly output roll. Military units whose personnel are at this stage have a constant 3 fatigue levels for purposes of the Mass Combat Rules, see page 46 for more details.

Stage 3: Stage 3 is the period after the second roll vs. CON is successfully made, but before the third roll is made to pass into Stage 4. The base roll to pass out of Stage 3 is Difficult vs. CON. While in Stage 3, physiology rolls must be made, but there are no modifications to the normal fatigue rules. When using the economic model (Chapter 4), an economic sector whose laborers are in this stage suffer a –2 DM on the monthly output roll. Military units whose personnel are at this stage have a constant 2 fatigue levels for purposes of the Mass Combat Rules, see page 46 for more details.

Stage 4: Stage 4 is the period after the third successful roll vs. CON is made, but before the final roll is made to become fully acclimated. Physiology rolls are still required, but these are made at –1 Diff Mod. When using the economic model (Chapter 4), an economic sector whose laborers are in this stage suffer a –1 DM on the monthly output roll. Military units whose personnel are at this stage have a constant 1 fatigue level for purposes of the Mass Combat Rules, see page 46 for more details. The roll to pass out of Stage 4 and to become fully acclimated has a base level of Average vs. CON.

Stage 5: Characters which have succeeded at the roll to pass out of Stage 4 are fully acclimatized to their new environment and need not concern themselves with further physiological rolls or other deleterious effects.

These details are summarized on the table to the right.

Only one acclimatization roll may be made per week. Modifiers to this roll are as follows:

There is a –1 Die modifier (not Diff Mod) for each additional attempt on the roll to get out of the current stage, i.e., total the number of weeks in the current stage, subtract 1, and the result is the –DM to be used on the roll. A –Diff Mod is also applied if medical assistance is available.

Characters with Medical (Diagnosis) assets may assist in the acclimatization process by prescribing medication and supervising the acclimatization conditioning. In order to do so, the medic(s) must succeed at a Medical task. The base difficulty level of the task is Difficult: Medical (Diagnosis) assuming that the medic is supervising the acclimatization of 20 characters. (This also assumes that the medic has access to a supply of basic medical supplies—this varies with circumstances and referee's discretion.) The difficulty level of this task is increased one level for each doubling of the number of characters being supervised, or reduced one level for each halving. Thus 5 or fewer characters is Easy, 6-10 is Average, 11-20 is Difficult, 21-40 is Formidable, and 41-80 is Impossible.

Success indicates that the difficulty of the patient's acclimatization roll for that week is reduced by one level. Catastrophic Failure indicates that the acclimatization roll for that week is not allowed. (The referee may require a PC medic to make this roll for each character the PC is attempting to assist, or, usually in the case of NPCs, may allow a single roll to be made which affects all acclima-

Stage	*These Penalties Apply*	*Until This is Rolled*
1	Easy Work counts as Hard Work, Fatigue doubled for Hard Work, Physiology rolls required, –4 DM on Output Roll 4 fatigue levels for Mass Combat Rules	Impossible vs. CON
2	Fatigue is doubled for Hard Work, Physiology rolls required –3 DM on Output Roll 3 Fatigue levels for Mass Combat Rules	Formidable vs. CON
3	Physiology rolls required –2 DM on Output Roll 2 Fatigue levels for Mass Combat Rules	Difficult vs. CON
4	Physiology rolls required, but at –1 Diff Mod –1 DM on Output Roll 1 Fatigue level for Mass Combat Rules	Average vs. CON
5	Fully acclimatized, no further effects	N/A



tization rolls supervised by that medic for that week.)

Acclimatization Rolls: Success on the weekly acclimatization roll means that the character(s) passes into the next stage of acclimatization. At the referee's descretion, Outstanding Success may allow a –1 Diff Mod on the following week's acclimatization roll as well.

Failure simply means that the character remains at the current acclimatization stage and must attempt the roll again the following week.

If a Catastrophic Failure is ever rolled on an acclimatization roll, the character falls ill for 1D6 days. During this illness, all physiology rolls are made at one difficulty level higher, and all Easy Work counts as Hard Work.

Final Caveat: Do not slavishly adhere to these rules if they are not appropriate to the story and the action. They are only intended to add detail in circumstances where they would be appropriate.

Atmospheric Taint

Now the survey examines the composition of the atmosphere. As we have already discussed, the atmospheric envelope is assumed to consist primarily of nitrogen and oxygen in a 4:1 ratio. However, even trace amounts of particular additional materials can dramatically affect the overall breathability of the atmosphere, and will result in the atmosphere being classified as "tainted."

The following table shows the UWP codes used for the tainted and untainted versions of each of the three major atmospheric densities.

	Untainted	*Tainted*
Thin	5	4
Standard	6	7
Dense	8	9

Determining Taint: Although the surveying characters can have already established the chemical composition of the atmosphere by spectroscopic analysis from orbit, some contaminants, particularly biological ones, must be discovered by physical analysis of the atmosphere. This can be done by using a remote probe (the probe presented on page 118 of the **Reformation Coalition Equipment Guide** may be used for this purpose by placing an atmosphere sampling trap in the space reserved for the neural activity sensor; the probe then returns the sample to the mother ship for analysis there), or by personally sampling the atmosphere from the ground. This task requires the use of atmospheric analysis equipment present on any starship (for example, see the atmosphere tester on **TNE** page 346) and is an Average test of Chemistry or Biology. If the ship is equipped with a lab, the difficulty is reduced one level to Easy.

If the atmospheric study task is successful, the referee reveals whether the atmosphere is tainted or not. If it is contaminated, the testing character rolls on the Atmospheric Contaminants Table to determine what contaminant is present. If a contaminant requires the use of a filter mask and a domed environment, the world will be

Aerodynamic Aircraft in Thin and Dense Atmospheres: Aerodynamic aircraft (as opposed to contra-grav vehicles) designed using the **Fire, Fusion, & Steel Traveller** technical architecture rules are designed using the standard Terran parameters: a standard atmosphere and a 1G gravity field. However, aircraft may be designed to fly in conditions other than these. Ownership of **Fire, Fusion, & Steel** is necessary to use the material presented in this sidebar.

Aircraft may only fly in thin, standard, or dense atmospheres (codes 4-9). If an aircraft (fixed or rotary-wing) is intended to be able to operate in thin or dense atmospheres (or both) in addition to standard atmospheres, multiply its airframe cost by 1.5 to allow for reconfigurable or variable geometry intake ramps, lift devices, etc. (Note that the air-breathing engines and power plants installed in these aircraft are perfectly capable of functioning in thin and dense atmospheres with the above modifications to the aircraft.)

In addition, multiply rotary wing rotor assembly mass by 2 if they are to function in another atmosphere type in addition to standard. This provides them with the additional gearing required to allow them to be fitted with different rotor assemblies for different atmosphere types. Each additional set of rotors masses 0.25 times the mass of the modified multi-atmosphere rotor assembly. These extra rotor sets will have to be stored and transported separately at a volume in m^3 of 20 times their mass in tonnes. Cost is calculated normally based on rotor assembly type.

An aircraft's airframe will yield different maximum and minimum speeds in different atmosphere types, and this must be examined. It may be that some aircraft can no longer fly, as they can no longer meet the minimum speed required to stay in the air in a thin atmosphere, for example. Maximum, cruising, and NOE speeds must be recalculated based on these new numbers, and aircraft with drag points calculate their new speeds down from these new maxima using the normal procedure. The new minimum speeds will change take-off and landing distances as well.

Note that while dense atmospheres "slide the performance window down" by reducing minimum and maximum speeds, thin atmospheres narrow the permissible performance bands. This is because the speed of sound is lower in thin atmospheres, and airframe maximum speed is based on its ability to handle the compression phenomena associated with the speed of sound. (The other side of this is that denser atmospheres provide more lift, hence lower stall speeds, while thinner atmospheres provide less lift so require greater speeds to remain airborne.)

Note also that this table uses a single average value for each of thin and dense atmospheres. The actual density of any atmospheres varies within a range, so in reality, these numbers would be different for each and every world, even those classified by **Traveller** as having the same atmosphere type. As the purpose of these rules is to allow aircraft to be relatively quickly converted from one world type to the next, it would be criminally stupid to attempt to calculate exact numbers for each individual world. Instead, for the purposes of these rules (and in the interest of universal mental health) any world of a given atmosphere code yields the same performance as any other world with the same code. The value used for thin atmospheres is 0.6 atmospheres and the value for dense is 2.0 atmospheres.

Airframes

	Thin (4, 5)		Standard (6, 7)		Dense (8, 9)	
Type	*Min*	*Max*	*Min*	*Max*	*Min*	*Max*
Simple	250/125	270	150/75	320	75/40	160
Autogyro	65/—	200	40/—	200	20/—	100
Fast Subsonic	265/135	680	160/80	800	80/40	400
Transonic	300/150	940	180/90	1100	90/45	550
Supersonic	465/235	2400	280/140	2800	140/70	1400
Hypersonic	585/290	4300	350/175	5000	175/90	2500
Wing-in-ground	125/—	400	75/—	400	40/—	200





unsuitable as a colony site and the group should move on.

If the task fails, the characters receive a false negative reading. (For this reason it is wise for the PCs to make several atmospheric study tasks at various locations to weed out potential false readings.) The referee should roll on the Atmospheric Contaminants Table and not reveal the effect if a contaminant is present until the characters leave the ship and breathe the local air. Catastrophic failure indicates there is a delayed action contaminant that will affect humans beginning 3D weeks after exposure.

ATMOSPHERIC CONTAMINANTS

1D10	*Contaminant*
1	Allergens
2	Fungi (F)
3	High Carbon Dioxide
4	High Carbon Dioxide
5	High Oxygen
6	High Oxygen
7	Low Oxygen
8	Microorganisms (F)
9	Nitrogen Compounds (F)
10	Sulfur Compounds (F)

Contaminant Results: On the table above, the notation (F) indicates that a filter mask is required. Colonists may adapt to other contaminants using the acclimatization rules found in the Atmospheric Pressures section above. See the listing for the precise contaminant below to find any modifications to be used with the acclimatization and physiological effects rules.

Allergens: Roll 1D10 again and multiply the result by 10. This indicates the percentage of humans who react to airborne allergens with mild to severe respiratory symptoms. Local inhabitants may have adapted to these allergens. If the characters are already having to become acclimatized to the atmosphere because of differing atmospheric pressures, the presence of allergens adds no additional difficulty to this.

If, however, the characters are from an atmosphere of identical pressure, they will need to undergo the acclimatization procedures for this world. However, all acclimatization rolls are made with a –1 Diff Mod, and the characters start at Stage 2. Until acclimatized, all physiological rolls are also made with a –1 Diff Mod in addition to any other applicable mods. These modifiers may make these rolls so routine that the referee may elect to dispense with them altogether.

Fungi: Atmosphere-borne fungi harmful to humans are present. They attack the mucous membranes of the mouth and throat, and invade the lungs causing eventual suffocation. Some strains may attack the skin. Filter masks are needed to remove them from breathing air.

High Carbon Dioxide: This produces rapid breathing and a suffocating effect. At moderate concentrations it can be tolerated over time as long as sufficient oxygen is present.

If the characters are already having to become acclimatized to the atmosphere because of differing atmospheric pressures, the presence of high carbon dioxide adds no additional difficulty to this.

If, however, the characters are from an atmosphere of identical pressure, they will need to undergo normal acclimatization procedures and physiological effects rolls for this world.

High Oxygen: The partial pressure of oxygen in the atmosphere is significantly higher than is typical. This produces symptoms similar to those of persons attempting to become acclimatized to higher pressure atmospheres.

For acclimatization purposes, treat the atmosphere as being one pressure level higher than its actual pressure would indicate (i.e., a thin atmosphere with high oxygen would be treated as a standard atmosphere, a standard atmosphere with high oxygen would be treated as a dense atmosphere, and a dense atmosphere with high oxygen would be one step above a normal dense atmosphere, two steps above a standard atmosphere, and three steps above a thin atmosphere).

Air-Breathing Power Plants in Tainted and Inhospitable Atmospheres: All of the chemical power plants and jet self-contained thrusters presented in **Fire, Fusion, & Steel** (pages 63 and 70) are "air breathers," i.e., require an outside source of oxygen to function. These plants and thrusters are all defined using a standard atmosphere as their baseline, and require the following considerations to me met in order to function in other atmospheres.

All air-breathing power plants include fittings for filters for use in tainted atmospheres at no additional cost. (Certain environments, such as sandy deserts, may also require such filters.) When fitted, these filters cost 0.01 times the cost of the power plant and have negligible mass and volume. While these filters are fitted, multiply maintenance points of the vehicle by 1.2.

Air breathing power plants may also be modified to function in tainted atmospheres by carrying their own on-board oxygen supplies (which also allows the plant to function in vacuum, trace, exotic, corrosive, or insidious atmospheres). Any air-breathing vehicle using liquid hydrogen for fuel may modify its fuel tankage to carry half liquid oxygen and half liquid hydrogen. Such a vehicle may then operate in vacuum, trace, exotic, corrosive, or insidious atmospheres, or in tainted atmospheres without filters, as it has no need for external sources of oxygen. However, its rate of fuel consumption is doubled.

This modification costs Cr50 per cubic meter of fuel capacity, and does not prevent the vehicle from using the full tank for liquid hydrogen for normal external oxygen operations.



Other noteworthy effects are present, such as the fact that fires will burn more rapidly than would be the case in a standard 20% oxygen environment. The effects of fires should be more pronounced, but the seriousness of this effect is also left up to the referee.

Low Oxygen: The partial pressure of oxygen in the atmosphere is significantly lower than is typical. This produces symptoms similar to those of persons attempting to become acclimatized to lower pressure atmospheres.

For acclimatization purposes, treat the atmosphere as being one pressure level lower than its actual pressure would indicate (i.e., a dense atmosphere with low oxygen would be treated as a standard atmosphere, a standard atmosphere with low oxygen would be treated as a thin atmosphere, and a thin atmosphere with low oxygen would be one step below a normal thin atmosphere, two steps below a standard atmosphere, and three steps below a dense atmosphere).

Another noteworthy affect of a low oxygen concentration is the fact that fires will not burn as well. They will be harder to start, and will burn slower once started than would be the case in a standard 20% oxygen environment. The effects of these slower, less dangerous fires is left up to the referee.

Microorganisms: Viruses and/or bacteria are present that will attack the respiratory or neurological system within 1D6 days. Filter masks are required to remove these from the air.

Nitrogen Compounds: The atmosphere contains a considerable portion of harmful nitrogen compounds. These are often the result of industrial pollution, especially resulting from the use of hydrocarbon fuels, interacting with ultraviolet stellar radiation. Filter masks are required to allow humans to avoid the deleterious effects of these chemicals.

Nitrogen compounds may be present on a depopulated or regressed industrial world. Nitrogen compounds absorb the blue-violet end of the visible light spectrum giving the atmosphere a characteristic brownish-yellow haze.

Sulfur Compounds: Sulfur compounds are present in the atmosphere, usually from volcanic activity on the world. Filter masks are required to screen out these irritating compounds to allow humans to live in such an atmosphere. Lung damage will result if these compounds are breathed over time. Some sulfur compounds, such as sulfur dioxide and hydrogen sulfide, have a repulsive smells as well.

Planetary Density & Gravity

If the players have not yet determined the planet's density and gravity from orbit, they will do so as soon as they land. (Use the World Density and World Gravity tables on page 87 to do this.) Note that a dense, relatively high gravity world usually indicates the presence of heavy metal deposits, making the planet a potentially valuable mining site.

Physiological Effects: As with atmospheres, the different physical demands placed on a body by higher than accustomed gravity can have physiological affects on characters. These effects are described in the TNE basic rule book, pages 197-198.

Temperature & Weather

Temperature: Referees must have completed a planetary temperature worksheet if the PCs intend to conduct a detailed survey which includes temperature evaluation. The PCs may take simple temperature readings in any hex they like, and thereby rapidly put together a temperature profile of the world. By consulting the worksheet, the referee can provide this data to the players on a hex-by-hex basis, or the players may be provided with a correct copy of the table provided they succeed at a Formidable Survey task. The difficulty level of this task is reduced one level for each 10 planetary hexes in which the PCs take temperature readings.

The temperatures will also be used later on when determining the suitability of planetary hexes for agriculture.

Weather: Weather is the result in large degree to two characteristics of the world: its primary star and the world's axial tilt. A world's star pumps energy into its ecosphere in the form of solar radition, and the more energetic the star, the more energetic and violent the resulting weather.

Likewise, the greater the axial tilt of a world, the greater the temperature difference that builds up with regard to that solar heating between the northern and southern hemispheres. Consequently, on a world with an extreme axial tilt, there is a near constant massive and violent movement of air from the cold winter hemisphere to the warm summer hemisphere. Conversely, there is little air movement on a world with little tilt that is evenly warmed and cooled.

Consult the Weather Factors table for a world's star and axial tilt characteristics to come up with a total weather factor number by adding the factors together (as many as three may apply to a given world). These factors may be used again later for local weather and agricultural richness, and also in the Colonial Economic model for random events and possible modifications to infrastructure maintenance (see page 35).

Gravity and Aerodynamic Aircraft Performance

Traveller does not focus on a world's gravity *per se*, but primarily on the density of its atmosphere, which is a reflection of its gravity. Players and referees should not feel compelled to worry about gravity effects on aircraft so long as they address the atmospheric requirements above.

However, some players who use the **Fire, Fusion, & Steel** technical architecture book to design aircraft may feel compelled to account for different gravities when calculating aircraft performance. **FF&S** assumes a standard atmosphere and a standard 1G field in its design sequences. In order to account for gravities other than 1G, multiply the aircraft weight by the local gravity before calculating G-Rating, Speed, and Take-off and Landing rolls. Calculate glide ratios normally, and then divide the result by the local gravity in Gs. In G-fields of greater than one, multiply normally-calculated maintenance points by the gravity in Gs, as more maintence is required to watch for and repair stress fractures, etc.

WEATHER FACTORS

+4 if system's star is type A
+2 if system's star is type F
–1 if system's star is type K
–2 if system's star is type M
–2 if axial tilt is zero.
–1 if axial tilt is 1-10 degrees
+1 if axial tilt is 20-29 degrees
+2 if axial tilt is 30-44 degrees
+4 if axial tilt is greater than 45 degrees
+1 if UWP hydrographic code 5+

Environmental Research and Testing

The PC survey team needs to conduct soil tests, collect soil samples, plant samples, and animal samples to learn about the local ecology and whether the soil is suitable for crops and domestic grazing animals. They must also test mineral outcroppings to determine if exploitable mineral deposits are present.

Mineral Testing: Mineral samples need to be tested to determine



their constituent metallic or organic elements. As discussed in the sidebar on uncertain tasks, they may be attempted more than one time to reduce the possibility of false positive or negative readings.

For purposes of the colonial economic model (see Chapter 4), the results of these tests are limited to three details: the presence or absence of fossil fuels and radioactives, and the extent to which the world has already had its mineral resources exploited by previous habitation. The results of these tests will be used again later in the survey procedure. Both tasks are Impossible: Geology, but should be reduced in difficulty for additional attempts as discussed in the Uncertain Tasks sidebar on page 11. Each test should take approximately one day once the team has arrived in the area to be tested. (Thus the quality of transportation available to the survey team will affect the time required by controlling how rapidly they can move from one site to the next.)

Fossil Fuels: Fossil fuels are the remains of long-dead lifeforms, mostly plants, that have been buried and transformed by geological processes into hydrocarbon fuels. The presence of fossil fuels (coal, oil, natural gas) require for the world to have sustained organic life long enough ago that it has since been geologically transformed. On worlds that cannot support life, or have not existed long enough for these conditions, fossil fuels cannot exist. The result of this test is a simple yes/no test for the planet as a whole.

Success at the uncertain Survey task allows the referee to report the correct answer (yes or no to presence of fossil fuels) to the PCs. Failure requires the referee to report a false result.

The table below assumes a primary star of luminosity class V and an atmosphere of 2-9.

Star Type	*Exceed on 2D6*
A	12+
F	10+
G	7+
K	6+
M	5+

Atmosphere DMs:	**Hydrographic DMs:**
2-3: –2	0: –2
4-9: 0	1-2: –1
	3-8: 0
	9-A: –1

Radioactives: This is a simple yes/no result, with radioactives being present on a 2D6 roll of 9+. DM –3 if low density planet, +3 if high density, –2 if primary star K or M.

Prior Exploitation: This test is based on the current or pre-Collapse population and tech level of the world, whichever is greater. Note that these figures may not be known to the survey team, but they need not be known for the team to obtain the correct answer, as the answer is obtained by actually sampling existing mineral deposits.

The referee consults the table below and conducts any necessary die rolls to determine the exploitation multiplier. This multiplier is used later in this chapter to modify the raw materials richness to account for previous inhabitants having already removed non-renewable resources.

Success at the uncertain Survey task allows the referee to report the correct number to the PCs. Failure requires that the referee report a false number.

The values obtained from the table below must be multiplied by 0.1 to create the final multiplier, and all results of greater than 1.0 become 1.0. Thus in the case of a world with a population A and TL of 16, a D6 result of 6 is obtained, yielding an outcome of (7–6=) 1. The final prior exploitation multiplier is therefore 1×0.1=0.1.

In the case of a population A, TL 11 world, the result is (12–1=) 11, 11×0.1 = 1.1, and this is corrected to the upper limit of 1.0.

	Population				
TL	*0-6*	*7*	*8*	*9*	*A*
0-7	—	—	—	—	15–D6
8	—	—	—	15–D6	14–D6
9	—	—	15–D6	14–D6	13–D6
10	—	15–D6	14–D6	13–D6	12–D6
11	15–D6	14–D6	13–D6	12–D6	11–D6
12	14–D6	13–D6	12–D6	11–D6	10–D6
13	13–D6	12–D6	11–D6	10–D6	9–D6
14	12–D6	11–D6	10–D6	9–D6	8–D6
15	11–D6	10–D6	9–D6	8–D6	7–D6
16	10-D6	9–D6	8–D6	7–D6	6–D6

Soil Testing: The survey team must also test the soil for human agricultural use. This test determines if the soil of the world contains materials that will prevent human agriculture. Such materials include heavy metals or salts in the soil, or biological organisms that are hostile to human-compatible crops.

The task is uncertain, Impossible: Chemistry *and* Biology, with the normal difficulty modifiers for multiple task attempts as discussed in the Uncertain Task sidebar on page 11.

The referee rolls secretly on the table below and records the result. Success in the PCs' task indicates that the referee can report the correct result to them. Failure requires that they be given a false result.

The result on this table is used when rolling for the agricultural richness rating for all of the world's planetary hexes in the Goal-Oriented Survey section below.

1D6	*Soil Contaminants*
1	None, no mod on Agricultural Richness table
2	None, no mod on Agricultural Richness table
3	None, no mod on Agricultural Richness table
4	Mild, –4 DM on Agricultural Richness table
5	Moderate, –6 DM on Agricultural Richness table
6	Severe, –10 DM on Agricultural Richness table

Biological Compatability: The survey team must also determine if local plant life will be edible and/or compatible with human agricultural activity. This uncertain task is Formidable: Biology, with the usual diff mods for additional attempts. Each such attempt requires one week. Otherwise this procedure is handled the same as soil testing above.

1D6	*Agricultural Compatibility*
1	Import Dominant, +2 on Agricultural Richness table
2	Import Compatible, no mod on Agricultural Richness table
3	Import Compatible, no mod on Agricultural Richness table
4	Import Compatible, no mod on Agricultural Richness table
5	Local Dominant, –1 on Agricultural Richness table
6	Local Dominant, –2 on Agricultural Richness table

GOAL-ORIENTED SURVEY TASKS

The conduct of goal-oriented survey tasks indicates that actual sites for habitation are being explored. This is usually done only after the general survey tasks are completed and it has been determined that there are no major obstacles to colonization (such as lack of fossil fuels or other mineral resources, unsuitable temperature or weather patterns, etc.). The goal-oriented survey provides the parameters that are used in the Colonial Economic Model presented in Chapter 4, and is therefore a necessary condition to the establishment of any kind of settlement.



A goal-oriented survey task consists of the in-depth examination of a single planetary hex by the survey team, but this single survey task provides all of the data required for the economic model, rather than requiring separate tasks for each piece of data. However, because of the length of time required for the goal-oriented task, the planetary hex to be surveyed should be carefully chosen based on promising characteristics (for example, it is probably not worthwhile to survey a desert hex). When a survey is conducted, all of the information below is generated and presented to the players if the task is successfully completed.

Hex Scale

Goal-oriented survey tasks are resolved on the scale of *planetary hexes*. Planetary hexes are the individual hexes shown on the "Global Data View" world maps (see pages 59 and 78 of this book for examples). Because these maps are designed to fit different-sized worlds into one standard format, these hexes do not have a constant scale, but vary in scale based on the size of the planet that is illustrated.

However, for the detailed colony and bootstrap campaigns that are presented in the **World Tamers Handbook**, these large planetary hexes are broken down into smaller hexes for better resolution. Unlike the planetary hexes, the smaller hexes used for these adventures have a constant scale of 20 kilometers from hexside to hexside, and are called *20-kilometer mapping hexes*, or mapping hexes for short. Because of the variable size of planetary hexes, the number of mapping hexes that fit into each planetary hex varies by planet. The Planetary Hex Survey table below and accompanying illustration sidebar show how planetary hexes of varying sizes are broken down into mapping hexes to allow referees to create the more detailed maps that are required for laying out colonies, tracking the progress of a war in a bootstrap campaign, etc.

Terrain Types

The two hex scales (planetary and mapping) also use two separate but related terrain scales. The scale used for planetary hexes has eight types, corresponding to the predominant terrain found in the hex. These do not include artificial additions such as starports, cities, etc.

The terrain "palette" used for 20-km mapping hexes consists of a greater variety of types. The terrain types used for these mapping hexes is identical to the terrain types used when generating animal encounter tables as listed in the **TNE** basic rulebook, page 215.

When referees and other world designers create the detailed 20-km hex maps, the terrain that they place in these smaller hexes is governed by the terrain type of the planetary hex itself. The detailed terrain types subsumed within the planetary hex terrain types are listed on the Terrain Scale Conversion table, below. Of course, any planetary hex can have unique or unexpected terrain types within it, so this table should serve primarily as a guideline.

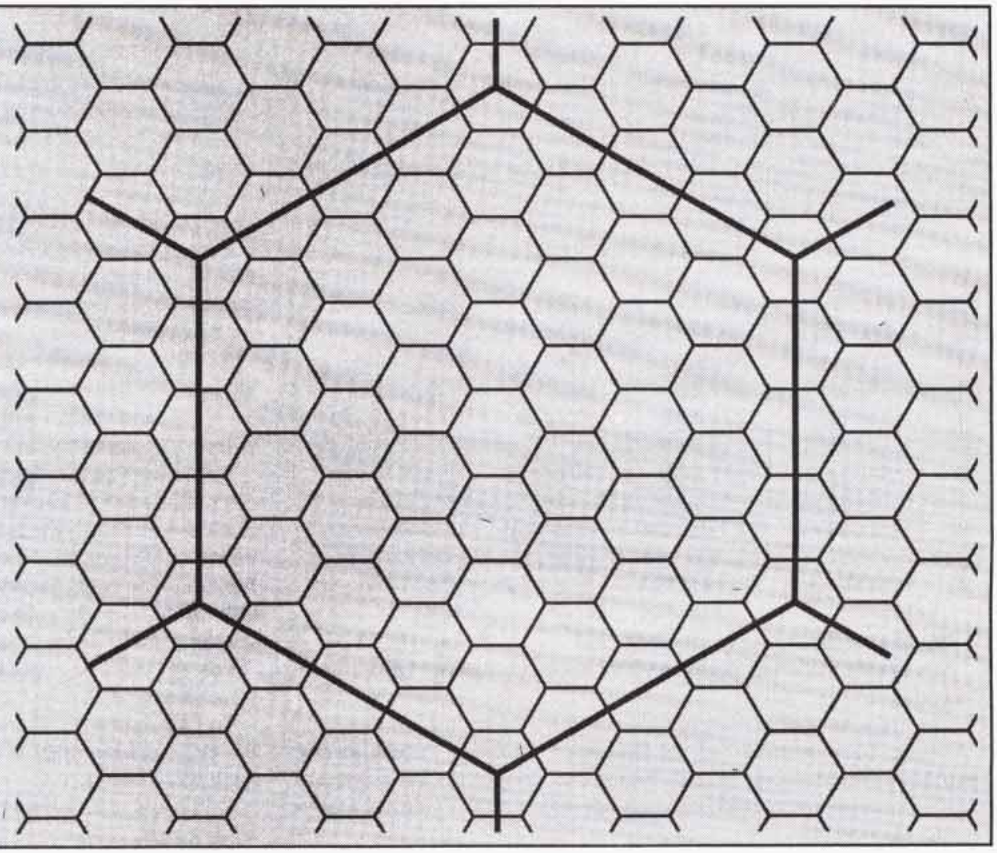
TERRAIN SCALE CONVERSION

Planetary Hex	*20-km Mapping Hex*
Sea	Surface, Shallows, Depths, Bottom, etc.
Mixed	Clear, Rough, Forest, River, Swamp, Marsh
Steppe	Prairie, River
Ice Cap/Glacier	Glacier
Desert	Desert
Badlands	Broken, Rough, River, Mountain
Tundra	Clear, Rough, River
Jungle	Jungle, River

Note that mixed terrain includes most terrain thought of as habitable by humans. Areas inhabited by humans and used for agriculture, i.e., cities, suburbs, and farms, are primarily mixed terrain hexes that have been cleared for development. On the more detailed scale, these hexes would be mostly clear and forest hexes.

The hex grid illustrated here is for use with the Planetary Hex Survey table at right. The example shows the 20-kilometer hexes within a single planetary hex of a UWP size 1 world. By consulting the table, we see that this hex has a total of 64 hexes in it, and has a vertex-to-vertex diameter of eight such 20-kilometer hexes. On the hex grid, this diameter is rendered as seven full hexes plus two half hexes, one at each end, for a total of eight.

Maps can be made showing the 20-kilometer hexes within a planetary hex by using the chart below with a sheet of blank hex paper and a ruler. Find the correct diameter for a given size planetary hex, and count that number of hexes off on the grid, marking the hex vertices, and then connect them by using the ruler. Use the sample UWP size 1 grid here as a guide, so that all hex diameters half a half hex on each end. Thus a Size 2 world has a diameter of 14 hexes (13 and two half-hexes), a Size 3 world has a diameter of 22 hexes (21 and two half-hexes), and so on.





The Goal-Oriented Survey Task

Unlike many of the general survey tasks earlier in this chapter, it is possible to conduct the goal-oriented survey so that success is guaranteed, i.e., the results delivered to the players are guaranteed to be the correct results generated by the referee.

The price of this exactness is a large time component. The Planetary Hex Survey table shows the time required to survey a single planetary hex for all UWP world sizes. There are certain factors than can reduce this required time, and these are listed in the box at right. Among these factors are the option to speed up the survey by making it into an uncertain task, which means that the survey team can bring home bad data. Although the survey task starts out as an automatic task, it is treated as having a base level of Easy for purposes of adding time-saving difficulty modifiers.

When rolling for this task, the referee should total up the party's relevant survey assets (see next paragraph) and divide by the total number of such assets possessed by the party to find the average asset number to roll against.

The survey team required for this task (whether it is automatic or not) should be at least four personnel, and these personnel should have significant skills in Map, Navigation, Observation, Tracking, Biology, Chemistry, Geology, Meteorology, Xeno-Biology, Sensors, and Survey (referee's discretion). It is assumed that the team is equipped with all basic survey equipment, testing kits, hand-carried sensors, etc.

Although PCs can theoretically go to an unexplored world and perform a goal-oriented survey task first, with the knowledge that the results will be perfectly correct, this is not the bargain it might seem. Without first performing the general survey, the players will have no world map, and will choose planetary hexes blindly, and will have no way of knowing in advance of fatal flaws such as extreme temperature, storms, poisonous soil, etc. This coupled with the time investment of a goal-oriented survey means that it is best to invest the time in the general survey first.

World Tamer's Handbook assumes a basic terrestrial lifestyle. The goal-oriented survey does not cover the survey of sea hexes, and may not be used to do so.

Time Reductions for Planetary Hex Survey

Factor	*% Decrease*
Diff Mod increase: (from Easy, i.e., one diff mod makes it Average, two diff mods makes it Difficult, etc.)	10% each
For each team member above four	1% each, to a maximum of 6%
For each tech level above 8	½% each
One or more labs available aboard ship or on ground	10%
Spacecraft	10%
Active EMS on Spacecraft	5%
Passive EMS on Spacecraft	5%
Densitometer on Spacecraft	5%
Neural activity sensor available to survey party	5%
Self-propelled ground vehicles for all party members	5%
Grav vehicles for all party members	10%

Planetary Hex Survey

World Size	*Hex Width*	*Hex Area*	*Hexes*	*Time*
1	160 km	22,170	64/8	1D6 days
2	280 km	67,896	196/14	1D2 weeks
3	440 km	167,663	484/22	1D6 weeks
4	560 km	271,586	784/28	1D6+1 weeks
5	720 km	448,948	1296/36	1D6+2 weeks
6	840 km	611,068	1764/42	1D6+4 weeks
7	1000 km	866,025	2500/50	1D6+6 weeks
8	1160 km	1,165,324	3364/58	1D6+9 weeks
9	1280 km	1,418,896	4096/64	1D6+11 weeks
A	1440 km	1,795,790	5184/72	1D6+14 weeks

World Size: Size code from UWP

Hex Width: Width of planetary hex measured between opposite hexsides

Hex Area: Area of planetary hex in square kilometers

Hexes: Total number of 20-kilometer mapping hexes in the planetary hex/number of such hexes that constitute the planetary hex's diameter, measured between opposite vertices (see accompanying illustration)

Time: Base time to conduct a goal-oriented survey of a single planetary hex, as modified by the factors on the Time Reductions table above.

Notes to Time Reductions Table: The team's tech level is assumed to be that of the world which sent/equipped them, although referees may make allowances for PC teams which have carefully equipped themselves with a wide variety of higher TL equipment. Spacecraft is a dedicated spacecraft used by the party as part of the survey, and must have a tech level at least equal to the rated TL of the survey team. If the ship's TL is lower, use the ship bonus but not the party's TL bonus. More than one ship adds no additional bonuses. Listed sensors are those aboard this spacecraft. The vehicle requirement is that the total vehicle capacity is equal to the party size, for example two air rafts each with seating for four would be sufficient for a party of eight, but not for a party of ten. The vehicle criteria are either/or, both bonuses may not be taken.

Partial land hexes have their survey time reduced because of their smaller surveyable area. The referee should judge the fraction of a partial land hex taken up by land, and the survey time should be multiplied by this fraction to obtain the final time required for the survey.

Agricultural Capacity

Each planetary hex is rated for its agricultural capacity in terms of useable area and richness. This capacity is based primarily on the terrain type of the planetary hex itself, but is also modified by the six surrounding planetary hexes (or in the case of mountains, hexsides). The values for the planetary hex apply to every 20-km mapping hex included in the hex. (Optionally, referees may use these values as averages and assign different values to different mapping hexes within the planetary hex.)

Growing Season: Each world must also have its growing season calculated. Some worlds are treated as having no seasons. These worlds are those which have no temperature difference between winter and summer. Note that this distinction varies with latitude/hex row. For example, look at the axial tilt table on page 85, in the column for a world with a 9-12° axial tilt. Hexes in rows 1-5 have no seasons, while hexes in rows 6-12 do.

For those worlds which do have seasons, the growing season is treated as exactly one-half of its year as calculated on page 83.

To calculate agricultural capacity of a planetary hex, roll twice on the table below, once in the Useable Area column and once in the Richness column.

Ice Cap/Glacier hexes have no agricultural capacity and need not be assessed.



D10	Useable Area	Richness	D10	Useable Area	Richness
–5	0%	0.05	6	60%	1.0
–4	5%	0.1	7	70%	1.1
–3	10%	0.2	8	80%	1.2
–2	15%	0.3	9	90%	1.3
–1	20%	0.4	10	95%	1.4
0	25%	0.5	11	96%	1.5
1	30%	0.6	12	97%	1.6
2	35%	0.7	13	98%	1.7
3	40%	0.8	14	99%	1.8
4	45%	0.9	15	100%	1.9
5	50%	1.0	16	100%	2.0

Die Modifiers: Useable Area Only
Badlands hex: –3
Steppe hex: +5
For each neighboring mountain hexside: –1
For each neighboring Steppe hex: +1
Die Modifiers: Richness Only
Jungle hex: –3
Steppe hex: +2
Desert hex: –5
Total Weather Factors –4–3: –1
Total Weather Factors +4-+5: –2
Total Weather Factors +6-+8: –3
Soil Contaminants: DM as obtained on page 18
Biological Compatability: DM as obtained on page 18
Summer Maximum Temp 50°C+: –10
Summer Maximum Temp 10°C–: –10
Winter Minimum Temp 10-50°C: +2
Growing Season (one-half of year) over 8 months: –2
World has no seasons: –2

Raw Materials Capacity

Each planetary hex is rated for its raw materials capacity in terms of useable area and richness. This capacity is based primarily on the terrain type of the planetary hex itself, but is also modified by the six surrounding planetary hexes (or, in the case of mountains, hexsides). The values for the planetary hex apply to every 20-km mapping hex included in the hex. (Optionally, referees may use these values as averages and assign different values to different mapping hexes within the planetary hex.)

Roll twice on the table below, once in the Useable Area column and once in the Richness column.

D10	Useable Area	Richness	D10	Useable Area	Richness
–5	—	1	6	30%	50
–4	—	2	7	35%	55
–3	—	5	8	40%	60
–2	—	10	9	45%	65
–1	—	15	10	50%	70
0	0%	20	11	55%	80
1	5%	25	12	60%	90
2	10%	30	13	65%	100
3	15%	35	14	75%	110
4	20%	40	15	80%	120
5	25%	45	16	85%	150

Die Modifiers: Useable Area Only
Glacier hex: No useable area; do not roll
Badlands hex: +2
Per neighboring mountain hexside: +1
Weather factors +6 or greater: +2
Die Modifiers: Richness Only
Steppe hex: –1
Desert hex: –2
World has fossil fuels: +4
World has low density: –3
World has high density: +3
World has radioactives: +1

Prior Exploitation: Remember to multiply the richness value of the hex by the value obtained earlier for prior exploitation. This step reduces the richness value to reflect the fact that much of the resources have already been removed.

Extractable Hydro Power

Each planetary hex has a certain amount of "free" hydro power available in it. This "free" power must then be extracted by mechanical means, such as water wheels, dams and hydroelectric turbines

The base hydro power in a planetary hex is obtained by indexing a world's size and hydrographic percentage on the Base Hydro Power table. The hex's base hydro power is then modified by a multiplier obtained by rolling on the Hydro Power Multiplier table, which incorporates the effects of different hex types.

Base Hydro Power

World Size	World Hydrographic Percentage 1	2	3	4	5	6	7	8	9	A
1	0.15	0.375	0.525	0.75	1.125	1.35	1.125	0.9	0.6	0.3
2	0.25	0.625	0.875	1.25	1.875	2.25	1.875	1.5	1	0.5
3	0.4	1.0	1.4	2.0	3.0	3.6	3.0	2.4	1.6	0.8
4	0.5	1.25	1.75	2.5	3.75	4.5	3.75	3	2	1.0
5	0.6	1.5	2.1	3.0	4.5	5.4	4.5	3.6	2.4	1.2
6	0.8	2.0	2.8	4.0	6.0	7.2	6.0	4.8	3.2	1.6
7	0.9	2.25	3.15	4.5	6.75	8.1	6.75	5.4	3.6	1.8
8	1.0	2.5	3.5	5.0	7.5	9.0	7.5	6.0	4.0	2.0
9	1.1	2.75	3.85	5.5	8.25	9.9	8.25	6.6	4.4	2.2
A	1.3	3.25	4.55	6.5	9.75	11.7	9.75	7.8	5.2	2.6

Values are in kilowatts (kW) of extractable power per square kilometer. Multiply this value by the area of the hex in km² as found on the Planetary Hex Survey table above to find the base extractable hydro power for the entire hex. Dividing this number by the number of 20-kilometer mapping hexes in the planetary hex yields the base extractable hydro power per 20-km mapping hex.

For example, a single planetary hex on a size 5 world with a hydrographic percentage of 6 would have a total extractable hydro power of (5.4 × 448,948 =) 2,424,319 kilowatts, or 2424.3 megawatts. The base extractable power per mapping hex would be (2424.3 + 1296 =) 1.87 megawatts. This base power is modified based on the results of the table below.

Hydro Power Multiplier

D10	Multiplier	D10	Multiplier
–5	0.01	6	1.0
–4	0.05	7	1.1
–3	0.1	8	1.2
–2	0.2	9	1.4
–1	0.3	10	1.6
0	0.4	11	1.8
1	0.5	12	2.0
2	0.6	13	3.0
3	0.7	14	4.0
4	0.8	15	5.0
5	0.9	16+	6.0



DIE MODIFIERS FOR HYDRO POWER MULTIPLIER TABLE

Hex Type	*Target Hex*	*Per Neighboring Hex /Hexside (Max)*
Mixed	+2	–1 per Steppe or Desert hex (–6) +2 per Mountain hexside (+6) +1 per Sea hex (+3)
Steppe	–5	–1 per Steppe or Desert hex (–6) +1 per Mountain hexside (+3) +1 per Sea hex (+3)
Ice Cap/Glacier	None*	None
Desert	–8	–1 per Steppe or Desert hex (–6) +1 per Mountain hexside (+3) +1 per Sea hex (+3)
Badlands	0	+2 per Mountain hexside (+6) +1 per Sea hex (+3)
Tundra	0	–1 per Steppe or Desert hex (–6) +1 per Mountain hexside (+3) +1 per Sea hex (+3)
Jungle	+2	+2 per Mountain hexside (+6) +1 per Sea hex (+3)
Island**	–5	None

Target hex is the planetary hex which is itself the target of the goal-oriented survey. The neighboring hexes are the six surrounding hexes. Hexes on the opposite side of mountain hexsides are not used for these calculations; the mountain hexside takes precedence as neighboring terrain no matter what is on the other side. Only full sea hexes count as sea hexes for purposes of the neighboring hex DMs; half-sea hexes count as land hexes of the appropriate land terrain type. Ice cap sea hexes also do not count as sea hexes for these DMs. Note that the chart indicates maximum DMs permitted from each terrain type.

*Hex has no extractable hydro power, regardless of surrounding hexes. Do not roll on table, enter "0" for hex's hydro potential.

**Any island which fits completely within one planetary hex uses this DM regardless of its terrain type.

Extractable Wind Power

As with hydro power, each planetary hex has a certain amount of extractable wind power available in it. The base wind power in a planetary hex is obtained by indexing a world's atmophere and hydrographic codes on the Base Wind Power table. The hex's base wind power is then modified by a multiplier obtained by rolling on the Wind Power Multiplier table, which incorporates the effects of different hex types.

BASE WIND POWER

World	*World Atmosphere Digit*			
Hydro	*0-3*	*4-5*	*6-7*	*8-9*
1	—	110	160	290
2	—	150	220	400
3	—	200	280	500
4	—	240	340	610
5	—	280	400	720
6	—	240	340	610
7	—	200	280	500
8	—	150	220	400
9	—	110	160	290
A	—	70	100	180

Values are in kilowatts (kW) of extractable power per square kilometer. Multiply this value by the area of the hex in km² as found on the Planetary Hex Survey table above to find the base extractable wind power for the entire planetary hex. Dividing this number by the number of 20-kilometer mapping hexes in the planetary hex yields the base extractable hydro power per 20-km mapping hex. This base power is modified based on the results of the table below.

WIND POWER MULTIPLIER

D10	*Multiplier*	*D10*	*Multiplier*
–2	0.2	8	1.2
–1	0.3	9	1.3
0	0.4	10	1.4
1	0.5	11	1.5
2	0.6	12	1.6
3	0.7	13	1.7
4	0.8	14	1.8
5	0.9	15	1.9
6	1.0	16+	2.0
7	1.1		

DIE MODIFIERS FOR WIND POWER MULTIPLIER TABLE

Hex Type	*Target Hex*	*Per Neighboring Hex/Hexside (Max)*
Mixed	–3	+2 per Mountain hexside (+6) +1 per Sea hex (+3)
Steppe	+1	+1 per Steppe hex (+6) +1 per Mountain hexside (+3) +1 per Sea hex (+3)
Ice Cap/Glacier	+1	+1 per Ice Cap/Glacier hex (+6) +1 per Mountain hexside (+2)
Desert	+1	+1 per Desert hex (+6) +1 per Mountain hexside (+3) +1 per Sea hex (+3)
Badlands	–3	+2 per Mountain hexside (+6) +1 per Sea hex (+3)
Tundra	+1	+1 per Tundra hex (+6)
Jungle	–3	+1 per Mountain hexside (+3) +1 per Sea hex (+3)

Target hex is the planetary hex which is itself the target of the goal-oriented survey. The neighboring hexes are the six surrounding



hexes. Hexes on the opposite side of mountain hexsides are not used for these calculations; the mountain hexside takes precedence as neighboring terrain no matter what is on the other side. Only full sea hexes count as sea hexes for purposes of the neighboring hex DMs; half-sea hexes count as land hexes of the appropriate land terrain type. Note that the chart indicates maximum DMs permitted from each terrain type.

Compile Economic Model Data

For the purposes of a colony or bootstrap campaign, the most important thing about the planetary survey are the numbers that feed into the colonial economic model, such as the agricultural and raw materials richness, useable area, maintenance modifiers, etc. Compile a list of all such relevant figures from the goal-oriented survey so that they are easily referenced for the economic model.

It is also possible that these numbers will be unfavorable, and the planetary hex will be rejected for habitation. In this case, another goal-oriented survey will be necessary if the world is to be settled.

SURVEY AS ADVENTURE

The above passages concentrate primarily on the Survey as a means of gaining information about a world's suitability for future purposes, but referees may also wish to use the survey mission as a framework for a roleplaying campaign.

As each surveyed world can be radically different, this chapter can only give the broadest of outlines for the kind of preparations a referee will wish to make.

Mapping

Any world which will be surveyed requires a map, on at least the scale of the global data view. If the PCs will be exploring specific areas in more detail, the referee may wish to prepare maps on the continental data view or local data view scale, or require the players to fill these out in the course of their explorations. Blank versions of all three map scales are available in the **Traveller Players' Forms** booklet.

Weather

When adventuring or exploring on the world, roll 1D20 on the Weather Change table every 8 hours (two periods), and move up or down the indicated number of lines on the Weather Track. Consult the Weather Factors table and index the world's axial tilt, primary star, and hydrographic code. As many as three such factors may apply, and are added together to find the correct column on the Weather Change table.

WEATHER FACTORS

+4 if system's star is type A
+2 if system's star is type F
–1 if system's star is type K
–2 if system's star is type M
–2 if axial tilt is zero.
–1 if axial tilt is 1-10 degrees
+1 if axial tilt is 20-29 degrees
+2 if axial tilt is 30-44 degrees
+4 if axial tilt is greater than 45 degrees
+1 if UWP hydrogaraphics code 5+

Weather Types

Clear: Good visibility and light winds up to 20 kilometers per hour.

Overcast: The sky is over 50 percent overcast with light winds.

Windy: Winds are blowing at up to 70 kilometers per hour. Depending on terrain and climate, this may result in a dust or sand storm, white-out conditions in snow, or high waves on bodies of water (Treat as Poor Weather for Tactical Visibility rules, **TNE** page 309, in this case).

Increase all tasks using Aircraft and Watercraft skill by one difficulty level.

Storm: Rain or snow is falling depending on local temperature. Treat as Poor Weather for Tactical Visibility rules (**TNE** page 309).

Increase all tasks using Aircraft or Watercraft skill by one difficulty level.

Severe Storm: Precipitation (rain or snow, depending upon temperature) accompanied by high winds up to 70 kph. Treat as Very Poor Weather for Tactical Visibility rules (**TNE** page 309).

Increase all vehicular tasks by one difficulty level, and all tasks using Aircraft or Watercraft skill by two difficulty levels.

At the beginning of an eight-hour weather period following a severe storm, weather reverts to Storm before rolling for the new weather.

WEATHER CHANGE
Total Weather Factors

D20	*–4*	*–3*	*–2*	*–1*	*0*	*+1*	*+2*	*+3*	*+4*	*+5*	*+6*	*+7*	*+8*	*+9*
1	U1	U1	U1	U2	U2	U2	U3	U3	U4	U4	U5	U5	U5	U6
2	—	U1	U1	U1	U2	U2	U2	U3	U3	U4	U4	U5	U5	U5
3	—	—	U1	U1	U1	U2	U2	U2	U3	U3	U4	U4	U5	U5
4	—	—	—	U1	U1	U1	U2	U2	U2	U3	U3	U4	U4	U5
5	CO1	—	—	—	U1	U1	U1	U2	U2	U2	U3	U3	U4	U4
6	CO1	CO1	—	—	—	U1	U1	U1	U2	U2	U2	U3	U3	U4
7	CO1	CO1	CO1	—	—	—	U1	U1	U1	U2	U2	U2	U3	U3
8	CO2	CO1	CO1	CO1	—	—	—	U1	U1	U1	U2	U2	U2	U3
9	CO2	CO2	CO1	CO1	CO1	—	—	—	U1	U1	U1	U2	U2	U2
10	CO2	CO2	CO1	CO1	CO1	CO1	—	—	—	U1	U1	U1	U2	U2
11	CO2	CO2	CO1	CO1	CO1	CO1	—	—	—	D1	D1	D1	D2	U2
12	CO2	CO2	CO1	CO1	CO1	—	—	—	D1	D1	D1	D2	D2	U2
13	CO2	CO1	CO1	CO1	—	—	—	D1	D1	D1	D2	D2	D2	U3
14	CO1	CO1	CO1	—	—	—	D1	D1	D1	D2	D2	D2	D3	U3
15	CO1	CO1	—	—	—	D1	D1	D1	D2	D2	D2	D3	D3	U4
16	CO1	—	—	—	D1	D1	D1	D2	D2	D2	D3	D3	D4	U4
17	—	—	—	D1	D1	D1	D2	D2	D2	D3	D3	D4	D4	U5
18	—	—	D1	D1	D1	D2	D2	D2	D3	D3	D4	D4	D5	U5
19	—	D1	D1	D1	D2	D2	D2	D3	D3	D4	D4	D5	D5	U5
20	D1	D1	D1	D2	D2	D2	D3	D3	D4	D4	D5	D5	D5	U6

WEATHER TRACK

Clear
Overcast
Windy
Storm
Severe Storm
Catastrophic Storm

U#: Up the indicated number of lines on the weather track

—: No change on the weather track

D#: Down the indicated number of lines on the weather track

CO#: Center toward overcast the indicated number of lines (i.e., move the current weather toward overcast, regardless of whether this is up or down on the track)



Catastrophic Storm: Precipitation (rain or snow, depending upon temperature) with winds above 100 kph, destroying wooden structures and vegetation. Treat as Poor Weather for Tactical Visibility rules (**TNE** page 309). Personnel and livestock out-of-doors should roll a Difficult task vs. Agility to avoid injury, roll 1D6 for dice of damage to random body part. Vehicles are attacked with a penetration value of 5 on a 1D10 roll of 2 or less every five minutes. Increase all vehicular tasks by two difficulty levels, and all other out-of-doors tasks by one difficulty level.

At the beginning of an eight-hour weather period following a catastrophic storm, weather reverts to Storm before rolling for the new weather.

Animals

Animals will naturally be encountered during the course of moving about on a world, and these encounters can range from the amusing or interesting to the frightening and deadly.

The referee will want to prepare animal encounter tables suitable to the terrain that the PCs will be exploring, using the rules in **TNE** pages 207-217. These rules can be used to craft animals for a particular purpose, or to randomly generate animals. Particularly interesting, dangerous, or important animals can be designed or chosen from a randomly generated table to be developed in more detail. This detail could include specifics of the animal's behavior, lifestyle, habitat, etc., which will come into play when these creatures are encountered by the PCs.

Blank forms for this purpose are available in the **Traveller Players' Forms** book, and examples of completed animal encounter tables may be found on pages 66-67 and 80-81 of this book.

Most survey missions will also involve cataloging the types of animals that can be encountered in various regions, particularly those which are expected to be developed by follow-on colonists or bootstrap teams. In this case, the referee could require the players to discover all of the creatures included on the encounter table for the local terrain type by using a combination of Tracking and Observation skills. Once the creatures have been found, the players may determine their values on the animal encounter table by observing their behavior (Observation skill) or by examining dead or tranquilized animals with Biology or Xeno-Biology skills.

Inhabitants

Interaction with local natives is an unlimited topic, and has been the subject of entire books of **Traveller** adventures. In the context of a survey mission, however, PCs have the opportunity to conduct first contact missions, using skills like Liaison, Persuasion, Psychology, Observation, and Bargain to open hopefully friendly relations with the locals.

Diseases

Diseases can be encountered in a number of ways in a **Traveller** campaign, and can have varying effects on the victim. They can be contracted from contact with local inhabitants or animal life, drinking unpurified water, bites from infected animals, or breathing airborne microbes. In general, however, diseases which are compatible with human biology will be contracted by contacting local humans, and this is the assumption used by the model below. However, referees should feel free to institute other disease vectors should they feel the need.

The following disease rules are also used in conjunction with the Colony and Bootstrap campaigns found elsewhere in this book.

To determine if a disease is present during a random encounter with human NPCs, roll 2D6 and compare it with the Disease Encounter table. If the result is equal to or greater than the number corresponding to the local tech level, disease is present.

DISEASE ENCOUNTER

TL	*Disease number*
0-4	10+
5-11	11+
11-15	12+

Note that the tech level applies to the local community, not the overall world tech level. As an example in the Bootstrap campaign, the "disease present" number in the bootstrap base camp is 11+, reflecting the sanitation and disease control capabilities of the team's TL 9 home world, Oriflamme. At the same time, the "disease present" number in the cities and villages of So Skire is 10+, reflecting that world's low technology level.

Characters can also contract disease by drinking unpurified water. Disease is present on a 2D6 roll of 12+ in water not treated with boiling, a water filtration/distillation unit, or tablets from a water purification kit. Characters may attempt to detect the presence of disease in water by rolling an Average test vs. Survival, Medical (Diagnosis), or Biology.

If a disease is present, roll on the Disease Table to determine what kind of disease is present and the basic data about its effects.

The result will indicate the type of disease present, its probability of infection, the length of its incubation period, the length the disease takes to run its course, the days it takes for the patient to be fully recovered, the probability of recovery, the probability of death if recovery fails, and the impact the disease has on the patient's fatigue level during recovery.

Infection: To determine whether an individual is infected, roll an Average: CON task. Add the Infection Number for the disease plus the current fatigue level number, if any, to the die roll result before

DISEASE TABLE

2D6	*Disease*	*Infection Number*	*Incubation (days)*	*Phase I (days)*	*Phase II (days)*	*Recovery (days)*	*Recovery Number*	*Death Number*	*Rec. Fatigue Treat./No Treat.*
2	Crippling	3	21	14	7	140	25	9	0/2
3	Intestinal	5	1	3	3	28	21	2	2/3
4	Nerve	3	5	10	20	120	22	5	1/2
5	Wasting	2	90	30	120	360	25	9	2/3
6	Minor	1D6–2	3	5	5	5	17+1D6	None	0/1
7	Respiratory	5	5	5	9	7	21	1	0/1
8	Minor	1D6–2	5	3	2	2	15+1D6	None	0/0
9	Respiratory	6	3	7	21	42	24	1	2/3
10	Skin	4	1	5	10	14	20	8	2/2
11	Heart	5	7	3	2	120	20	9	3/3
12	Killer	6	3	3	7	100	20	10	2/2



comparing it to the target number (2×CON). If the roll is failed, the individual is infected.

Incubation: A disease will usually take a number of days after the patient is exposed before symptoms appear. During this time the patient is infectious and may spread the disease to others.

Diagnosis: Characters with Medical skill may attempt a diagnosis task. If the task fails, the wrong disease will be diagnosed, and the prescribed treatment may be ineffective. Each disease has a task level indicated in its description. This is for diagnosis during Phase I. Diagnosis during Phase II is one level easier because the symptoms are more advanced.

Recovery: The patient recovers if he rolls the recovery number or greater on 1D10 modified by adding the treatment received (+n), the Medical *skill level* of the person administering the treatment, and the CON of the diseased character. Negative modifiers should be assigned for inadequate diet (–1) and inadequate shelter (–1) as described on **TNE** page 199. A recovery roll is made at the end of Phase I. If the roll fails, make a second roll at the end of Phase II. If treatment is not begun until Phase II (or there is no treatment at all), only the Phase II roll is attempted, and any treatment DMs are halved. If the Phase II roll fails, roll 1D10 against the Death Number. A roll equal to or less than the number means the patient has died. If the patient lives after rolling the Death Number, he suffers a permanently reduced fatigue level equal to the Non-Treated fatigue level for that disease.

Duration: The disease is active during Phases I and II, and the patient will not begin to recover until the end of Phase II, no matter when the successful recovery roll is made. The patient may find his fatigue level increased during the Recovery period. There are two Recovery Fatigue levels for each disease in the table. Apply the first to the patient if he was successfully treated in during Phase I. Apply the second if he was treated during Phase II or was not treated at all.

Disease Types: Because thousands of diseases can be found on each planet, it is more useful to describe them by type than individually. Some are minor, mere annoyances. Others are swiftly lethal. Where DMs are prided for multiple drug types (i.e., metabolic, antitoxin, and antibiotic, see **TNE** page 335), use only the single DM for the drug used. Some of these diseases may be already known, with appropriate antitoxins and antibiotics already available, but some may be unknown, and require research and fabrication of new cures (referee's discretion).

Crippling: This attacks the nervous system controlling the extremities. It paralyzes the patient, sometimes causing him to draw up his limbs in a grotesque rictus. Advanced stages of this disease can kill by paralyzing the diaphragm and preventing breathing. Similar Terran disease: polio. Diagnosis is Formidable.

Treatment: Metabolic (+6), administer oxygen (+1), relieve pain and fever (+1).

Intestinal: This causes severe cramps, diarrhea, nausea, vomiting, and severe dehydration. Similar Terran disease: cholera. Diagnosis is Difficult.

Treatment: Metabolic (+6), specific anti-toxin (+6), antibiotic (+2), intravenous fluids (+2), relieve pain and fever (+2).

Nerve: This attacks the brain and central nervous system. Paralysis and death may result. Similar Terran disease: encephalitis. Diagnosis is Difficult.

Treatment: Metabolic (+6), specific anti-toxin (+6), antibiotic (+4), relieve symptoms (+1).

Wasting: This is a long term disease that gradually debilitates the patient over time. The patient suffers drastic loss of weight, muscle mass, and strength. Similar Terran disease: some forms of cancer. Diagnosis is Formidable.

Treatment: Metabolic (+4), surgery (surgeon's skill).

Minor: This represents a minor respiratory and/or intestinal infection. Similar Terran disease: cold or flu. Effects differ slightly to represent differences in severity. Diagnosis is Difficult.

Treatment: Antiobiotics/metabolics (+8), relieve pain and fever (+2).

Respiratory: This disease attacks the lungs and interferes with breathing, as well as being generally debilitating. Similar Terran disease: pneumonia. Effects differ slightly to represent differences in severity. Diagnosis is Difficult.

Treatment: Metabolic (+6), antibiotics (+4), relieve pain and fever (+2).

Skin: This is a skin infection accompanied by fever. Caused by a fungus, this disease can attack the mucus membranes of the mouth, nasal passages, and eventually the lungs where it can cause death by suffocation. Similar Terran disease: severe and massive thrush fungal infection. Diagnosis is Formidable.

Treatment: Metabolic (+4), relieve symptoms (+2).

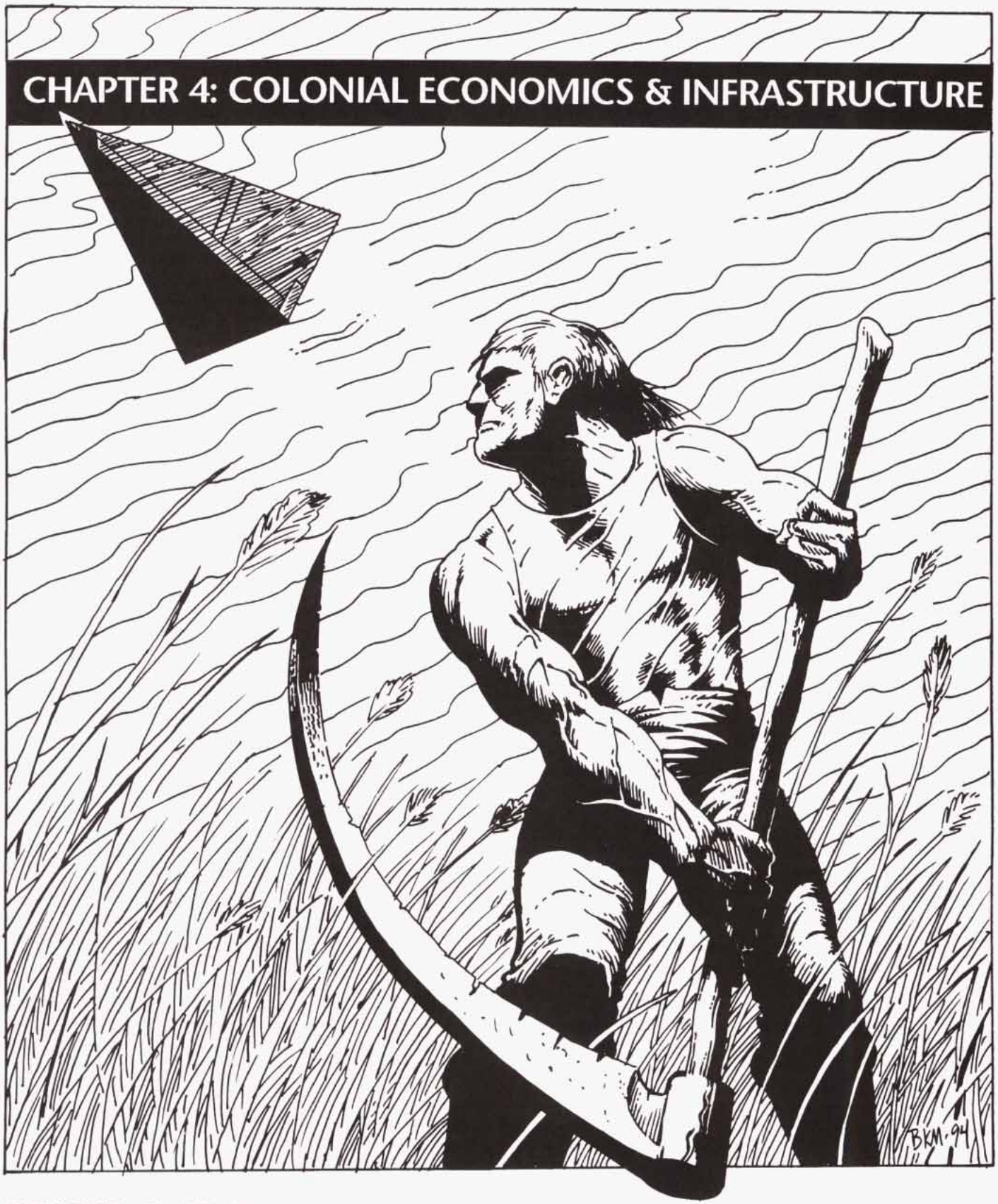
Heart: A viral infection that attacks the heart muscle. This disease has a high mortality rate. If the patient does not die, he is severely debilitated. Similar Terran disease: scarlet fever. Diagnosis is Difficult.

Treatment: Metabolic (+2), relieve symptoms (+2).

Killer: This is a massive, general viral infection of the blood and all the body's vital organs. Patients mostly die within two weeks. Similar Terran disease: Streptococcus infection, but much more deadly and untreatable. Diagnosis is Formidable.

Treatment: Metabolic (+2), relieve symptoms (+1).

CHAPTER 4: COLONIAL ECONOMICS & INFRASTRUCTURE



RUNNING A COLONY

In order to run a high-level world tamers campaign, the PC colony (or bootstrap team) leaders need to be able to make decisions that have an impact on the growth and success of the colony, and also need to understand the functioning of the colony so that these decisions can be made in an informed and rational manner. This requires a simple and effective model of the economic processes that go on in a colony.

This model is presented below for use with the Bootstrap and Colony adventures presented in this book (Chapters 6 and 7). It can also be used as the basic system for an infinite variety of other **Traveller** situations, such as working out the details an existing colony, outpost, or primitive society encountered in the Wilds. As a simple system, it is amenable to add-on modifications for additional color or variation, and referees should feel free to experiment with it to allow for variations in local conditions.



THE COLONIAL ECONOMIC MODEL

The economy of a colony is divided into four general sectors: agriculture, industrial production, materials, and power.

Agriculture is the organized production of foodstuffs to feed the colonists or export for cash. This includes crop farming, animal husbandry, and fishing.

Materials is the extraction of raw materials from the environment for use in the other three economic areas. It includes mining of minerals and solid fuels from the ground, wells to extract petroleum, logging, and even the raising of certain non-food crops such as cotton and hemp.

Manufacturing is the conversion of raw materials to finished manufactured items. It is divided into heavy industry, light industry, and construction. Heavy industry produces large vehicles and machinery, as well as smelting metal from ore. It is necessary for industrial expansion. Light industry makes finished consumer goods, such as furniture, electronics, and textiles. Construction builds infrastructure items such as roads and housing.

Power generates electrical power (or its equivalent at earlier tech levels) for industry.

Basic Structure

Each of the four economic sectors is defined within the same set of categories (the energy sector is an exception in some of the areas, see the Energy section below for details): labor, capital, energy, raw materials, required land, and output, as defined below.

Labor: This represents the number of people working in that sector of the economy. The unit used to quantify the amount of labor is the *laborer*. The greater the number of laborers working in a sector, the greater the output that sector can create. In the model, however, a laborer is defined as the actual workers in an area as well as their dependants. This avoids the need to keep separate track of total population as opposed to actual labor force. Thus a family of four in the agricultural sector would count as four laborers.

Capital: This represents the quantity of equipment, tools, and machinery that is devoted to this sector of the economy. For agriculture this is plows, barns, fishing boats, etc., for industry it is factories, for materials it is mines, digging equipment, oil wells, and the like. For simplicity, this capital equipment is quantified not in numbers of pieces of machinery, but by its value in *credits*. This allows rough equivalencies to be made between such dissimilar things as shovels, fish traps, and rivet guns.

The greater the amount of capital in a sector, the more labor-saving devices are available, which increase the productivity of the labor in the sector, increasing the output of that sector.

For you budding Marxists out there, "capital" in this sense is equivalent to *the means of production*.

Land: Both agriculture and raw materials production require land, and that requirement is measured in square kilometers per laborer. The requirements for agriculture vary with tech level. The requirements for materials vary with the richness of the deposit. Poorer deposits require larger tracts of land to extract economically useful amounts of materials. The richness of deposits is determined by the planetary survey (see page 21). Each 20-kilometer mapping hex has an area of 350 square kilometers.

Power: Power is required by certain sectors to operate their equipment. In most cases, this power can be assumed to be electrical in nature (although at low tech levels it might be mechanical energy transmitted short distances by gears and pulleys, etc.). Power is measured in *Kilowatts*, where 1000 Kilowatts equal 1 Megawatt (multiply power in Kilowatts by 0.001 to get Megawatts).

Raw Materials: Sectors require raw materials to operate their machinery (in the form of fossil fuels) or to transform into manufactured goods (iron to make steel, steel to make machinery, cotton to make clothing, copper to make electrical wiring, etc.). Raw materials are measured by their mass in *tonnes*.

Output: Output is the end product produced by the economic sector in question. The units in which output is measured depends upon the sector, as the industrial sector produces capital, the materials sector produces raw materials, the energy sector produces power, and the agricultural sector produces the food eaten by all citizens.

Agriculture

Agricultural output is a product of labor, capital, land, and (at higher tech levels) raw materials. All must be present to produce food. The basic building block is labor.

Labor: The basic unit of measure is the Agricultural Laborer. Agricultural Laborers (ALs) comprise all of the agricultural members of the population (farmers, their families, etc.). In order to produce agricultural output, each AL requires capital, land, and raw materials. This varies by tech level as explained below.

Capital: Capital goods are the machines that labor operates to farm the land (plows, tractors, combines), as well as necessary buildings (such as grain silos, barns, and farrowing houses) and livestock. Normally each AL is provided with one unit of agricultural capital goods. The price of a unit of agricultural capital goods is listed on the table below.

Excess Labor: Societies short of capital may still increase agricultural production by employing more agricultural workers. Up to twice as many ALs of labor may be employed in the agricultural sector as there are units of capital, but all ALs in excess of the total units of capital produce at half the normal rate. For simplicity, where labor exceeds capital, subtract the units of agricultural capital from the total number of agricultural laborers. Multiply the result by 0.5, and add this number to the number of units of agricultural capital.

The result is the output multiplier which is applied to the agricultural sector's output (see below). Results of greater than 1.5 times the total units of agricultural capital are not possible.

AC + (0.5×[AL–AC]) = Output Multipler
with a maximum result of 1.5×AC
AC: units of agricultural capital
AL: agricultural laborers

What is a Laborer?

In the passages below, economic relationships are defined in terms of *laborers*: agricultural laborers (AL), industrial laborers (IL), and material laborers (ML). These are treated as abstract units for the purposes of computing the functioning of the colonial economy, but they have real-world equivalents.

Each laborer is equal to one actual person in the colony's population. This individual person is not necessarily a member of the workforce, however. Each laborer represents roughly one quarter of a worker, representing the members of a society who are too young or too old to work, or are otherwise occupied in non-workforce roles (including full-time parents, etc.). Thus if a colony currently has 800 industrial laborers, this number includes the families of the actual industrial workers, whose actual number is around 200.

This distinction does not affect the way the economic model works, but is helpful to referees and players attempting to visualize the roleplaying "reality" that is being modelled here.



Excess Capital: Societies short of labor may increase production by using more and better machines (capital goods). Each AL which has a second unit of capital assigned to it produces at 1.25 times the normal rate. An AL derives no additional benefit from having more than two units of capital assigned to it. For simplicity, where capital exceeds labor, subtract units of labor from units of capital. Multiply the result by 0.25 and add this to the total units of labor.

The result is the output multiplier which is applied to the agricultural sector's output (see below). Results greater than 1.25 times the total AL are not possible.

(0.25×[AC–AL])+AL = Output Multiplier
with a maximum result of 1.25×AL
AC: units of agricultural capital
AL: agricultural laborers

Livestock: An additional component of agricultural capital is livestock. Livestock is measured in terms of rations (as they are edible, and can be replaced from agricultural production by converting slaughter animals to breeding stock). Each AL must be provided with rations equal to the rated monthly output for that tech level as initial livestock, up to a maximum of 33 rations. As with capital goods, this is a one-time investment. Unlike capital goods there is no continuing maintenance cost.

For example, a tech level 7 colony wishes to add additional ALs to the farm work force. Each AL requires Cr4900 in heavy industry output, Cr4900 in construction industry output, and 21 rations worth of livestock. An additional AL in a tech level 11 colony requires Cr12,100 in heavy industry output, Cr12,100 in construction industry output, and 33 rations worth of livestock.

Certain random events may cause the colony to lose livestock, in which case they must be replaced from food reserves or production. ALs which do not have their required livestock capital suffer a 10% reduction in agricultural output.

Buying New Agricultural Capital: Agricultural capital is produced by the heavy industry sector, and the tech level of the new capital is equivalent to the tech level of the industrial capital that manufactured it. Agricultural capital may also be deliberately built at any tech level lower than that of the manufacturing industrial capital.

Land: Each farm laborer requires a fixed amount of land to farm. This amount increases with tech level, and is noted on the table below. Land requirements are based on the number of ALs *or* the units of agricultural capital, *whichever is less*. Extra labor or capital are used to increase output on land already under cultivation, and so do not increase land use.

The survey of the hex in which the colony is located will provide a richness rating of the land as well as a useable percentage. The richness rating is a modifier to agricultural output. The useable percentage is the proportion of the land in the hex (and in each 20-kilometer mapping hex within it) which can be used for farming.

Power: The agricultural sector has no specific needs for power; these are subsumed within other sections of the economic model.

Raw Materials: From tech level 4 and above, the agricultural sector requires an amount of raw materials, measured in tonnes per month, to produce food. This amount of raw materials is based on the number of ALs *or* the units of agricultural capital, *whichever is greater*.

These raw materials include fuel for farm machinery, fertilizers, pesticides, herbicides, etc. If this is not provided, that AL or unit of capital produces food, but only at the rate for tech level 3. When some raw materials are provided, but not enough for the entire sector, the colonial leadership will have to decide how to allocate raw materials to existing units of agricultural capital and assign ALs to the supplied and unsupplied units of capital.

The per-AL energy requirement differs with tech level. Raw materials are only required in months of the growing season (as determined in the Survey chapter).

Output: Output of the agricultural sector is measured in a base value of "rations" produced per month per AL or AC. A ration is enough to feed one person for one month at subsistence level. Agriculture only produces rations during the growing season (as determined in the Survey chapter). The capital provided for each AL is assumed to include sufficient storage space for whatever rations are produced.

This tech level-based value is multiplied by the Output Multiplier calculated above. This output is multiplied by the hex's richness rating as determined by the survey.This output may be further modified by random events and the results of the monthly output roll.

For purposes of transportation, a ration (food for one person for one month) masses 0.1 tonne and displaces 0.1 cubic meter.

AGRICULTURAL SECTOR KEY VALUES

TL	*AC*	*RM*	*Land*	*Output(Rations)*
0	—	—	0.1	2
1	300	—	0.15	3
2	800	—	0.2	4
3	1500	—	0.3	6
4	2400	1	0.4	9
5	4000	2	0.5	12
6	6000	4	0.6	15
7	9800	6	0.7	21
8	14,400	8	0.8	27
9	18,000	10	0.9	33
10	21,000	12	1.0	39
11	24,200	14	1.1	45
12	27,600	16	1.0	52
13	31,200	14	0.8	60
14	35,000	12	0.6	68
15	39,000	10	0.4	75

What is the Tech Level of My Colony?

The tech level of a colony is determined by the tech level of its capital machinery. Since capital machinery is purchased separately for the separate economic sectors, different sectors can be at different tech levels, and a single sector can include capital machinery from more than one tech level.

In general terms, the difference in tech levels between two sectors cannot be greater than one, and a single sector can have capital machinery from only two consecutive tech levels at a time: the lower tech level it is converting from, and the higher tech level it is converting over to.

Since this is a science fiction game in which a virtually infinite variety of social structures can be encountered, referees should feel free to design societies that have greater technological differences between or within sectors, but for the purposes of PC groups leading their own colonies, the one TL limit above should be enforced.

Industrial Production

Industrial production is a product of labor, capital, energy, and raw materials. All four must be present to produce finished goods. For our purposes, the basic building block will be labor.

Labor: The basic unit of measure is the Industrial Laborer. Industrial Laborers (ILs) comprise all of the members of the population associated with the manufacture of finished goods from raw materials. At each tech level the capital, power, and raw material needs of an IL are different, as explained below.



Capital: Capital goods are the machines that labor operates to manufacture finished goods, as well as the buildings that house them. Normally each IL is provided with one unit of industrial capital goods (IC). The price of a unit of industrial capital goods (one IC) is listed on the table below.

Excess Labor: Societies short of capital may still increase industrial production by employing more workers. Up to twice as many ILs of labor may be employed in the industrial sector as there are units of capital, but all ILs in excess of the total units of capital produce at only one-half the normal rate. For simplicity, where labor exceeds capital, subtract the units of industrial capital from the total number of industrial laborers. Multiply the result by 0.5, and add this number to the number of units of industrial capital.

The result is the output multiplier which is applied to the industrial sector's output (see below). Results of greater than 1.5 times the total units of industrial capital are not possible.

IC + (0.5×[IL–IC]) = Output Multiplier
with a maximum result of 1.5×AC
IC units of industrial capital
IL: industrial laborers

Excess Capital: Societies short of labor may increase production by using more and better machines (capital goods). Each IL which has a second unit of capital assigned to it produces at 1.25 times the normal rate. An IL derives no additional benefit from having more than two units of capital assigned to it. For simplicity, where capital exceeds labor, subtract units of labor from units of capital. Multiply the result by 0.25 and add this to the total units of labor.

The result is the output multiplier which is applied to the industrial sector's output (see below). Results greater than 1.25 times the total units of industrial labor are not possible.

(0.25×[IC–IL])+IL = Output Multiplier
with a maximum result of 1.25×IL
IC: units of industrial capital
IL: industrial laborers

Types of Industrial Capital: There are three types of capital goods: heavy industry capital goods, light industry capital goods, and construction industry capital goods. These types differ in terms of capital goods requirements and in what they may manufacture. The price listed on the table below is for light industry capital goods; heavy industry capital goods cost three times this amount, while construction capital goods cost half this amount.

When purchasing capital goods for any sector, half must be produced from heavy industry output and half from construction output. When initially setting up a colony the machinery for industry is usually transported in by starship, but the buildings to house it (the half of the cost represented by the construction sector) must still be erected. (See pre-fabricated buildings on page 36 of the infrastructure section following.)

Buying New Industrial Capital: Existing heavy industrial capital can manufacture new industrial capital at any tech level equal to or less than its own.

Heavy industrial capital may build new industrial capital at the current tech level +1 at *twice* the listed cost, and only if all capital (of all types: agricultural, raw materials, and all three types of industrial) has already been brought up to the same tech level. This means that on the turn immediately following this technological breakthrough, the lower tech industrial capital may no longer build at the current TL +1: all new capital at the higher tech level must be built by the new "prototype" capital. (This artificiality is intended to put the brakes on technological advancement within this simple economic model without having to expand it to include complex rules on research and development, science, etc.)

Converting Industrial Capital: Existing industrial capital may be converted into industrial capital of the next higher tech level at the rate of 20% of its cash value. For example, 100 units of TL-4 light industrial capital are valued at (Cr500×100=) Cr50,000. If this were to be converted to TL-5 light industrial capital, the amount would be 20% of 50,000 or Cr10,000, which would become (10,000÷1350=7.4, dropping fractions =) 7 units of TL-5 light industrial capital. This conversion may only be conducted if at least 50% of the current heavy industrial capital is at this higher tech level, and the new (higher TL) value of the converted equipment must be less than or equal to the current heavy industrial output in credits.

Industrial capital may only be converted into higher-tech industrial capital of the same type, i.e., light industry into light industry only, heavy industry into heavy industry only.

Land: The industrial sector requires no land of its own *per se*. Rather, the land required for industry is factored into that required for housing infrastructure (see the Infrastructure section, below).

Power: Each IL of labor requires a fixed amount of power to produce finished goods. If this is not provided, that IL cannot work (and produces nothing in that period). The per-IL power requirement differs with tech level, and is expressed in terms of kilowatts of power generating capacity continuously devoted to industry.

Raw Materials: Each IL of labor requires a fixed amount of raw materials, measured in mass tonnes per month, to produce finished goods. If this is not provided, that IL cannot work (and produces nothing in that period). The per-IL energy requirement differs with tech level. Heavy industry requires twice the listed mass of raw materials if producing heavy manufactured goods (see Output below). If producing light manufactured goods it requires the listed mass of raw materials.

Output: The base output in finished goods of an IL is measured in Credits of value produced per month. This base value can be

INDUSTRIAL SECTOR KEY VALUES

TL	Light IC	Heavy IC	Construction IC	KW	RM*	Output
0	5	15	2.5	—	0.1	50
1	10	30	5	—	0.2	75
2	15	45	7.5	—	0.3	100
3	150	450	75	0.1	1	200
4	500	1500	250	0.2	4	300
5	1350	4050	675	0.3	7	500
6	3000	9000	1500	0.4	15	750
7	6500	19,500	3250	0.8	30	1000
8	11,000	33,000	5500	1.2	45	1500
9	15,000	45,000	7500	1.5	55	2000
10	20,000	60,000	10,000	1.8	65	2500
11	24,000	72,000	12,000	2.0	70	3000
12	28,000	84,000	14,000	2.2	75	3500
13	32,000	96,000	16,000	2.4	80	4000
14	37,000	111,000	18,500	2.6	85	4500
15	42,000	126,000	21,000	2.8	90	5000

*Value listed is for the production of light manufactured or construction goods. For the production of heavy manufactured goods (possible only with heavy capital goods), double this value.



adjusted up or down based upon provision of capital goods (as explained above) and by the results of the monthly output roll.

Heavy Industry may produce either heavy industrial goods or light manufactured goods. Light industry may only produce light industrial goods. Construction industry produces infrastructure.

Heavy industrial goods are the capital goods used in all of the economic sectors, plus power plants, vehicles, aircraft, ships, spacecraft, artillery, large rockets and missiles, etc.

Light industrial goods are all other manufactured items (electronics, home appliances, paper products, pharmaceuticals, textiles, furnishings, military small arms, shoulder-fired rockets and missiles, etc.).

Infrastructure consists of buildings, roads, bridges, starports, monorails, etc.

Materials Industry

The materials sector of the economy produces the raw materials that are used by the other sectors to fuel vehicles, fertilize the ground, and build finished goods (all of which are abstracted into a single raw material requirement) . Materials production is a product of labor, capital, land, and power. It does not require materials, but rather produces them. For our purposes, the basic building block will be labor.

Labor: The basic unit of measure is the Materials Laborer. Materials Laborers (MLs) comprise all of the members of the population associated with discovery, collecting, creation, and/or extraction of raw materials. At each tech level the capital and energy needs of an ML are different, as explained below.

Capital: Capital goods are the equipment that labor operates to find and recover or produce raw materials, as well as the structures in which these operations are conducted. Normally each ML is provided with one unit of capital goods. The price of a unit of capital goods is listed on the table below.

Excess Labor: Societies short of capital may still increase raw materials production by employing more workers. Up to twice as many MLs of labor may be employed in the materials sector as there are units of capital, but all ML in excess of the total units of capital produce at only one-half the normal rate. For simplicity, where labor exceeds capital, subtract the units of materials capital from the total number of materials laborers. Multiply the result by 0.5, and add this number to the number of units of materials capital.

The result is the output multiplier which is applied to the materials sector's output (see below). Results of greater than 1.5 times the total units of materials capital are not possible.

MC + (0.5×[ML–MC]) = Output Multiplier
with a maximum result of 1.5×MC
MC: units of materials capital
ML: materials laborers

Excess Capital: Societies short of labor may increase materials production by using more and better machines (capital goods). Each ML which has a second unit of capital assigned to it produces at 1.25 times the normal rate. An ML derives no additional benefit from having more than two units of capital assigned to it. For simplicity, where capital exceeds labor, subtract units of labor from units of capital. Multiply the result by 0.25 and add this to the total units of labor.

The result is the output multiplier which is applied to the materials sector's output (see below). Results greater than 1.25 times the total units of materials labor are not possible.

(0.25×[MC–ML])+ML = Output Multiplier
with a maximum result of 1.25×ML
MC: units of materials capital
ML: materials laborers

Buying New Materials Capital: Materials capital is produced by the heavy industry sector, and the tech level of the new capital is equivalent to the tech level of the industrial capital that manufactured it. Materials capital may also be deliberately built at any tech level lower than that of the manufacturing industrial capital.

Land: The materials sector requires land to extract and process raw materials. Land requirements are determined by the planetary survey. Each hex will have a richness rating and a useable percentage rating. The richness rating is the tonnes of raw material per month which can be extracted from a square kilometer of land. The useable percentage is the percentage of land in the hex which may be used to extract raw materials. It is possible to have a high richness rating and a low useable percentage, indicating a limited but very concentrated deposit.

Land use per ML is based on the output of those MLs. For example, 10 TL-6 MLs properly supplied with capital and power can produce 1500 tonnes of raw materials per month. The amount of ground required to support this output varies with the richness rating. If the materials richness rating of the hex were 100, the 10 laborers would require 15 square kilometers to meet their capabilities.

Power: Each ML of labor requires a fixed amount of power to produce raw materials goods. If this is not provided, that ML can work but only produces output at the TL-2 level. The per-ML power requirement differs with tech level, and is expressed in terms of kilowatts of power generating capacity continuously devoted to the materials sector.

Output: The base output of the materials sector is in tonnes of raw materials per month. This base value can be adjusted up or down based upon provision of capital goods (as explained above) and by the results of the monthly output roll.

Materials Sector Key Values

TL	*MC*	*KW*	*Output*
0	0.5	—	1
1	1	—	2
2	1.5	—	3
3	15	0.1	10
4	50	0.2	40
5	135	0.3	70
6	300	0.4	150
7	650	0.8	300
8	1100	1.2	450
9	1500	1.5	550
10	2000	1.8	650
11	2400	2.0	700
12	2800	2.2	750
13	3200	2.4	800
14	3700	2.6	850
15	4200	2.8	900

Agricultural Production of Raw Materials: Agricultural products can be used for textiles, fuel, building materials, synthetics, glues, and a host of other raw material functions. If desired, up to 30% of the colony's raw materials needs may be met by agricultural produce. Each ration masses 0.1 tonne and may be used on a one-for-one basis for raw material. Thus ten rations could be substituted for one tonne of raw materials.

Power

This segment of the economic model produces the power that is consumed by the other sectors of the economy. The power sector does not require persons to be assigned to it, only to have the proper power-generating equipment built, and to have materials (fuel) and



maintenance provided for it. There are no "power laborers."

Power-generating equipment is designed using the Power Production sequences in **Fire, Fusion, & Steel**, and/or the supplemental power generation systems detailed below.

Chemical Power: Any of the chemical power production plants listed in **Fire, Fusion, & Steel** can be used as a stationary power source.

The fuel demand in tonnes of a chemical power plant must be calculated so that these needs may be met by the materials sector of the economy and the transportation network.

Because the economic model does not distinguish between fossil fuels, it is only important that these are noted as being present on the planet. However, to simulate the use of coal instead of oil or natural gas at lower tech levels, use the coal fuel use multiplier from **FF&S** (×1.5) at TLs 3 and 4. If fossil fuel is not available on the world, chemical power plants must instead burn alcohol or wood at the conversion rates listed in **FF&S**. However, aside from the differences in required tonnages, these different types of fuel are all supplied by the materials sector without differentiation.

Nuclear Power: These are designed using the Nuclear Power Plants table of **FF&S**. Fission power plants must have a supply of radioactives, either from local sources or from off-planet. In the case of high-tech fission plants that are maintained from off-world, it is assumed that this off-world maintenance includes refueling, so a local supply of radioactives is unnecessary.

Hydro Power: In the survey chapter, each planetary hex was evaluated for the total quantity of extractable hydro power. This power is extracted using the water wheels and turbines on the table below. At TL 4 and lower, this power is hydromechanical, and is extracted via gears and pulleys to operate machinery. At TL 5+, electrical generator turbines extract this power as hydroelectric power which is naturally much more flexible in the uses it can be put to, although this economic infrastructure model imposes no penalties on the use of low tech hydromechanical power.

Water wheels and hydrogenerator turbines at a given tech level have a listed efficiency of extraction. This shows the limit to the amount of extractable hydro power in the hex that can actually be harnessed at that tech level. Multiply the hex's extractable hydro power by this number to find this maximum quantity of power at each tech level.

The extraction of a mapping hex's hydro power via hydrogenerators removes a portion of that hex's land area from other service, i.e., it cannot be also used for housing, agricultural, or raw materials land. This simulates the large reservoirs created by hydroelectric projects. Divide the power output of installed hydrogenerators by the total extractable hydro power in the hex (modified by the TL extraction efficiency) and divide by 2. The result is the percentage of area in the hex that can no longer be used for any other purpose. These penalties to not apply to water wheels, which are simply placed alongside streams or rivers, requiring their attached facilities to also be close by.

Hydrogenerators may not be imported from off world; they may only be manufactured by the construction sector of the world. This is because TL-5+ hydroelectric projects require massive and time consuming programs to build dams, and this capacity is limited by local productive capacities and cannot be simply bought and installed.

Water wheels may be imported. Both water wheels and hydrogenerators are treated as being constructed by the economy's construction sector.

HYDRO POWER GENERATORS

TL	*Type*	*MCr per kW output*	*Efficiency*
1	Water Wheels	0.01	0.4
3	Water Wheels	0.02	0.5
5	Hydrogenerators	0.25	0.95

Wind Power: In the survey chapter, each planetary hex was evaluated for the total quantity of extractable wind power. As with hydro power above, wind generators have extraction efficiencies that vary with tech level. Multiply the hex's extractable wind power by this number to find this maximum quantity at each tech level.

Also like hydro power, harnessing a hex's wind power removes portions of that hex's land area from service. Multiply the hex's extractable wind energy by the tech level efficiency figure on the table below. Then take the total installed output of wind generators installed in the hex and divide it by the modified extractable energy available in the hex. The result is the percentage of square kilometers in the hex that are no longer available for any other use because they are now covered by wind turbine farms.

WIND POWER GENERATORS

TL	*Type*	*MCr per kW output*	*Efficiency*
3	Windmills	0.01	0.3
4	Windmills	0.05	0.5
5	Wind Turbines	0.2	0.8
7	Wind Turbines	0.25	1.0
9	Wind Turbines	0.3	1.2
12	Wind Turbines	0.4	1.5

Solar Power: Solar power arrays described in **FF&S** may be assembled in ground installations to provide supplementary power during daylight hours. However, unless sufficient storage batteries are available, a solar array can provide no power at night.

Orbiting solar arrays capable of capturing stellar energy from synchronous orbit and beaming it to surface rectifier/antenna (rectenna) installations can overcome most of the daylight limitation. These solar arrays transmit their power to the ground rectennas via large masers. Double the price and mass of the solar cells (not collector panels) to allow for the transmission masers and capacitors/batteries required to hold the power during transmission interruptions.

Rectenna installations are needed to receive the microwave power and to step down the frequency to a standard electrical range (50-60 hertz). The rectenna installation area is 100 square meters per megawatt of power being beamed down from orbit. Rectenna installations cost MCr0.1 per 100 square meters.

Infrastructure

A colony requires a certain basic level of physical infrastructure, consisting of transportation and housing. Both of these are built by the construction sector, while vehicles to move goods on the transportation lines are built by heavy industry.

Transportation: Cities require transportation lines into them from farm communities to move food, and from resource sites to bring raw materials. In addition, each inhabited 20-km hex requires a road network within it for local traffic. In both cases (resource transportation roads and local transport nets) are based on population, although the presence of heavy industry in a city will increase this.

For purposes of this model, the term *city* and *colony* are functionally equivalent terms, denoting a self-supporting population. While larger (hence older) cities/colonies may be spread over multiple hexes, bringing agricultural goods and raw materials from outlying hexes into the central industrial hex, young colonies will likely have all of their economic components—agricultural, materials resource sites, and industrial—located within the same 20-km hex.

All of these described transportation lines include roads and rail transportation (as appropriate to tech level, of course), but as any net includes elements of both of these types, they are abstracted as a general transportation capability. Transportation lines are rated by their potential load value, in millions of tonnes per month. A TL-1



transportation line has a load value of 0.5 million tonnes per month, for example, while a tech level-5 line has a load value of 8 million tonnes, and a tech level-8 line has a load value of 30 million tonnes. None of the transport nets or lines below are considered to take up any of the space in a hex, but are subsumed within the other land usages.

Local Transport Net: Each inhabited 20-kilometer hex of the colony requires 500 kilometers of road for local traffic. The population that can be accommodated in each hex is equal to the road net's load level in tonnes. As each 20-km hex may only have the single 500-kilometer road net built within it, this creates a tech level-based restriction on the maximum population that can live in a hex. As an economy's tech level increases, it is possible to upgrade the local transport net (by simply building a new 500-kilometer net which is assumed to replace the old one) to allow more people to live in the hex.

Resource Transport Lines: Resource transportation lines are required in inhabited hexes in addition to the transport net described above. Resource transportation lines consist of 20-kilometer stretches of roads, i.e., transportation arteries running from one side of the hex to the other. The required load level of the resource transportation system supplying a hex is equal to the tonnes of raw materials required per month plus the hex's total population multiplied by 0.1. Several such arteries may be built to meet the required load level. Thus a TL-2 colony hex with a required load level of 4 million tonnes would have to have at least four such 20-kilometer roads (4×the load level of 1 million tonnes per road = 4 million tonnes), at a total cost of (80km×MCr0.0015=) Cr120,000.

If raw materials or rations are drawn from sites outside the hex containing the city, those hexes must be linked to the hex containing the city hex by transportation lines of sufficient load level to carry the raw materials or food. Each such transportation line leading into the city must equal or exceed the required load level or the city will not receive sufficient food or raw materials.

For example, a city hex is inhabited by 30,000 persons and draws in a total of 6,000,000 tonnes of raw materials and food each month. Of that tonnage, 2,000,000 is produced within the hex itself, 1,000,000 is produced in a hex two hexes from the city, and 3,000,000 is produced in a hex three hexes away from the city. Each of the three occupied hexes requires its own 500-km local road net. Although the colony's tech level is 2, the local nets are left at TL-0,

ROADS

Roads are basic to any society. The first roads are dirt tracks through the wilderness, and the first streets are the spaces between the buildings in a village. As a society advances and finds and utilizes sources of petrochemicals, limestone, sand, and gravel, roads are paved so that wheeled traffic can move more efficiently, mud can no longer bog down vehicles, and dust and dirt generated by passing traffic is kept to a minimum.

Roads allow vehicles to move from point to point at speeds greater than their normal cross-country speeds by levelling out uneven terrain, eliminating mud, etc. The low-tech roads described below provide a road bonus which is added to the vehicle's cross-country speed while travelling on the road. However, this speed cannot exceed the vehicle's permanent rated road speed (as calculated in the design sequence or listed with the vehicle's ratings). At higher tech levels, roads simply allow vehicles to use their rated road speeds.

Trails & Tracks (TL 0): These are the first overland roads. They cost nothing to build as they are essentially formed by the passage of humans and their wagons and sometimes by the passage of local animal life. Vehicles using trails and tracks move at their cross-country speed rate +1.25 kph (add 5 to cross-country travel move) as they do not have to break through brush. They are reduced to their basic cross-country speed in rainy weather because of mud.

Improved Trails & Tracks (TL 1): These are basically trails and tracks that have been widened and graded with animal-powered scrapers. Traffic may pass in opposite directions without one party leaving the road. Vehicles using improved trails and tracks move at their cross-country speed rate +2.5 kph (add 10 to cross-country travel move) in good weather, but are reduced to their cross-country speed in rainy weather because of mud.

Crowned Roads (TL 2): These roads are constructed with a cambered surface so that water will flow off them to be carried away by drainage ditches alongside them, and are usually also topped with gravel or stones. Vehicles using crowned roads move at their cross-country speed rate +3.75 kph (add 15 to cross-country travel move) and do not have a mud penalty in rainy weather.

However, continuous use by heavy vehicles (10 tonnes or greater) will destroy these roads in 1D20 days, and sustained use by tracked vehicles will destroy them after only two hours, in either case reducing them to the quality of improved trails and tracks, above.

Macadam Roads (TL 3): These are crowned and drained roads surfaced with chipped stones or gravel to form a water-impervious surface. Vehicles moving on macadam roads move at their cross-country speed +5 kph (add 20 to cross-country travel move) and do not have a mud penalty in rainy weather.

Sustained use of the road by heavy vehicles (10 tonnes or greater) will destroy these roads in 1D10 weeks, and use by tracked vehicles will destroy the surface in six hours, reducing the road to the quality of an improved trail/track.

Asphalt Roads (TL 4): These crowned and drained roads are topped with a bitumen-gravel mix, and are the basic road type found on mid-technology worlds. They are built with two or more lanes to allow opposing traffic and passing. Vehicles moving on asphalt roads move at their full road speed and do not have a mud penalty in rainy weather.

However, sustained use by heavy vehicles (10 tonnes or greater) will destroy these roads in 10+1D10 months, and use by tracked vehicles will destroy the road surface in 12 hours, reducing the road to the quality of an improved trail/track.

Concrete Roads (TL 5+): A more durable alternative to asphalt roads, concrete roads are surfaced with a mixture of sand, gravel, and limestone which has been thermally converted into cement. Vehicles moving on concrete roads move at their full road speed and do not have a mud penalty.

Concrete roads are not damaged by vehicles of less than 50 tonnes, but will have their surfaces destroyed by 18 hours of sustained use by tracked vehicles, which reduces the road to the quality of an improved trail/track.

Fused Roads(TL 12+): The ultimate in road surfacing and construction, fused roads are built with mobile fusion reactors that use plasma jets to melt and fuse the ground into a thick, ceramic-like surface. Vehicles on fused roads travel at their full road speed. Fused roads are not damaged by heavy nor tracked vehicles, though tracked vehicles usually must be fitted with rubberized track shoes to get proper traction on the ceramic surface.



as the load level at TL 0 still allows up to 100,000 persons to live in a single hex, and is therefore sufficient for the colony's current needs.

The city hex requires resource transport lines with a total load of 6,000,000 tonnes,

Local and transportation lines are built by the construction sector of the economy. The table below lists the load capacity of a single transport line or network (in millions of tonnes), and the cost per kilometer of transport line, broken down by tech level.

TL	*Load*	*MCr*
0	0.1	Free/0.0005*
1	0.5	0.001
2	1	0.0015
3	4	0.003
4	6	0.004
5	8	0.005
6	10	0.006
7	15	0.008
8	30	0.01

*The cost for a TL-0 500-km local road network is free, but resource transport lines cost MCr0.0005 per kilometer.

Required Raw Materials: When calculating required loads above, it is important to remember that the raw materials required by the colony are not limited to those needed by the agricultural, industrial, and power sectors to keep their production going. This number also must include any excess raw material production that is being devoted to off-world trade, as well as the raw material requirements of the armed forces (see below).

Vehicles: In order for a transportation line to operate at its capacity, it must also have transport machinery: cars and trucks for the roads, trains and train cars for the railroads and monorails. These are built by the heavy industry sector, and are measured in units of one million kilometer-tonnes of haulage.

If, for example, a city needed 1,000,000 tonnes of food and raw materials per month, and had to haul it in from a mean distance of four hexes or 80 kilometers (determined by the location of farming communities with sufficient excess food production to feed the city and material sites sufficient to meet its raw material needs), the city would need transport nets with a combined capacity of at least 1,000,000 tonnes (one tech level 2 transport line would be sufficient) and 80,000,000 kilometer-tonnes of vehicles in operation, or 80 units.

Note that vehicles have a raw material tonnage (fuel) for operating, also rated per unit of million kilometer-tonnes. At low tech levels this cost is in rations per month needed to feed the draft animals. This raw material or ration cost is added to the needs of the city being serviced. Thus in the example above, the TL-2 city requires 80 units of transport, and these units require (80×2000=) 160,000 rations per month.

The table below shows the price of vehicles in MCr per million kilometer-tonnes of capacity, as well as the tonnes of raw materials (or, at low TLs, number of rations) required for each million km-tonne unit of vehicles. When purchasing units of vehicles for a colony, note that the maximum tech level of vehicle which may be operated on a local road network or transport line is the tech level of the transport network or line +1. When a road network consists of multiple tech levels, use the lowest tech level present.

The MR column indicates the movement rate of a unit of transportation purchased at that tech level. This value is used only with the armed forces infrastructure below and the mass combat system, pages 46-47.

VEHICLES

TL	*MCr*	*RM*	*MR*
0	2.5	—	2/1
1	1.25	(3300 rations)	3/2
2	1	(2000 rations)	3/2
3	0.5	500	3/2
4	0.4	250	4/2
5	0.3	175	5/2
6	0.2	100	15/5
7	0.175	80	15/5
8	0.15	70	15/5

Housing: Housing is defined in total cubic meters of housing available to the people of the colony. Housing is built by the construction industry and costs Cr100 per cubic meter.

Dividing the total cubic meters of housing by the total population will yield the cubic meters available per person, which is used to determine the Standard of Shelter (see below). As a general rule, 25 cubic meters per person is minimal shelter, usually provided by communal dormitories. Standard of shelter improves up to about 100 cubic meters per person, which is comfortable housing. Additional cubic meters provide more luxury than utility, and progressively greater increases are necessary to obtain meaningful benefits.

Power: Housing does not require power *per se*, as these requirements are subsumed within the per-laborer power requirements for the industrial and raw materials sectors.

Land: Housing requires land, and the amount of land required per cubic meter depends on the tech level. (At higher tech levels, high-rise buildings consume less land area for the cubic meters of housing provided.) The following chart indicates the square kilometers of land required per million cubic meters of shelter at different tech levels. When colony leaders lay out their colony within a hex, they may specify that housing is placed on land not suitable for agriculture or raw materials usage, within the referee's discretion.

TL	*km² per million m³*	*persons per km², assuming 25m³ each*
0	4	10,000
1	2	20,000
2	1	40,000
3	0.8	50,000
4	0.6	66,666
5	0.5	80,000
6	0.4	100,000
7	0.3	133,333
8	0.25	160,000
10	0.2	200,000
12	0.15	266,666
14	0.1	400,000
15	0.05	800,000

Armed Forces

There is one final segment of society that must be considered, and that is the armed forces. These are not included in the economic model above, because their contribution cannot be measured in economic terms. In fact, to the casual observer, the provision of armed forces appears to be a drain upon a society's economy.

It is difficult to measure the marginal value of the common defense, or to determine what is the cheapest amount that can be spent to prevent the destruction of a society by its neighbors. There is substantial agreement among healthy societies that they do wish to be defended, but little consensus on how much defense is enough.

Labor: The armed forces are measured in armed forces laborers.



Armed Forces Laborers (AFLs) represent the portion of society dedicated to military pursuits. The total number of AFLs multiplied by 0.25 yields the number of *troops*, each of which represents one person enlisted in the armed forces.

Capital: Capital goods are the baseline equipment that allow the armed forces to exist: infrastructure such as barracks, armories, typewriters, etc. This value is listed on the table on page 35, and one unit of capital goods must be provided per AFL (not troop). Note that this value does not include weapons of any kind.

All weapons, including small arms, ammunition, vehicles, aircraft, spacecraft, etc., must be purchased or designed and purchased using such resources as the equipment section in the **TNE** basic rules, **Fire, Fusion, & Steel**, the **Reformation Coalition Equipment Guide**, and the equipment section and supplementary design sequences (for black powder and bow weapons) that appear in Chapters 10 and 9 of this book, respectively. The amount of such weaponry purchased depends upon the number of troops available, but the organization of these troops and the level of their equippage is up to the society's leaders (in this case, usually the PCs). See also the Infrastructure subheading below.

Energy: Each troop requires a fixed amount of energy to remain in readiness. If this is not provided, those troops are incapable of responding adequately to hostile acts (referee's discretion). The per-troop energy requirement differs with tech level, and is expressed in terms of kilowatts of power generating capacity continuously devoted to the armed forces.

Raw Materials: The armed forces require raw materials based on the fuel consumption of their capital goods (vehicles, etc.). This is calculated based on the performance data found in the various equipment listings, and is based on the amount of operation that the equipment will undergo in a given month. Note that the amount of raw materials provided will not only govern the tempo of military operations in a war (see page 47 of Chapter 5, the Mass Combat System), but will affect the quantity of training that can be conducted with this equipment in peacetime.

Raw materials should be provided to allow equipment to be operated for a certain number of hours per month. For simplicity, assume that all pieces of military equipment are operated for the same amount of time each month. Equipment designed with **Fire, Fusion, & Steel** or picked from published equipment lists have their fuel consumption rates listed, usually in terms of liters of fuel per hour.

Although goods from the materials sector are referred to as raw materials (which is to distinguish them from the finished goods which come from the industrial sector), for the purposes of this model, assume that these raw materials are fully useable in their delivered form (refined fuel, gasoline, jet fuel, etc.).

Not all fuels are available at all tech levels, which clearly places a limit on the armed forces which can be maintained by a given world. A world whose materials sector tech level (defined as the tech level of capital goods which constitute 50% or more of the materials sector) cannot produce the required fuel type must import fuel for its armed forces.

TL	*Fuel Type*	*FC*	*Tonnes per liter*
0	Wood	Bio	0.002
1	Alcohol	Bio	0.001
1	Coal	FF	0.002
4	Hydrocarbon Distillates	FF	0.001
5	Liquid Rocket Fuel	FF	0.001
6	Radioactives	—	0.019
7	High-Grade Hydrocarbon Distillates	FF	0.001
7	Hydrogen Rocket Fuel	—	0.0003
7	Liquid Hydrogen	—	0.00007

FC: Fuel Class. This indicates certain restrictions on fuel availability that vary from world to world, as established in the Survey Chapter. Fuels labelled "FF" (fossil fuels) may only be produced by the materials sector on worlds where such fuels are available. Fuels labelled "Bio" are biological in origin, and may only be produced by the materials sector on worlds where life is possible. The notation "—" indicates no such restrictions.

Note that for armed forces which use animal transportation, each horse (or horse equivalent if using non-Terran beasts) requires one ration and provides an absolute value of 160 hours of operation per month. This 160-hour figure is effectively a minimum usage level, as horses cannot be multi-tasked. For example, if an army's organization requires 100 horses (say, 40 horse-mounted cavalry and 30 wagons each with two horses), it must be provided with 100 rations and is capable of being operated up to 160 hours per month, regardless of whether it actually is. That force could not be provided with only 50 rations and operated at 80 hours per month. On the other hand, if the leaders wished for this army to be able to operate at 240 hours per month, it would require more horses and rations: 150 horses consuming 150 rations per month.

Readiness: The amount of operating hours will affect the readiness of the armed forces by dictating the amount of training that can be conducted.

Quality	*Hours/month*
Elite	120
Veteran	80
Experienced	40
Novice	20

The above activity levels are required to *maintain* the listed troop qualities; units of lower troop quality may not be improved to higher levels by providing them with more hours of operation. For example, a unit of Elite troops must have raw materials provided to it to allow all of its equipment to be operated for 120 hours a month. If it were allocated 80 hours, the unit would fall to Veteran quality, or to Experienced quality if it were allocated raw materials for only 40 hours. A unit whose quality has been allowed to fall for lack of operating hours can be raised back up to its original quality by restoring the appropriate level of raw materials, but each level recovered takes six months. Thus the Elite unit allowed to fall to Experienced quality would require six months of supply at 80 hours before it would be considered to be back up to Veteran quality, and then a further six months of supply at 120 hours before it would be treated as Elite again. (See the **TNE** sourcebook **Path of Tears: The Star Viking Sourcebook**, pp. 95-97 for discussion of how to determine quantity and quality of planetary armed forces.)

Infrastructure: Rather than requiring players to design supply units to support their combat formations, simply total up the mass of ammunition owned by the armed forces plus the mass of the monthly raw materials provided to the armed forces, and purchase transportation sufficient to carry that tonnage of materials from the Vehicles table on page 33 (one unit of vehicles per million tonnes). The table shows the movement rate that will be used for the army's supplies, see page 44 of the Mass Combat Chapter.

Output: The base output of the armed forces is the capability to break things and hurt people, and this is measured using the **TNE** rules for combat (including the rules for mass combat including in Chapter 5). The process of converting that capability into the somewhat intangible commodity called security is the art called *statecraft*. That is the province of the society's leaders. Good luck.



Armed Forces Key Values		
TL	*AFC*	*KW*
0	2.5	—
1	5	—
2	7.5	—
3	75	0.1
4	250	0.2
5	675	0.3
6	1500	0.4
7	3250	0.8
8	5500	1.2
9	7500	1.5
10	10,000	1.8
11	12,000	2.0
12	14,000	2.2
13	16,000	2.4
14	18,500	2.6
15	21,000	2.8



Maintenance

Assuming that the average machine tool lasts for about 20 years, every year 5% of the industrial capital (heavy, light, and construction) must be replaced, or 0.4% each month. Half of this is provided by the heavy industry sector and half by the construction industry sector. This is *mostly* what heavy industry does, and if it weren't for this drain on productivity, societies could grow like crazy.

For example, 100 units of tech level 5 heavy industrial capital are worth Cr405,000, and require a maintenance value of (405,000×0.004=) Cr1620 to be paid each month, Cr810 from each of the heavy industry and construction sectors.

When the colony first starts, all of the capital tools and buildings are presumably new, so none need to be replaced. But starting on year 10 of the colony, 0.1% per month must be put into maintenance, 0.2% in year eleven, 0.3% in year twelve, and 0.4% in year thirteen and every year afterwards. (This delayed requirement keeps players from having to worry about this requirement in most cases, which few of them will find disappointing.)

The power sector and armed forces require maintenance at the same rate, based on the monetary value of all installed power generation systems and weapons (but not ammunition).

Infrastructure (including armed forces infrastructure) must be maintained as well, and each month the construction industry must invest 0.2% of the total value of the infrastructure (transportation and housing) in its maintenance.

Agricultural and materials sector capital goods are exempt from maintenance requirements.

If the colony has no heavy industry, or none of sufficient tech level to maintain high-tech imported systems, this maintenance must be imported from off-planet (and is purchased as a simple monetary value). Failure to meet the maintenance requirement leads to a gradual erosion of the capital base, as machines are cannibalized for parts. (That's what's been happening in the Wilds for decades.) The decline in useable capital machinery is *twice* the maintenance shortfall.

Maintenance is paid monthly, based on the quantity of equipment (capital goods, infrastructure, etc.) existing at the beginning of the month.

Weather Effects on Maintenance: Note that the required infrastructure maintenance rate (normally 0.2% per month) may be modified by local weather conditions, as calculated on page 17 of the Survey chapter. If weather factors total +3 or less, there is no change to this base rate. If weather factors total +4 to +5, the monthly rate becomes 0.3%, and if weather factors total +6 or more the monthly rate becomes 0.4%.

Off-World Trade

Trade consists of exports sold off-world to generate money to purchase goods that are imported back to the world. These imports can consist of luxury goods, crucial high-tech spare parts, weapons, capital goods, etc.

A successful economy will produce surplus goods from any or all of the agricultural, industrial, and materials sectors. Even a marginal economy can be controlled to produce trade goods by skimping on the products that are reinvested back into the economy, at the option of that society's leaders.

Exports: First the value of the world's exports must be defined. Industrial production is already defined in terms of credits, but agriculture and raw materials output must be converted into monetary terms.

This is done by converting rations and tonnes of raw materials into displacement tons of starship cargo. For rations, divide by 100 to get displacement tons, and for raw materials divide tonnes by 20 to get displacement tons. Then take the total number of tons of cargo to the top half of page 239 in the **TNE** rulebook and calculate the price that they are purchased for by traders that call at the world. (It is assumed that sufficient starships call each month to purchase all exports that are offered. After all, the Coalition or the sponsoring colonizing world is trying to expand its trade—it would be foolish to not see to it that the opportunities are there.)

Add the price paid for the agricultural and raw materials cargos to the monetary value of industrial exports. This is the total value of the goods in local credits. This value must then be converted using the exchange rates rules found on **TNE** pages 230-231 into terms of the currency of the sponsoring world. (For example, Baldur in the case of the colony adventure. In other cases, such as bootstrap operations, use the friendly base from which the mission was launched.) This is the amount of money available to buy imports.

Imports: Imports may be purchased using the money generated by exports. Note that purchases made with this money must still be adjusted for the exchange rates between the currency's base value and its value on the world where the imports are being purchased. For example, the world sponsoring the colony is a TL 12, Starport B world, and the colony is attempting to purchase goods from a Starport A, TL-15 world. The monetary value calculated above in "Exports" would have to be multiplied by 0.08 to find its purchasing power on the tech-15 world.

Referees will want to exercise some control over the imports that can be obtained: in a Reformation Coalition campaign, imports will obviously be limited to goods that can be produced in the Coalition. However, referees may stipulate that trade relations must first be opened to trading partners via some kind of diplomacy before trade can be attempted, etc.



On-World Trade: In campaigns on already-inhabited worlds, the PC-led group will be able to trade with the on-planet neighbors. Handling these details will be up to the referee, as it should involve roleplayed diplomacy, and should probably involve detailed knowledge of the nature of the goods being traded. Furthermore, such trade might not always be for economic advantage. For example, a PC colony might simply give excess food or manufactured goods to a neighboring group in order to gain their good will.

Set-up Procedures

Several rules affect only the initial set-up of the colony, and these are covered below.

Capital Machinery: All agricultural, industrial, and raw materials capital goods for the laborers in the colony must be transported aboard the colony transports. This equipment is transported at the rate of one displacement ton per Cr4000 of value.

Start-up Rations: Wise colony leaders will bring along rations sufficient to feed the colony for one or more months, until the economy can be gotten up and running. This food is shipped at the rate of 100 rations per displacement ton.

Livestock: Agricultural livestock capital normally paid in the form of rations may not be transported to the colony as bulk food, as it represents living organisms. Animals are brought to the colony in specially designed low berths. These low berths, called livestock low berths, have characteristics identical to emergency low berths. Each livestock low berth carries the equivalent of 10 rations worth of livestock.

Temporary Shelters: It will take a while to build even primitive dormitories, and in the mean time the colonists will need shelter from the elements. Basic tents can provide this shelter or limited time. Housing tentage costs Cr100 and masses 0.001 tonne and displaces 0.002 cubic meter per member of the colony.

Tents may also be used to provide cover for agriculture and machinery, thus letting farming and the other industries get under way immediately. Tents cost 10% of the normal capital construction price for construction and agriculture. They mass 10 tonnes and displace 20 cubic meters per million credits of tentage purchased.

Tents will last for approximately twelve months, at the end of which time they are worn out and are discarded.

Prefabricated Buildings: Housing and other buildings can be carried as prefabricated components and then assembled on the planet. The full price of the building is paid for the prefab components and then 10% of their value must be spent (again) by the construction sector on the planet to assemble them.

Lack of Roads: The necessary roads will not appear instantly, but economic activity will begin almost at once. All economic activity in a hex except for construction will operate at 60% efficiency (construction operates at 100%) until the necessary transportation network is completed. Fortunately, a 500-kilometer TL-0 local transport net appears immediately for free in the colony hex meaning that only resource supply roads need be built right away.

Placement in the Hex: The colony should be placed in one or more 20-kilometer hexes. Each such hex has 350 square kilometers of useable land in it, which must be divided up among raw material production, agriculture, and housing. (Land devoted to industry is included in the housing requirements.) Hexes on the seacoast will have their total area reduced based on how much of the hex is water. Players should make sketch maps of the layout of the colony, being sure to leave room for expansion.

Acclimatization

Acclimatization can be a difficulty if the colonists come from a world that is too different from their destination. The acclimatization stage of colonists has an effect in the economic model (handled in the output roll). Colonists should be rolled for in groups, treating them as NPCs for purposes of attributes. In detailed campaigns where the players have carefully interviewed colonists, the referee may be able to work out aggregate attribute values based on the established characteristics. In other cases, treat industrial, agricultural, and raw materials laborers as having a CON attribute of 6, and treat any troops as their rated NPC class for attributes. Referees and players may stipulate that crucial or detailed NPCs are rolled for individually. Naturally any bonuses for medical personnel in the colony/bootstrap team should be applied.

PLAYING THE COLONIAL ECONOMIC MODEL

The economic model is played in monthly turns, meaning that food, materials, and industrial production is totalled on a monthly basis and assessed against population and the internal needs of the economic sectors.

Month: Because different worlds will have different lengths of day, year, etc., for the purposes of this economic model, the term *month* is defined as approximately 750 hours, plus or minus a few percent to allow the referee to fit it conveniently to local units of time. For example, 750 hours equals 31.25 days each of 24 hours. An Earth month averages 30.4 days. 30.4 days is within 3% of 31.25, so the referee may simply use the existing Terran calendar to keep track of months. As always, the referee is the final judge of these matters.

Annual Considerations

Population Growth: At the end of every year the colonial population grows by 2%. These new laborers may be assigned to any economic sector desired by the colony leaders.

Scenario Conditions/Bookkeeping: Certain colony or bootstrap scenarios may be defined as being a year in duration, or have their criteria for success defined on a yearly basis.

Random Events

Events are rolled for each month at the beginning of the administrative cycle. These include weather events, random events, and scenario specific random events.

Weather Events: The only DMs used on this table are the Weather Factors obtained during the planetary survey. The results are implemented on the current monthly turn.

WEATHER TABLE

D20	*Result*	*D20*	*Result*
–3	Drought	13	No Effect
–2	No Effect	14	Drought
–1	Drought	15	Severe Storm
0	No Effect	16	Severe Storm
1	Drought	17	Drought
2	No Effect	18	No Effect
3	No Effect	19	Severe Storm
4	No Effect	20	Severe Storm
5	No Effect	21	Catastrophic Storm
6	No Effect	22	Severe Storm
7	No Effect	23	Drought
8	Drought	24	Severe Storm
9	No Effect	25	Catastrophic Storm
10	Drought	26	Severe Storm
11	No Effect	27	Catastrophic Storm
12	No Effect	28	Catastrophic Storm



Drought: Lack of water causes –2 DM on Agricultural output roll for current turn.

Severe Storm: Violent storm damages colony. –2 DM on agricultural out put roll for current turn, plus roll 1D6 for specific result:

1-3: Kills number of colonists and destroys number of units of capital machinery equal to (1D6–colony tech level)×5. Roll for sector, 1-3=agriculture, 4-5=materials, 6=industrial.

4: Destroys (1D20–colony tech level)×500 cubic meters of housing

5: Destroys 1D6×100 stored rations

6: All of the above

Catastrophic Storm: Extremely violent storm damages colony. Agricultural output for current turn cut in half, plus roll 1D6 for specific result:

1-3: Kills number of colonists and destroys number of units of capital machinery equal to (1D20–colony tech level)×10. Roll for sector, 1-3=agriculture, 4-5=materials, 6=industrial.

4: Destroys (1D20–colony tech level)×2000 cubic meters of housing

5: Destroys 1D6×500 stored rations

6: All of the above

Scenario Specific Random Events: The bootstrap and colony adventures in this book show examples of scenario-specific random events tables. These are in addition to the tables above. Referees may create their own random events tables to reflect unique conditions on various worlds.

Satisfaction Indices

Three indices of public satisfaction are tracked: standard of nutrition, standard of shelter, and standard of living. All three are described below, and all three provide a DM to be used on the political table. However, although all three of these DMs are are calculated each month, only the *lowest* (i.e., that with the greatest negative effect) one of these three DMs is actually used on the political table.

However, note that the standard of nutrition does provide a DM on the output roll even if it is not the satisfaction DM being used on the political table.

Standard of Nutrition

The standard of nutrition (SN) is an important index of a colony's well being, as it has two effects. First, the SN level provides a DM on the monthly output roll as an index of the overall health of the population. Second, the SN level may provide a DM on the colony's monthly political roll as a measure of the overall happiness of the population, at least as regards their diet.

Determine the standard of nutrition in the following manner.

Total up the number of rations produced during the month, and determine the amount that are being allocated to the population (as opposed to being set aside for export, the creation of new agricultural capital, stored for future consumption, used for raw materials, used to feed animal-drawn transport or military equipment, traded to local natives, etc.). Divide this number by the total population, and the result is the standard of nutrition, expressed in rations per person.

Random Events

Roll 1D20. On a result of 16+, roll 1D20 on the Random Events table. On any other result, there is no random event for the month. There are no DMs on this table.

Referees should adjust numbers of deaths from plagues, etc., to allow for very small or very large colonies.

D20	*Result*
1	Plague strikes populace: 1D10 persons die each day until Impossible Medical (Diagnosis) task is completed (task may be rolled once per 24 hours). –4 DM on all output rolls this turn. –2 on political roll.
2	Disease strikes livestock: Kills 1D10 units of livestock each day until Impossible Medical (Diagnosis or Veterinary Medicine) task is completed (task may be rolled once per 24 hours). Due to diseased meat, agricultural output cut in half for this turn. –2 on political roll.
3	Plague strikes populace: 1D6 person die each day until Formidable Medical (Diagnosis) task is completed (task may be rolled once per 24 hours). –2 DM on all output rolls this turn. –1 on political roll.
4	Disease strikes livestock: Kills 1D6 units of livestock each day until Formidable Medical (Diagnosis or Veterinary Medicine) task is completed (task may be rolled once per 24 hours). Due to diseased meat, agricultural output reduced by 25% for this turn. –1 on political roll.
5	Hostile starship visits (vampire ship, pirate, slaver, etc., referee's discretion)
6	Vermin eat 1D10×5% of stored rations. –2 on political roll.
7	Blight destroys crops. Agricultural output for turn cut in half. –2 on political roll.
8	Earthquake: 1D6×10% of housing destroyed. –1 on political roll.
9	Vermin eat 1D6×5% of stored rations. –1 on political roll.
10	Crime wave, succeed at Impossible Investigation, Psychology, or Streetwise task or –2 on political roll.
11	Crime wave, succeed at Formidable Investigation, Psychology, or Streetwise task or –1 on political roll.
12	Local carnivore rampages through colony, kills 1D20. Succeed at Impossible Tracking and Hunting task or –2 on political roll.
13	Indigenous animals stampede, destroy 1D20 units of agricultural capital. –1 on Political roll.
14	Crime wave, succeed at Formidable Tracking and combat task or –1 on political roll.
15	No traders arrive this month, no exports sold this turn, all rations set aside for export spoil.
16	Friendly starship visits (referee's discretion)
17	Discovery of tasty local life form. Permanently add +1 to all agricultural output rolls. +1 on political roll this turn only.
18	Population explosion of local edible lifeforms. +4 DM on agricultural output roll for this month. +1 on political roll.
19	Discovery of hardy, prolific, edible, local life form. Permanently add +2 to all future agricultural output rolls. +2 on political roll this turn only.
20	Population explosion of local edible lifeforms. Multiply agricultural output by 2 for this month. +2 on political roll.



THE MONTHLY TURN

Each month, the following things must be done:

1. Roll on the standard random events tables plus the scenario-specific random events tables, if applicable.
   - Assess the impact of the events and play out any roleplaying that is associated with handling these events
   - Assess the impact of the roleplaying or decisionmaking in response to the events
   - Carry forward political table die modifiers from the **previous** turn, such as standard of nutrition, standard of living, standard of shelter, malcontent population, etc.
   - Roll on political table with all appropriate DMs
   - Play out any dictated events from the political table, including roleplaying responses to same

2. Carry forward and total up all DMs that will apply to the output rolls
   - Roll the Agricultural Output roll
   - Roll the Industrial Output roll
   - Roll the Materials Output roll

3. Total up the amount of rations, including those stockpiled and those newly produced
   - Allocate rations to population for the **current** month
   - Allocate rations to other areas, such as animal-powered transportation, ration stockpiles, agricultural production of raw materials, or other purposes, such as frendship donations to neighboring powers, etc.
   - Allocate rations for off-world export
   - Calculate and record the standard of nutrition of the colony used on the **next** turn
   - Carry forward remaining stockpiled rations

4. Calculate the quantity of energy produced, based on the amount of raw materials received, and other inputs for wind, hydro, or solar power
   - Allocate energy to industrial and raw materials sectors for the **current** month

5. Total up the amount of raw materials produced
   - Allocate raw materials to the agricultural, industrial, and energy sectors for the **next** month
   - Allocate raw materials to other areas, such as armed forces, stockpiling, etc.
   - Allocate raw materials for off-world export
   - Carry forward remaining stockpiled rations

6. Calculate the quantity of industrial output produced, broken down into heavy, light, and construction
   - Allocate production to new capital goods, and convert low tech capital to higher level
   - Allocate production to maintenance
   - Allocate production to new infrastructure
   - Allocate production for off-world export
   - Allocate production to armed forces
   - Allocate production of consumer goods to population
   - Calculate and record the standard of living of the colony used on the **next** turn)
   - Calculate and record the standard of shelter of the colony used on the **next** turn)

7. Based on new capital production, calculate new economic capacities for following turn
   - Assess the need for new infrastructure to support load level
   - Reassign laborers within or across economic sectors, if necessary

8. Calculate the amount of currency generated by off-world export
   - Make purchase of off-world goods, equipment, weapons, etc.
   - Make purchase of off-world maintenance



Note that an SN of 2 does not necessarily mean that each person is eating twice as much. Rather, the higher numbers indicate that a greater proportion of the diet consists of luxury foods, or foods from "higher on the food chain." The ration unit is based on the amount of agricultural effort required to create sufficient food to keep a person alive for a month, rather than an absolute mass of edible material. This means that with a given amount of effort, a farmer could produce any of the following: a large quantity of wheat, a somewhat smaller quantity of oranges, a smaller quantity still of beef steak (because each kilogram of beef requires the cow to eat around 10 kilograms of feed), a still smaller quantity of veal, or an extremely small amount of fat goose liver.

Thus we assume that an SN of 1 describes a diet consisting mostly of grain (e.g., rice) or grain products (bread) plus a bare minimum of animal protein and other goodies, while higher SNs indicate a greater and greater percentage of labor- and nutrition-intensive foodstuffs, such as meat and luxury fruits and vegetables.

SN	*Output DM*	*Political DM*
0.45-0.54	–8	–4
0.55-0.64	–5	–3
0.65-0.74	–3	–2
0.75-0.84	–2	–1
0.85-0.94	–1	–1
0.95-1.1	—	—
1.2-2.0	—	+1
2.1-3.0	—	+2
3.1-6.0	—	+3
6.1-10.0	—	+4
10.1+	—	+5

Standard of Shelter

The colony's standard of shelter (SS) is defined as the cubic meters of housing per member of the population. Simply divide the total volume of housing in cubic meters by the total number of citizens. The result is the SS.

The standard of shelter provides a potential DM on the colony's monthly political roll.

SS (m^3)	*Political DM*
25-50	–2
51-80	–1
81-120	—
121-160	+1
161-250	+2
251-350	+3
351+	+4

So Whatcha Gonna Do About It?

Random events in the economic model are a prime example of how high-level play can serve as a "scenario generator" for low-level roleplaying.

If there is a crime wave, the players may wish to take their characters out to capture the miscreants. If a local wild animal is on a rampage, the players may wish to hunt it down personally. If vermin are eating stored rations, the players may try to address the problem themselves. In all of these cases, the creativity of the referee is called into play. The referee must quickly decide how the situation looks in roleplaying terms, and what is required for success, and then place the characters into that low-level framework. If the players succeed amazingly well, the referee may rule that the random event was nipped in the bud and had no effect, its severity is reduced, or that it will not recur on following turns. If they fail, the event takes effect normally. If they fail disastrously, perhaps the event's effects are doubled, perhaps they will automatically recur each month, or perhaps public awareness of the failure will cause adverse DMs on various other tables.

In some cases, the players will wish to hire or appoint persons to serve as extra police officers, guard for grain elevators, etc. Any persons hired for such purposes are treated as armed forces laborers for purposes of the economic model.



Standard of Living

The colony's standard of living (SL) is defined by consumer goods and is indexed on a monthly basis. The SL is determined by establishing the amount of light industrial production that is allocated to the population. These represent various consumer goods, luxuries, and labor-saving devices that are made available to the population. Divide the total monetary value of these goods by the number of laborers, and add this value to the per-person consumer goods already possessed by the populace. This value is then compared to the original per-person value to find its percentage comparison, and is also compared to the value for the previous month, to see if it has increased or decreased.

The population arrives on the world with a base value of consumer goods as shown on the table below (these are brought by each colonist in his or her personal effects, and are assumed to have no volume or mass for shipping purposes). This value declines 2% per month (multiply by 0.98 each month), and must therefore be augmented by new production. The base value of these goods per person varies by tech level as seen by the table below, where "Home TL" is the tech level of the world from which the colonists are drawn.

Home TL	*Consumer Goods*
0-3	Cr5
4-5	Cr50
6-8	Cr250
9-10	Cr500
11-13	Cr1500
14-16	Cr2500

Consult the following table to find the political DM. The table reads out in DMs for increase over last month/decrease since last month. For example, a colony with a base level of Cr500 per person had Cr435 last month and Cr450 this month. Cr450 is 90% of Cr500, so is within 6-10%. The SL increased since last month, so the DM is +1.

Percentage variation from original value	*Above Base*	*Below Base*
Within 5%	—/—	—/–1
Within 6-10%	+1/–1	+1/–1
Within 11-20%	+1/–1	+1/–2
Within 21-30%	+1/–1	+1/–3
Within 31-50%	+1/–2	—/–4
Within 51-100%	+1/–2	—/–5
More than 100%	+1/–3	N/A

Political Roll

The political roll is made monthly and is an index of the current popularity of the colonial leadership. (This roll is intended for use in PC-led colony operations, and is less suited for NPC-led societies, although its use in these cases is up to the referee.) The results of this roll reflect the current attitude of the populace, and this attitude will affect the following output roll as happy people do more work and unhappy people do less.

The roll on the Political table will yield a DM to use on one or more of the output rolls for the current turn, and may direct a change in levels on the Political Track. The Political Track always starts out on Level 3: Good when a colony is established.

Die Modifiers: Die modifiers are provided from other results in this section: from the satisfaction indices, from random events, from low-level roleplaying results, from the monthly persuasion roll, from the political table itself, and from the current level on the political track.

In addition, there are two permanent DMs that can result from the incorporation of criminals or undesirables in the colony population (see the Colony chapter for discussion). For every 1% of the colony population (round fractions up) composed of criminals, a permanent –1 DM. For every 5% of the colony population (drop fractions) composed of undesirables, a permanent –1 DM.

POLITICAL TABLE

D20	*Result and Output DMs*	*Track Movement*
–5	Coup Attempt, –5	Down 2 levels
–4	Severe Riots, –4	Down 2 levels
–3	Assassination Attempt, –4	Down 1 level
–2	Severe Riots, –3	Down 1 level
–1	Strikes, –3	Down 1 level
0	Riots, –2	—
1	Strikes, –2	—
2	Boycotts/Slowdowns, –2	—
3	Boycotts/Slowdowns, –2	—
4	Dissatisfaction, –1	—
5	Dissatisfaction, –1	—
6	No Effect	—
7	No Effect	—
8	No Effect	—
9	No Effect	—
10	No Effect	—
11	No Effect	—
12	No Effect	—
13	No Effect	—
14	No Effect	—
15	No Effect	—
16	+1 DM, one random sector	—
17	+1 DM, one random sector	—
18	+1 DM, one random sector	—
19	+1 DM, one random sector	—
20	+1 DM, all sectors	—
21	+1 DM, all sectors	—
22	+1 DM, all sectors	Up 1 level
23	+1 DM, all sectors	Up 1 level
24	+2 DM, all sectors	Up 1 level
25	+2 DM, all sectors	Up 2 levels
26	+2 DM, all sectors	Up 2 levels





Dissatisfaction: Small segments of the economy are unhappy with current conditions. –DM shown applies to only one sector (1-2: agriculture, 3-4: materials, 5-6: industrial)

Boycotts/Slowdowns: Small segments of the economy are sufficiently unhappy that they stage work stoppages or disrupt other workers. –DM shown applies to only one sector.

Strikes: Many workers are unhappy and stop work. –DM shown applies to materials and industrial only, not agriculture.

Riot: Groups of the population engage in violence to express their dissatisfaction. –DM shown applies to all economic sectors.

Severe Riot: Rioting causes significant property damage, destroys 1D20 units of capital in any one sector. –DM shown applies to all economic sectors.

Assassination Attempt: As violence continues to escalate, small, disorganized group or individual attempts to kill colony leadership. Referee's discretion, low-level roleplay is recommended. –DM applies to all sectors.

Coup Attempt: Organized group attempts to take over government from current leadership. Referee's discretion, low-level roleplay is recommended. –DM applies to all sectors.

POLITICAL TRACK

Level	*DM*
Level 1: Excellent	+3
Level 2: Very Good	+2
Level 3: Good	+1
Level 4: Fair	—
Level 5: Marginal	—
Level 6: Poor	–1
Level 7: Bad	–2
Level 8: Terrible	–3

DM: Die modifier applied to roll on Political Table on turns when that political level is in effect.

Monthly Persuasion Task: PC colony leaders may make one attempt per month to affect the political roll by using their Charisma-based skills such as Leadership, Persuasion, etc., usually in the form of public addresses. Difficulty level for these tasks is based on how big a DM the PCs are trying for. Outstanding success and catastrophic failure also are determined by the difficulty level. There is no penalty for normal failure.

Using Persuasion and Leadership

The referee should require the player or players to roleplay their presentation, which may involve acting out certain portions of an impassioned plea, but which will certainly require them to recite to the referee what they plan to say. The referee will then have to assess the validity of the speech compared to the reality of the situation and the state of mind of the listeners. If the players' speech is logical, persuasive, stirring, and appears to solve the issues, the referee should reduce the difficulty level of the task accordingly. If the speech completely misses the point, proposes a stupid solution, or otherwise fails to impress the referee, the difficulty level should be increased. In either case, however, the final success is determined by a task roll against the appropriate asset of the PC making the address or aggregate asset of the PC group.

DM	*Diff Level*	*If Outstanding Success*	*If Catastrophic Failure*
+1	Easy	+2	–2
+2	Average	+3	–3
+3	Difficult	+4	–4
+4	Formidable	+5	–5
+5	Impossible	+6	–6

See the persuasion and leadership sidebar for discussion. The persuasion task may only be attempted once per month.

The Output Roll

Roll once for each of the Agricultural, Industrial, and Raw Materials sectors. The result is the multiplier used on the sector's output for that month.

D20	*Output Multiplier*
1	0.80
2	0.85
3	0.85
4	0.90
5	0.90
6	0.95
7	0.95
8	1.0
9	1.0
10	1.0
11	1.0
12	1.0
13	1.0
14	1.05
15	1.05
16	1.10
17	1.10
18	1.15
19	1.15
20	1.20

Die Modifiers

- From Political Track and Political Roll, above
- From Random events, above
- Controlled Economy, DM –1 (see sidebar)
- If population in Acclimatization Stage 1, DM –4
- If population in Acclimatization Stage 2, DM –3
- If population in Acclimatization Stage 3, DM –2
- If population in Acclimatization Stage 4, DM –1
- If population in Acclimatization Stage 5, No DM

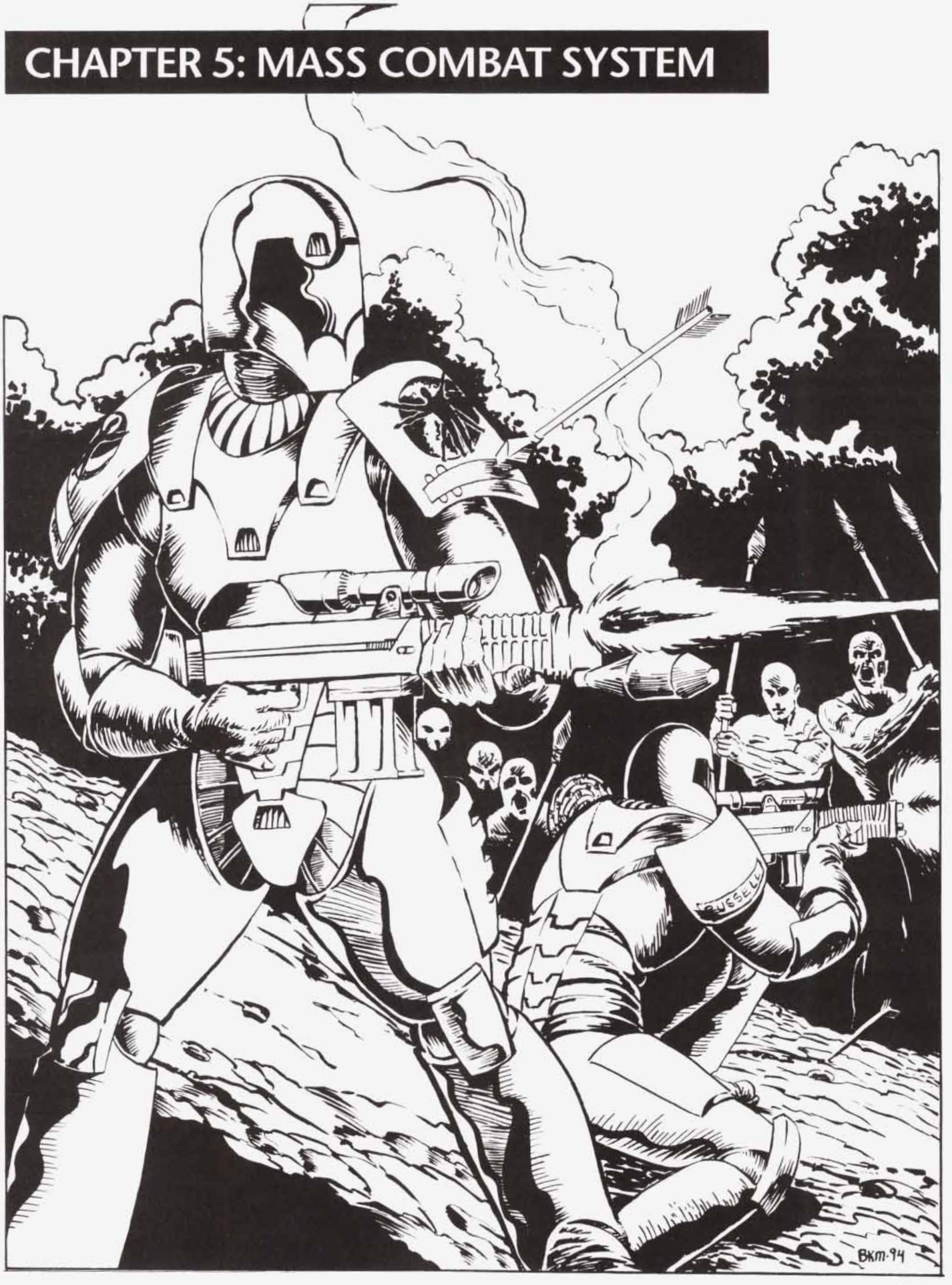
Free Market or Controlled Economy?

If you want central economic planning, you lose productivity (during the Output Roll step). If you want productivity and a free market, don't count on getting exactly the economy you planned on. It will go where the bucks are (as determined by the referee). A lanthanum strike can cripple industry as trained machinists head for the hills to prospect.

This is a rather complex topic, because economies are such a complex thing. Face it, no one really understands *real* economies, much less science fiction ones. Fortunately, this is less of a problem than it might seem. Because the scenario model involves a group of player character colony leaders running every aspect of a colony, this is really not a choice; the PCs are running a *controlled* economy.

In cases where the PCs do not wish to run a controlled economy or would rather simply play low-level characters and allow the colonial administration to be run by NPCs, referees must make the various monthly decisions on whatever basis they see fit. These may be entirely rational and workable decisions, these decisions may include sporadic errors to keep a sense of interest and unpredictability, or they may be completely capricious and disastrously incompetent (thereby forcing the PCs to take over control), depending upon the referee's wishes for the campaign.

CHAPTER 5: MASS COMBAT SYSTEM





MASS COMBAT

Throughout a campaign situations will arise where land combat will take place. In some cases the size of the combat will be such that a detailed roleplaying resolution of it will be inappropriate, but the results will be important for the ongoing campaign. For these cases, we present the **Traveller** mass combat rules.

These rules assume that the players are all on the same side, that their actions will be moderated by the referee, and that the opposing force's actions will be determined by the referee.

Scale

Each mass combat turn represents eight hours of time. Movement and combat are plotted on maps using the 20-kilometer mapping hex grid scale (the same scale used in mapping the colony and discussed in the Survey chapter). Units may range from companies, or even smaller detachments, up to divisions, with battalions being the most common force in most campaigns.

Turns

In each 8-hour turn, the referee decides where hostile ground units will move as well as the movement of all friendly units not under the control of the player characters (either because they are outside the player characters' command or are out of communication). Players give orders to friendly units and, in most cases, the friendly units will act on those orders.

Movement is simultaneous by both sides. Following movement the referee resolves all detection, resolves all combat, and determines morale effects, if any. The player characters then receive reports from their units in communication and prepare to issue orders for another turn.

Note that since movement is simultaneous and combat can occur when opposing units enter the same hex, it will sometimes be necessary to pro-rate movement by all units and move them hex by hex to determine if opposing units are in the same hex at the same time.

Rating Units

Each maneuver unit (infantry, cavalry, armor) in the mass combat system has a combat value. This value is usually calculated per maneuver battalion, but it can also be calculated per division (for really large campaigns). If a force smaller than a battalion is used, calculate the value of a battalion and then divide it by the number of smaller units which would comprise that battalion.

For example, a 125-man company is about one quarter of a battalion's strength. To find its strength, calculate the value of the battalion and divide by 4.

Combat value is calculated by selecting a base battalion combat value (BCV) and then applying any appropriate multipliers. The referee decides which of the three base BCVs is appropriate, but the notes in the "Scales of Equipment" sidebar are provided as a general guide.

The referee should feel free to tinker with the base BCV depending on the scale and quality of heavy equipment available. This allows fine-tuning of unit values to take into account different types of units in the same general category (tank and mechanized divisions, for example, would both be considered heavy in most armies) as well as inferior or superior equipment.

Base Battalion Combat Value

Light	*Medium*	*Heavy*
6	10	15

Combat Value Multipliers

Condition	*Multiplier*
Tech Level	1+TL
Novice	0.6
Experienced	1
Veteran	1.5
Elite	2
Division	10

Example: A tech level 5 novice light infantry battalion has a combat value of 6x0.6x6=21.6 (rounded out to 22)

Scales of Equipment

For black powder armies, the difference between light, medium, and heavy infantry is usually a function of how much supporting artillery is available. Armies without artillery are light, armies with light battalion guns in the battalion of separate field batteries are medium, and armies with both light battalion guns and separate field batteries are heavy.

Early animal-mounted cavalry, on the other hand, determine weight almost exclusively by the size of mounts and the amount of body armor carried. Light cavalry usually consists of unarmored troopers mounted on fairly small mounts. Medium cavalry consists of lightly armored troopers (usually equipped only with a helmet) on larger mounts. Heavy cavalry consists of troopers with helmets and some body protection (usually a breastplate, but sometimes just shoulder scales) mounted on the largest mounts available. Horse artillery is never present with light cavalry and should always be present with heavy cavalry.

For more modern forces, weight is generally determined by the proportion of heavy crew-served weapons present in the battalion. Forces with few or no heavy weapons are light, those with a generous allotment are medium, and those consisting exclusively of heavy weapons (usually tank units) are heavy. Powered armor units are almost always considered medium, as are motorized or mechanized infantry. (Even if fairly lightly provided with heavy weapons, a motorized force will carry more ammunition with it and thus be better able to use its weapons over time.)

Combat value multipliers are determined by the tech level of the unit (the multiplier is the unit's tech level plus 1), its average level of NPC experience (as shown on the table below), and its size (divisions multiply the battalion strength by 10; companies multiply battalion strength by a fraction determined by the referee, depending on the size of the company). After all multipliers have been applied to the BCV, any fractional results are rounded to the nearest whole number (rounding fractions of 0.5 up). No BCV may ever be reduced to 0 by rounding, however, and so fractional BCVs of less than 0.5 are retained as fractions.

The final value of the unit, once all multipliers have been applied, is its Combat Value (CV). Battalion BCVs and multipliers are listed on the table at lower left.

Mobility

Units' movement is expressed in hexes moved per 8-hour turn. The mobility of the unit is determined by the travel movement of the slowest vehicle in use in the unit. Divide the travel movement rate (in kilometers) by 25 to determine the mass combat system movement in hexes per turn.

The following table lists common movement allowances for low-tech units, and may be used as a general guide to movement rates of hostile forces. The first number is the number of hexes moved per turn on a road or, in the case of helicopters and lift units, in high mode. The second number is the number of hexes moved cross country or, in the case of helicopters and lift units, in NOE mode.

Type	*Movement*
Infantry	2/1
Cavalry	3/2
TL 5 Motorized	5/2
TL 6+ Motorized	15/5
Mechanized/Armored	10/5
ACV	20/15



Terrain: Some terrain is more difficult to move through than others and so slows movement. The Terrain Effects Chart (TEC) lists most common terrain types encountered and their movement costs. Terrain types with a dash are moved through normally, while those with a number following the multiplication sign cost additional movement. These movement costs vary with the type of unit actually moving through the hex. Hill terrain, for example, has no special cost for track-mobile, ACV-mobile, and lift-mobile units. Leg-mobile and wheel-mobile units, however, count the hex as two hexes for movement.

Units which do not have sufficient movement left to enter a hex may not do so, but may expend their remaining movement toward the entry cost of the hex for the next turn. (It would otherwise be impossible for infantry to enter any difficult terrain.)

Units may move along roads at the road movement rate, regardless of the type of terrain in the hex. The presence of a "P" on the chart indicates prohibited terrain; units with that mobility type may not enter the hex (except on a road).

Supply and Fatigue: A unit's ability to move is constrained by supply and fatigue. Supply limits a unit's movement usually due to fuel limits. Vehicles which have limited fuel must spend a turn refueling after they have expended their normal load. Troops may rest while refueling. Fatigue limits all units, and while the specific effects of fatigue are covered later, it is normal for a unit to rest for one turn per 24-hour day.

Deploying: A unit which does not move during a turn is considered to be deployed in the hex it occupies, and should be so noted. A deployed unit has advantages in combat, detection, and blocking enemy movement. A unit may rest at the same time that it is deployed.

Leaving an enemy hex: Units may begin the turn in the same hex as an enemy unit and may use movement to withdraw from the hex. Several special rules govern this movement, however.

If movement through the hex has been blocked, units may only leave the hex across the same hexside they entered. If other friendly units are in the hex at the start of the turn and they entered across different hexsides, units may withdraw across those hexsides as well.

If there are no friendly units left in the hex at the end of the turn but there are still hostile units there, all hostile units in the hex may conduct pass-by fire at the unit or units which withdrew. All hostile units may conduct only one pass-by fire at withdrawing units, however, not one attack against each withdrawing unit.

Detection

Players should not be told the location of enemy ground combat units unless they are detected by a friendly unit in communication with other friendly units (and ultimately the players). Detection of aircraft by electronic sensors or detection from orbit is resolved using the normal detection rules in the game. A special procedure is used for detection of ground units by hostile ground units, however.

Detection takes place when two opposing units enter the same hex. Units moving by road or in high mode are automatically detected. Other units may be detected if a successful task roll is made.

Detection is resolved immediately, as detection of an enemy unit may stop movement and initiate combat. Detection is a standard task roll using the asset level of the average NPC quality of troops in the unit (Elite = 15, Veteran = 13, Experienced = 11, Novice = 9, as noted on TNE page 59). Detection is a Difficult task, and the difficulty level is modified as shown on the following table. The terrain occupied by the unit affects the difficulty of detection. The difficulty levels are noted on the TEC. For other modifying conditions + numbers are increases in the difficulty level while – numbers are decreases.

Condition	*Modifier*
Heavy detecting unit	+2
Medium detecting unit	+1
Target less than a battalion	+1
Light target unit	+1
Night or inclement weather	+1
Detecting unit deployed	–1
Target a division or more	–1
Heavy target unit	–1
Every 2 tech levels detector is above target	–1
Terrain	see TEC





Blocking Movement

A unit may block movement of enemy units through its hex if it detects them and if it has sufficient combat power to control the hex. Each hex has a control value listed on the TEC, which is the total combat value needed to insure that enemy movement is blocked. The combat value of deployed troops counts double for purposes of blocking enemy movement.

If the enemy unit is not detected, there is no possibility of blocking its movement and forcing combat.

If the moving unit is detected and the opposing player has combat value in the hex equal to or in excess of the hex's control value, enemy movement may be blocked at the option of the detecting player.

If the moving unit is detected and the opposing player has less combat value in the hex than the hex's control value, that player may attempt to block movement by rolling a D20. Divide the total combat value of the detecting player's units in the hex (remembering to double the value of deployed units) by the control value of the hex, and then multiply the result by 5, rounding to the nearest whole number. The final result is the number or less needed on a D20 roll to successfully block movement.

If movement is blocked, neither side continues moving and combat takes place in the hex.

Aircraft and lift units in high mode can never have their movement blocked by enemy units.

If movement is not blocked but the moving unit is detected, the detecting unit may conduct pass-by fire (see below).

Withdraw Before Combat

If one player detects an enemy unit and is faster than that unit, it may withdraw prior to combat. If it is itself detected, the opposing units in the hex may conduct pass-by fire on the unit as it withdraws. The withdrawing unit is subject to the normal restrictions on leaving an enemy-occupied hex, and they automatically are subject to pass-by fire from the hostile unit in the hex, even if it does not remain in the hex. Withdrawing units may never withdraw from the hex across a hexside used by a hostile unit to enter the hex, and if the hostile units are strong enough to block movement through the hex the withdrawing unit must exit the hex across the hexside used to enter the hex.

Withdrawal before combat aborts any other scheduled move of the withdrawing unit, although it may continue to withdraw in the face of an advancing enemy unit within the limits of its movement allowance (withdrawing back up its original path of movement to the contested hexes). If in withdrawing it moves into another enemy-occupied hex it may not withdraw before combat again that turn.

Combat

Combat takes place after movement, and consists of all units of both sides firing at detected enemy units in the same hex. The referee first determines the order of fires, and then resolves them in order.

Order of Fires: The order of fires is determined by detection, tech level, terrain, and troop quality. Order of fire is important, as casualties are removed as soon as a unit fires. As casualties are expressed in terms of combat value, casualties reduce the ability of the unit to cause casualties when it is that unit's turn to fire.

If one sidesæ units are undetected, those units automatically fire first before any hostile units in the hex.

If both sides' units are detected, units fire in the order of their tech level, with highest tech units firing first.

If both sides have detected units of the same tech level, deployed units fire first if occupying First Fire terrain. First Fire terrain consists of rough, mountains, swamps, forest/jungle, and broken, as noted on the TEC.

If both sides have detected units of the same tech level, and are not deployed units in first fire terrain, units fire in order of troop quality category, with elites firing first.

If both sides have detected units of the same troop quality and tech level, and are not deployed units in first fire terrain, the units fire simultaneously.

Allocating Fires: A unit must divide its fire as evenly as possible among the enemy units in the hex if they have detected it. If a unit has not been detected it may (but is not required to) fire at any enemy units in the hex it desires. However, any unit which a unit fires at may fire back. Units which have not previously detected a firing unit fire back using the "firing at undetected unit" penalty noted below.

Fire Resolution: To fire a unit, either the referee or a player rolls a D20, multiplies the result by the unit's combat value (CV), and then multiplies that result by 0.01, rounding fractions to the nearest whole number. The result is the casualties suffered by the target unit and this amount is subtracted from its combat value. This result, however, is modified by terrain and by certain other conditions of that target unit.

Terrain effects are listed on the TEC. Terrain either has no effect on fire or halves casualties. The effects listed are different for deployed units and moving units, and apply to fire delivered by the listed unit, not against it. For example, a moving unit in a mountain hex has the casualties caused by its fire halved, while a deployed unit does not.

Other effects related to the target unit are summarized below, and are additional multipliers to the total casualties suffered by the unit.

Target	*Effect*
Deployed	x0.5
Deployed in fortifications	x0.25
Undetected	x0.5
Pass-By Fire	x0.1
Fired on by routed unit	x0.1

Hit and Run

If a unit is undetected at the start of combat but has detected an enemy unit in its hex, it may conduct a hit and run attack. In a hit and run attack the attacking unit always fires first but multiplies its CV by 0.5 (in addition to all other multipliers). The target unit is allowed to fire back, but multiplies its CV by 0.1 (instead of the normal 0.5 multiplier for firing at an undetected unit). The attacker then must withdraw from the hex, that hex of movement being counted against itsnext turn's movement.

Morale

As units suffer casualties, their morale begins to falter. Better troops are more stoic under fire, and so can stand more casualties before collapsing, but eventually any unit can break and run, or even surrender.

Morale is determined each turn, and is based on the casualties suffered by a unit that turn as a percentage of the unit's strength at the start of the turn. For example, a unit which started the turn with a CV of 10 and which suffered losses of 2 CV would have suffered 20% losses in the turn.

There are three possible adverse morale effects triggered by casualties: retreat, rout, and surrender.

Retreat: When a unit takes casualties in a turn equal to its retreat number, it must break contact with the enemy and move away. This movement takes place at the end of the turn and the movement cost to leave the hex is counted against the unit's next turn's movement. All of the normal restrictions on leaving an enemy-occupied hex are in effect, including the possibility of pass-by fire if no friendly units are left in the hex.



Rout: When a unit takes casualties in a turn equal to its rout number, it must break contact with the enemy and move away. This movement takes place at the end of the turn and the movement cost to leave the hex is counted against the unit's next turn's movement. All of the normal restrictions on leaving an enemy-occupied hex are in effect, including the possibility of pass-by fire if no friendly units are left in the hex.

Routed units remain routed until they have had two consecutive turns of rest. When routed units fire, multiply all casualties inflicted by 0.1.

Surrender: When a unit takes casualties in a turn equal to its surrender number, it immediately surrenders, even if this prevents it from firing in its part of the turn. Units which would normally suffer casualties in excess of their surrender number suffer only casualties sufficient to cause surrender and then give up.

Morale Levels: The retreat, rout, and surrender levels of units are determined by their troop quality rating, as shown on the table below.

Type	*Retreat*	*Rout*	*Surrender*
Novice	5%	10%	20%
Experienced	10%	20%	40%
Veteran	15%	30%	60%
Elite	20%	40%	80%

Fatigue

Units which fight a battle are fatigued until they spend a turn resting. In addition, units not in combat which do not rest for one turn per day are fatigued. Each condition which causes fatigue (i.e. each battle fought and each day spent without rest) increases the fatigue level of the unit by 1. Each turn spent resting reduces the fatigue level of the unit by 1.

In addition, units which are fighting in planetary environments to which they are not acclimatized suffer fatigue according to the following chart. Note that these fatigue levels cannot be removed by rest, but are permanent until the personnel become acclimatized. (See pages 13-14 of the Survey chapter for more details on acclimatization.)

Acclimatization Stage	*Fatigue Levels Added*
1	4
2	3
3	2
4	1
5	0

Each fatigue level reduces the casualties caused by the unit in fire combat by 10%. In other words, units at fatigue level 1 multiply their CV by 0.9 (in addition to all other modifiers), while units at fatigue level 4 multiply their CV by 0.6.

Units which are greatly fatigued have their morale reduced. For every two fatigue levels, treat the unit as one troop quality level lower for morale purposes. An elite unit at fatigue level 5, for example, would have morale levels determined as if it were an experienced unit.

No unit may be reduced below novice morale level. Any unit with a fatigue level of 10 or more automatically surrenders to any enemy unit it encounters.



Supply

Although supply is critical to sustained combat, it is very easy to become completely absorbed by logistics to the exclusion of other game considerations. As a result, only the simplest of supply rules are presented here.

Types of Supply: There are three types of supply considered in the game: rations, fuel, and munitions.

Each unit requires rations once per day, and the rations are used when the unit is resting. If the unit does not receive its rations for the day, it has its fatigue level increased by 1. Units which are already fatigued and which are resting for more than one turn are denied the beneficial effect of one turn of rest per day if they receive no rations. There are no additional effects from lack of rations.

Fuel is required each time a vehicle uses up its onboard fuel. Units fuel all of their vehicles at once and usually do so while resting. Fuel supply must be available while the unit is resting in order for the vehicles to refuel.

Munitions are used when a unit fights. Whenever a unit fights it uses munitions and must receive more to fight at full effectiveness. Once a unit fights, multiply the casualties inflicted by it by 0.5 in all future combats until it receives munitions. Munitions are received at the beginning of a turn; the receiving unit does not have to rest to receive munitions.

Tracing Supply: Units are in supply if they can trace a supply line back to a friendly supply base. The supply line should be shorter than one turn's move-



ment of the army's supply movement rate (as calculated on pages 33-34 of the Economy and Infrastructure chapter). If it is longer than one turn's movement, units which require supplies may or may not receive them, based on the following table. The number under the die roll column is the roll (or less) needed on a D20 for a unit to receive supplies.

Distance	*Die Roll*
2 turns	16
3 turns	12
4 turns	8
5 turns	4

Each unit rolls separately to determine whether or not it received supplies.

Terrain Effects Chart

	Combat				*Movement*				
Terrain	*Dep*	*Mov*	*Detect*	*Cntrl*	*Leg*	*Wheel*	*Track*	*ACV*	*Lift*
Clear	—	—	—	200	—	—	—	—	—
Prairie	—	—	–1	300	—	—	—	—	—
Rough	FF	—	—	100	×2	×2	—	—	—
Mountain	FF	½	+1	50	×2	P	×4	P	—
Marsh	—	—	—	100	—	×4	×4	—	—
Swamp	FF	½	+1	100	×2	P	P	—	—
Forest	FF	½	+1	300	×2	×4	x2	×4	—
Jungle	½	½	+2	500	×2	P	×4	P	—
Desert	—	—	–2	500	×2	×2	—	—	—
Broken	FF	½	+1	100	×2	×4	x2	×4	—
Glacier	—	—	–2	500	×2	×4	x2	—	—

Supply Bases: Players may establish supply bases wherever they like in friendly territory. Any city hex containing industrial laborers (ILs) is also considered to be a supply base. If a move into enemy territory is required it will probably be necessary to establish additional forward supply bases to sustain the move.

In order to create a new supply base, the player must tell the referee where the base is to be and then spend three turns "stocking" it. Once supplies have been available to the hex for three consecutive turns, the base is operational.

If a supply base ever goes for six consecutive turns without receiving supplies, it is no longer an active supply base.

Integrating Supply with the Economic Model: The goods supplied to friendly military units in the supply system above are the same goods which are allocated to the Armed Forces sector using the guidelines in the Economic Model chapter. The intent of the following paragraphs is to translate how these goods are used up in the mass combat system. It is not intended that these supplies be tracked in a painstaking manner. Rather, these guidelines should be used to allow the referee to determine if a society has a sufficient supply base to continue prosecuting a war without concern, or if it must be penalized for not having allocated sufficient resouces to its armed forces, such as ammunition or operating hours of fuel.

Rations: So long as sufficient rations are provided to the Armed Forces Laborers in the economic model, there will be sufficient supply to push forward to the troops in accordance with the supply rules above.

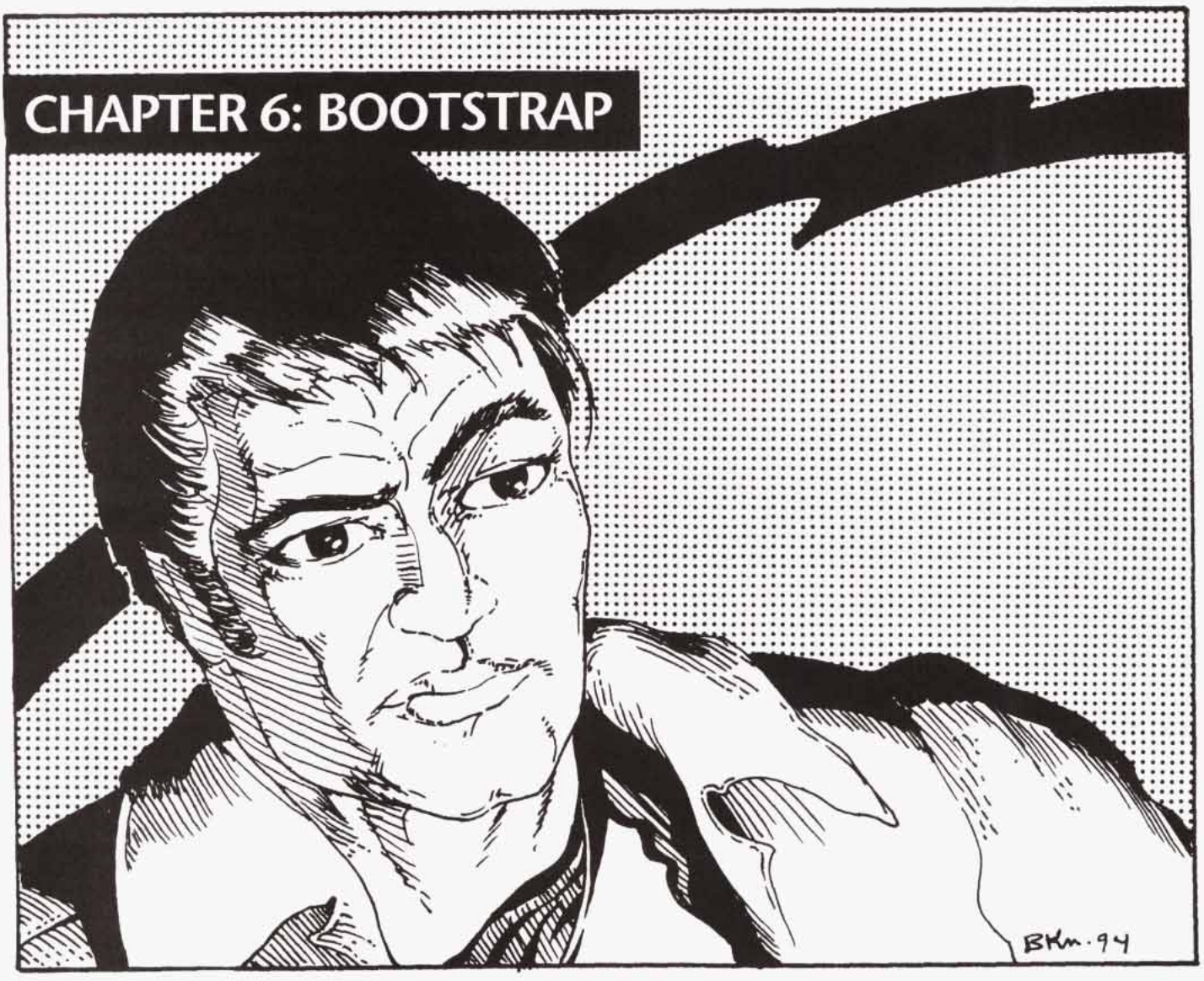
Munitions: Consumable ammunition is purchased for each weapon in the economic model, and this ammunition must be replaced when it is used up in combat. For purposes of this model, each turn of combat consumes ammunition at the rate of 25 times the weapon's basic rate of fire for all weapons in the unit, except for guided missiles, which are consumed at the rate of 5 rounds per launcher (or, in the case of disposable package launchers, 5 rounds per soldier/vehicle primarily equipped with this weapon). The rate of fire used for these purposes is the standard ROF listing in the TNE equipment tables. For SA and automatic weapons, do not multiply this rate by 5 for the maximum possible number of shots; therefore a ROF of SA is treated as 1, and an automatic ROF of 5 is treated as 5. For weapons with a reload rate, add one to the rate and invert it to serve as a fraction. Thus a weapon with a reload rate of two would become a ROF of ⅓ for these purposes.

Thus a colony which intends for its armed forces to be able to fight for one 750-hour month with one eight-hour turn of combat per day (assuming 24-hour days) must purchase or produce ammunition sufficient for (31.25x25=) 781 rounds per weapon or vehicle with a rate of fire of 1 shot per combat turn, 3906 rounds per weapon with a ROF of 5, or 39,063 rounds per machinegun with a ROF of 50.

Fuel: Raw materials in the form of fuel are provided to the armed forces on a monthly basis, and are expressed in the number of hours of operation that this allows to the armed forces per month (based on the assumption that all of their equipment is being operated simultaneously). As each turn in the mass combat system is eight hours, it is simple to calculate the rate at which fuel is used up. It will be useful to divide the total monthly hours of operation by eight, and then by the total number of battalions to find the total amount of fuel in battalion-turns. Each turn that an in-supply battalion moves or fights, it uses a battalion-turn of fuel. Each turn that an in-supply battalion does not move or fight, it uses ½ a battalion-turn of fuel. Only out-of-supply units use no fuel, and units may *not* be voluntarily placed out of supply merely to save fuel.



CHAPTER 6: BOOTSTRAP



A CHANGE OF PACE

It's good to be back in the RC, even Oriflamme. It's nice not being shot at. And its nice to have some cash in your pocket after Auction. But your group is tired. Tired of too many hot DZs, too many SAG raids, too much killing and death. You've reaped the rewards, but you need something else. Something less deadly, something life affirming, something where you can build a future. After all, future building is what it's all about in the New Era—right?

You are in your hotel lounge one evening, with one eye on the newscast while you try to figure out what to do next. After the news anchor runs through the usual traffic accident and ship arrival stories, she cuts to a feature on a world named So Skire. After wide shots of peaceful vistas and friendly natives harvesting their fields, the field reporter comes on camera with members of the So Skire survey team who have just landed back on Oriflamme.

"We've found a rich world here, ripe for development," the team leader says, "With a little help, So Skire could be an excellent trading partner with the Coalition."

After more wide vistas of green fields and snow-capped peaks, the camera cuts to a tight shot of the field reporter.

"This is one lucky freelancer," she says. "The RCES announced this morning that they've bought his data packages and they are preparing a bootstrap expedition to the Dawn Isles, a friendly country in So Skire's tropics. First reports say So Skire could be a good resource world, and if we are going to have allies on the Back Side of the Coalition, this would be a good place to start."

The RCES owes you a few favors. Particularly Jerszy Kaminski, the local detailer, since you led the SAG raid that busted his son out a desert dungeon on Keipes and caught a slug in your thigh in the process. The next morning you call his office and make an appointment for lunch.

Jerszy "Crusher" Kaminski

Veteran NPC

Combat Assets: Slug Weapon (Rifle & Pistol), Armed Martial Arts (Large Blade), Unarmed Martial Arts, Archery

Other Assets: Leadership 12, Persuasion 12, Ground Tactics 10, Recruiting 8, Liaison 8, Language 8, Admin/Legal 8, Riding 6, Instruction 6, History 6

Motivation:

Club Queen: Kaminski handles a problem by lowering his head and charging into it, not stopping until the problem or situation is resolved. He has a reputation throughout the RCES: if something critical really has to be done, give it to Kaminski.

Spade 10: Kaminski embodies the RC's philosophy of being the agency to reunite humankind. He wants to personally bring as many planets as he can into the RC and restore civilization to the stars before he dies.



Bootstrap n. 1. A strap on a boot for pulling it on. adj. 2. To cause to succeed without the help of others. 3. To achieve success by one's own unaided efforts. 4. To help others help themselves, as in a bootstrap operation.

HIRING ON

The player characters meet with "Crusher" Kaminski in a pleasant restaurant atop an office building near the downport and the RCES offices. At the referee's discretion, he can remember some good work the PCs have done for him in the past (as in the introductory passage above), in which case he can be looking forward to be working with the PCs again. Alternatively, the PCs may be unknown to him, and will have to work to impress him by some combination of roleplaying, interaction tasks, presentation of credentials, etc. If Kaminski warms up to the PCs, he says, "If you decide to sign on, you'd better put your affairs in order, because you're going to be away for a long time. This is no hot recovery. You'll be going to a place called So Skire where the natives are sort of friendly but go around wearing iron pants and throwing spears at each other. Expect to be there at least a year.

"So Skire is important to us for a number of reasons. First, it's a dense world and the ore samples taken so far look very interesting. So Skire seems to have a great potential as a heavy metals and rare earths source.

"Second, if the local humans can be brought back into interstellar society, they would be a great market for higher tech manufactured goods, and help revive trade and commerce in this area.

"Third, So Skire is at the coreward end of the So Skire Main, a huge cluster of 66 worlds that are accessible by jump-1 transportation. They run all the way rimward into Alpha Crucis and trailward along the Old Expanses-Alpha Crucis border into Spica. Some of these worlds are ripe for recontact and fairly advanced. Hiver reports and initial scouting has located one at TL-9, and several others at 6, 7, and 8. If we can establish a foothold on So Skire, we could have an the ideal base for expanding into the main. It could also help support Baldur's new colony on Poyzen.

"And just as importantly, a base here will help bridge the gap in the Wilds toward the Hiver worlds.

"*Immanuel Kant* will be leaving here in a month and will meet up with *Trigger* at L'Steich for the trip over. We want you on board. The fact that the Coalition is using their brand new clipper for this mission ought to tell you how important they think this job is."

If the PCs agree to sign on, Kaminski takes them to his office.

"Here's the data we have on So Skire so far," he says, while projecting a map of the world on the wall. He hands each PC a copy of the RCES scouting report compiled from the free-lancer's survey. The referee should make at least one set of photocopies of pages 57 through 60 available to the players to examine. GDW grants permission to owners of the **World Tamers Handbook** to photocopy these briefing pages for these purposes.

After the players have had a chance to read the data sheets for a few minutes, Kaminiski pulls some forms from his desk drawer and says, "Interested? If you are, here's a one-year contract for your services that can be extended as needed. If you're tired of sitting around on Oriflamme, here's a chance for some real adventure, not just a quick drop and recovery."

He offers the PCs a pen and says, "The rest is up to you."

REFEREES' SECTION
PLAYERS DO NOT READ BEYOND THIS POINT

At this point, the adventure can proceed in one of two ways, depending on your players capabilities and interests, and whether you are playing a primarily high level or low level campaign. Throughout this campaign at appropriate locations you'll see suggestions for using your players in a high or low level campaign. In the first example below, high level players become involved in the complexities of recruiting NPCs. Low level players simply sign on with the expedition under the leadership of NPCs.

High Level

If the PC group is to be the leaders of the bootstrap expedition, they meet Kaminski for lunch and make a deal with him to lead the operation. The objectives of the operation should be discussed as well as its duration. Rewards, in keeping with the usual modest Reformation Coalition standards for these things, can be talked about here too. The next step will be finding and recruiting some 100 bootstrap specialists and travelling to So Skire.

Low Level

If the PC group is looking for jobs on the expedition, Kaminski will be the one doing the recruiting. He will also be leading the operation. For players with a military background, there is plenty of opportunity for work as intelligence specialists, as military advisors to the Dawn Isles ground forces, as naval advisors to the Dawn Isle Wet Navy, and as members of the expedition's security team.

REFEREES' INFORMATION FOR THE PLANET SO SKIRE

Armed Forces of the Woden Empire

Total Personnel: 300,000
Wet Navy: 48,000 (Experienced crews)
32 major combatants (TL-1)
Ground Forces: 252,000
9 divisions of foot (3 TL-1 Experienced, 6 TL-1 Novice)
2 mounted divisions (TL-1 Veteran with 5 cavalry squadrons each)
5 separate cavalry squadrons (TL-1 Veteran)
1 Imperial Guard division (TL-1 Veteran)

Armed Forces of the Dawn Isles

Total Personnel: 200,000
Wet Navy: 64,000 (Veteran crews)
40 major combatants (TL-1)
6 other combatants (TL-1)
Ground Forces: 136,000
5 divisions of foot (TL-1 Experienced)
2 cavalry brigades (TL-1 Experienced)
1 amphibious brigade (TL-1Veteran)
2 Marine battalions deployed as ship's troops (TL-1 Veteran)
1 arquebusier battalion (TL-2 Elite)



Armed Forces of the Southern Republic

Total Personnel: 150,000
Wet Navy: 48,000 (Experienced crews)
32 major combatants (TL-1)
Ground Forces: 102,000
1 Marine division (Ship's troops, TL-1 Experienced)
3 divisions of foot (TL-1 Novice)
1 cavalry division (TL-1 Experienced)
1 Brotherhood Guards battalion (TL-1 Veteran)

Armed Forces of the Aylward Islands

Total Personnel: 100,000
Wet Navy: 16,000
32 regular combatants
Ground Forces: 84,000
1 amphibious division (TL-1 Experienced)
3 divisions of foot (TL-1 Experienced)
2 marine battalions (TL-1 Veteran)



So Skire Minor Powers Armed Forces

Nation	*Wet Navy*	*Regular Combatants*	*Patrol Craft*
Borean Enclave	6400	10	6
Svensholm	8800	10	15
South Dawn	8800	12	11
Ragnar	400	0	2

Nation	*Ground Forces*	*Division Equiv.*	*Battalion Equiv.*
Borean Enclave	73,600	3	7
Svensholm	101,200	5	0
South Dawn	46,200	2	3
Ragnar	4,500	0	2

Survey Data on the Dawn Isles

The brief free-lance survey conducted on So Skire did not get detailed survey data on the Dawn Isles. If the PCs elect to conduct their own survey, the following data will be obtained of the three planetary hexes shown in the map on page 79. The referee may elect to run a detailed campaign using elements of the economic model detailed in Chapter 4, in which case this data will be necessary.

Planetary Hex: Northern Aaland

Agricultural Richness: 1.3
Agricultural Useable Area: 60%
Raw Materials Richness: 110
Raw Materials Useable Area: 35%
Fossil Fuels: Yes
Radioactives: Yes
Extractable Hydro Power: 4200 kW per 20-km mapping hex
Extractable Wind Power: 88.2 MW per 20-km mapping hex
Base Latitude Temperature: +10°C
Summer Maximum Temperature: +21°C
Winter Minimum Temperature: –9°C
Weather Factors: 0

Planetary Hex: Southern Aaland and Northern Gotland

Agricultural Richness: 1.3
Agricultural Useable Area: 50%
Raw Materials Richness: 120
Raw Materials Useable Area: 40%
Fossil Fuels: Yes
Radioactives: Yes
Extractable Hydro Power: 3360 kW per 20-km mapping hex
Extractable Wind Power: 117.6 MW per 20-km mapping hex
Base Latitude Temperature: +16°C
Summer Maximum Temperature: +23°C
Winter Minimum Temperature: +4°C
Weather Factors: 0

Planetary Hex: Southern Gotland

Agricultural Richness: 1.6
Agricultural Useable Area: 60%
Raw Materials Richness: 90
Raw Materials Useable Area: 30%
Fossil Fuels: Yes
Radioactives: Yes
Extractable Hydro Power: 3780 kW per 20-km mapping hex
Extractable Wind Power: 137.2 MW per 20-km mapping hex
Base Latitude Temperature: +22°C
Summer Maximum Temperature: +29°C
Winter Minimum Temperature: +10°C
Weather Factors: 0

So Skire's Governments

Nation	*Population (in millions)*	*Government*	*Corruption*	*Talent*	*Cruelty*	*Paranoia/ Aggression*	*Xenophobia*
Woden Empire	30	8-TO	High	High	High	High	Moderate
Dawn Isles	20	4-CD	Low	High	Low	Moderate	Low
Southern Republic	15	7-MD	Moderate	Moderate	High	High	High
Svensholm	11	8-TO	Moderate	Low	High	Low	High
Aylward Islands	10	3-RD	Low	High	Low	Low	Low
Borean Enclave	8	3-RD	Low	Moderate	Low	Low	Moderate
South Dawn	5.50	4-CD	Low	High	Low	Low	Low
Ragnar	0.50	1-TG	High	Low	High	High	High



RECRUITING (HIGH LEVEL)

Bootstrap teams are a mix of civilian specialists and military personnel who have been seconded to the RCES. All are volunteers. They have many motives. Some are looking for adventure. Others genuinely want to help people. Still others need a convenient way to get off-planet for an extended period of time.

Team Composition

There are four categories of bootstrap team members to be recruited. These include team leaders, technicians, military advisors, and security specialists (see the table on page 62). Because of the nature of the bootstrap mission, all team leaders, technicians, and military advisors should have significant Instruction skills in addition to any other skills listed below.

Team Leaders: These are volunteers with useful professional skills. They would be commissioned characters (where appropriate) drawn from careers such as Law Enforcement, Medicine, Veterinary Medicine, Civil Engineering, and Science. Retired or serving Army or Marine officers would also be included in this category.

Altogether there are 7 professional leadership slots available. The referee should roll up detailed professional NPCs for the players to consider for the leadership slots. In addition to considering their career qualifications, the players should interview these NPCs in depth to examine their motivations as well as their skills. Remember, the PCs and these NPCs will be working closely together for a long time.

Team leader jobs to be filled include Team Commander, Deputy Team Commander, Chief Scientist, Chief Medical Officer, Chief Agronomist, Senior Military Advisor, and Chief Security Specialist.

Note that these are job slots that may be partially or entirely filled by the player characters. If there are not enough PCs to fill these jobs, the remaining slots must be filled by NPCs.

Technicians: These are civilian team members with useful technical skills. These include skills from Medical, Engineer, and Physical Science clusters, particularly Farming. These may come from any career but must have proficiency in one of these skills. Successful candidates should also have good Interaction skills because their primary job will be "winning the hearts and minds" of the local population and teaching them their skills. There are 35 technician job slots available. The referee should create these as Experienced template NPCs, assigning them skills from the Technician , Artisan, Physical Science, Social Science, Interaction, or Engineer skill clusters. If desired, the players can select higher skilled individuals and generate complete UPP attributes and skills as part of interviewing prospective team members.

Military Advisors: These are experienced military professionals skilled in modern and archaic weapons who will serve as field advisors as well as drill instructors with the host government's armed forces. Create these by using the Star Viking Ground Specialist and Regency Marines NPC templates on **TNE** pages 65 and 66. Military advisors must have skills in Archery, Thrown Weapon, Archaic Artillery, Early Firearms, both Unarmed and Armed Martial Arts, Leadership, Instruction, Persuasion, and Ground Tactics. See page 63 for more details on the integration of these skills with the mass combat system.

There are eight military advisor job slots available. They will work closely with the Dawn Isles armed forces training them in the tactics needed to get the most efficient use out of their TL-1 weapons and introducing an increasing amount of TL-2 technology—principally musketry and black powder artillery—so they will be strong enough to repel an invasion from the Woden continent. It is hoped that this display of technology will attract other armed forces and their leaders to the Dawn Isles banner. In addition to retired and seconded officers and senior enlisted personnel from the world armies and wet navies of the Coalition, a detachment of RC Marines from the 3rd Battalion, 3rd Brigade is available as training specialists.

Security Forces: Even though all bootstrap personnel will be armed with their personal weapons, experienced troops are needed to provide security if the team suddenly finds themselves on the losing side of a local conflict or if their hosts suddenly turn on them. A squad-sized cadre from the 1st Battalion, 3rd Brigade RCMC has been seconded to this bootstrap operation to provide security force leadership and logistics. Volunteers are available from both the RCMC and the Oriflammen Marines to round out the platoon-sized security detachment, and these characters are portrayed as Regency Marine template NPCs from **TNE** page 66. Security slots may also be filled with recently mustered out veterans. Balduri pesonnel and others with High-G environment skills are preferred because of the 1.5 G environment on So Skire. Skills with archaic and melee weapons would be helpful but not necessary. The security force will be armed and armored as light infantry.

Altogether approximately 110 troops and technicians are expected to make up the So Skire Bootstrap Team.

The Selection Process

The PCs will want to interview key NPCs. The referee needs to do two things to prepare for these interviews. First, the referee needs to generate the key NPCs. These include:

- The members of the leadership group that are not played by the PCs.
- The more highly skilled technicians.
- The more senior and highly skilled military advisors.
- The senior members of the security detachment.

Second, the referee needs to secretly generate the NPCs' personalities, their quirks, their hidden flaws (if any), and to play out these personality traits during the interview. This gives the players a "hands on" feel to the campaign and helps make them realize the interviews are important.

The personality of each NPC will be partially generated through the drawing of the cards as outlined in the basic **TNE** rules. To supplement this, however, the referee should roll 1D20 on the Personality Table and play the NPC during the interview with the resulting personality.

NPC Personality

D20	*Personality*	*D20*	*Personality*
1	Charismatic	11	Reserved
2	Charismatic, Flawed	12	Reserved, Flawed
3	Charming	13	Reserved
4	Charming, Flawed	14	Reserved, Flawed
5	Friendly	15	Closed
6	Friendly, Flawed	16	Closed, Flawed
7	Open	17	Arrogant
8	Open, Flawed	18	Arrogant, Flawed
9	Open	19	Antisocial
10	Open, Flawed	20	Antisocial, flawed

Charismatic: The NPC establishes an instant rapport with the PCs, which the PCs should also experience. The NPC is highly enthusiastic about the bootstrap project.

Charming: The NPC is very friendly and tries to establish common ground with the players through common experiences or contacts they may all know, campaigns they know about, etc.

Friendly: The NPC is very interested in the mission and its goals, and explores ways with the players to achieve these goals.

Open: The NPC has a somewhat extroverted personality and is capable of easily talking and relating with the players. However, he or she is careful to maintain some personal "space."

Reserved: The NPC is somewhat introverted. He or she is business-like and somewhat cool.



Closed: The NPC seems to have a rigid personality and does not talk freely. He or she refuses to discuss personal matters and does not engage in small talk. While the social "temperature" around a reserved NPC is cool, this one is downright chilly. From time to time, this person's mind seems to be on something 1000 kilometers away.

Arrogant: The NPC is smug, superior, and overbearing to the point of being obnoxious. This is particularly common among academics with doctorates.

Antisocial: This is a sarcastic individual that puts down the bootstrap project and expresses open disdain to the players. Such persons may also exhibit antisocial tendencies by dressing poorly, not bathing, and picking their noses. Although they may be geniuses in their fields or quite well-off financially, they look as though they live in a transit station.

If the result includes "flawed," this indicates the character has a secret flaw or background situation in his or her life that may influence his or her reactions at a later critical moment. The referee should roll on the NPC Personality Flaw Table to determine what this is.

PCs with Research or Streetwise skills may be able to successfully investigate the NPC's background and reveal the hidden flaw.

NPC Personality Flaw

D10	*Personality Flaw*
1	Criminal Record
2	Death
3	Killing
4	Bad Debts
5	Runaway
6	Family Problems
7	Substance Abuse
8	Cowardice
9	Mental Instability
10	Hidden Illness

Many people have had problems in their lives and need a fresh start. The bootstrap operation may be their way of getting one. On the other hand, their flawed backgrounds may lead to trouble. Remember, secretly write down these flaws and don't reveal them to the players unless they discover them on their own as during the interview or through investigation. If they are not discovered, spring them on the players at an unexpected but appropriate time.

Criminal Record: The individual has been convicted and served time for a crime either in civilian or military life. The individual may have actually committed the crime or not, and may have even committed the crime for good reason. The individual may have been given the opportunity to volunteer for the bootstrap operation in order to avoid more prison time. Such an individual could retain criminal tendencies, ranging from compulsive gambling to thievery to killing rages that could manifest themselves sometime later.

Death: Someone close to the NPC, such as a spouse, parent, or child, has died fairly recently. The NPC may be running away from from a sense of guilt, or simply be looking for a new start, but could be distracted by grief or depression at a critical moment.

Killing: The NPC has accidentally or deliberately killed someone. He or she may be given to violent rages, or fall into a remorseful depression.

Bad Debts: The NPC owes a major financial debt such as a gambling or loansharking debt, back taxes, or alimony payments. He or she is joining the bootstrap operation to escape.

Runaway: This individual is running away from a bad situation: a bad marriage, a bad relationship with parents, from criminals, etc.

Family Problems: Similar to the Runaway, this person is trying to escape from a bad relationship. In this case, however, the relationship has been legally terminated and the person simply wants to get away from painful surroundings.

Substance Abuse: The individual has problems with alcohol or drugs. Assuming the individual is able to retain access to an addictive substance, this will have a major impact during a critical moment of the project, such as during negotiations with So Skirans, or during a complex scientific or medical procedure, or during combat.

> The nightmare came again; the woman turning white on the operating table as the beep of the heart monitor slowed and stopped. He awoke and remembered the slip of the scalpel that nicked the aorta, and the resulting red flood. Most of all he remembered the grief and hate in her husband's eyes. For months he escaped by drinking himself into oblivion. The referrals stopped coming and his practice dwindled to nothing. Soon he was borrowing money from friends to survive. One evening, he was drinking away the day in a Startown bar when he heard the new bootstrap expedition was looking for an assistant surgeon. The next morning, he took his thundering hangover downtown and applied. "A new world, a new beginning," he thought. "Maybe I can finally get away from the demons."

Cowardice: The individual will break and run during combat or in other critical life-threatening situations.

Mental Instability: The NPC acts normal most of the time but may act hyperactive and manic, or become depressed and weepy for no apparent reason. In addition, the person cannot handle stress and will break down in a stressful situation. Under extreme stress, this person could totally withdraw into a catatonic state. The individual may be receiving medication. If so, this person may act normal while his or her medication is available but could exhibit symptoms if their medicine is withdrawn.

Hidden Illness: The individual suffers from a hidden, chronic, physical illness. As long as his or her medication is available, the NPC lives normally. However, if the medication is withdrawn, the illness flares up and could become life threatening. An individual with diabetes, epilepsy, or severe asthma would fall under this "flaw." Such a flaw could be discovered by routine physical examinations and deemed acceptable, or this flaw could be successfully concealed by the NPC, or the illness could be unusual and undetectable.

TRANSIT

A month is allowed for interviewing, recruiting, physical screening, assembling supplies, etc. This period is also used for firearms familiarization training for all members of the bootstrap team who do not have at least a skill level of 1 in Slug Weapon or Energy Weapon. All characters without such a skill receive a skill level 0 in Slug Weapon (Pistol), Slug Weapon (Rifle), Energy Weapon (Pistol), or Energy Weapon (Rifle).

At the end of this period, the bootstrap team boards the Group III *Aurora*-class clipper *Immanuel Kant* in orbit around Oriflamme. She is fresh out of the yards following her post-shakedown overhaul. *Kant* is loaded with a full complement of modules so she has jump-2 performance on the way out. Her modules include:

- 400 ton Fuel Module (refining)
- 200 ton Cargo/Cutter Module
- 2x100 ton Mk 1a Quarters Modules
- 100 ton Troop Carrier Module with assault landers
- 50 ton Cargo Module
- 50 ton Planetary Survey Module with skiff

Kant is also carrying her assigned fueler *Skate*, one 50-ton modular cutter with a passenger/cargo module, a fuel scoop module, and two pre-loaded cargo modules; one 30-ton ship's boat, one 10-ton skiff



attached to the planetary survey module, and three Fury assault landers attached to the troop carrier module (see the **Reformation Coalition Equipment Guide** for details on the above *Aurora*-class clippers, *Manta*-class fuel skimmers, modules, and small craft).

Kant is to leave the smaller cargo, quarters, planetary survey, and troop carrier modules in orbit around So Skire along with her small craft (except for *Skate*) so that the bootstrap team can unload their supplies and equipment as needed. The larger cargo/cutter module will be emptied and carried back to Oriflamme, with its contents, including the three cutter modules, left in orbit around So Skire.

Before *Kant* departs, her crew will clip together the stay-behind clipper modules into an orbiting station. This will give the team an orbital base to which they can retreat if the mission goes sour, and quarters for an orbiting quick reaction team (one squad of 13 RC Marines) equipped with the assault landers. The cutter will use her fuel skimming module to scoop fuel from the inner gas giant for herself, the other small craft, and the self-powered clipper modules. A 2000 square meter, 1 MW solar array is attached to the cargo module to provide power.

Kant's cruise will cover the route Helios, L'steich (where she will rendezvous with *Trigger*), Sand, and So Skire. Returning she will jump directly to L'steich, refuel, and jump home to Oriflamme. The outbound leg is expected to last about four weeks.

Kant's sistership *Thunderchild* is expected to call in four to six weeks with additional supplies.

The referee will roll for starship encounters at each system, but *Kant*'s captain has been given strict orders to avoid a fight if possible. After all, the bootstrap operation is a mission with long-term consequences. RCES does not want it aborted in a fight with a pirate.

PLANETFALL

Kant jumps into the So Skire system after four weeks in and out of jump space. She heads to the nearest gas giant where *Skate* scoops fuel to fill herself as well as *Kant*'s 400-ton fuel module. *Kant* and *Trigger* head inward, constantly looking for other vessels. Note that So Skire is only two parsecs from the class D starport on Targa and three parsecs from the class D starport and Hiver temporary staging base on Barlow. Therefore, encounters with outside human or Hiver starships are small but real possibilities (see the **Reformation Coalition Equipment Guide** for data on Hiver starships). Also, if small craft are encountered, this is an indication of some outside activity at So Skire, the only habitable planet in the system.

Once at So Skire, *Kant* assumes a standard parking orbit and prepares to land the bootstrap team leaders. On the way in, *Kant* dispatches a small craft to place a communications satellite in geosynchronous orbit around So Skire. The team is to land at Gotland, the largest of the three Dawn Isles and the seat of government for Holmgren, Lord of the Isles, nominally allied with the Reformation Coalition. The nearest thing Gotland has to a starport is a broad beach on a protected bay near the fishing village of Sudhaven. Spacecraft can either make a water landing and taxi to a pier built out into the bay, or land on the beach. The only other available clear areas are cultivated. Setting a 50-ton cutter down on a soon-to-be-harvested corn crop would be looked upon with dismay by the locals.

Holmgren was contacted more than a year ago by a covert RCES survey mission during the first exploration of So Skire. The RCES determined that he had the most stable popular support of any leader on the planet and that his driving interest was improving the life of his people. The Dawn Isles was judged to be the wealthiest nation on So Skire and the nation most likely to advance technologically. And, Holmgren was judged to be the leader most open to off-world contact and development in his nation.

The second survey of So Skire, a more ambitious and open mission, confirmed these findings and received permission from Holmgren for the bootstrap mission. The second survey team reported that Holmgren was eagerly looking forward to the bootstrap team believing them to be strong allies against his principal political enemy Rudolph the Bald, ruler of the Woden Empire.

The arrangement left with Holmgren is that the "star people" will return within a year and will pass over his capital at Kongsholm to announce their return to him with the characteristic double sonic boom of a spacecraft entering the atmosphere. Upon receiving the signal, Holmgren will hasten to meet them at the beach "starport."

Thunder on a Clear Day

With the crew in the planetary survey module keeping careful watch of the weather at the landing site (see page 23 of the Survey chapter for weather procedures), the team leaders may begin planning for their arrival. Bad weather can clearly complicate flight and unloading tasks, so the characters will be well advised to not ignore these details.

On approach to the landing beach, they can make a high altitude pass over Kongsholm, capital of the Dawn Isles on the west coast of Gotland to let Holmgren know they have arrived. If this is a high-level campaign, the player characters are the team leaders in this first encounter; if it is a low-level campaign, the PCs are members of the security force.

The very first encounter upon landing that the bootstrap team has with the locals will set to tone for the entire campaign. While Holmgren will be on his way, having heard the pre-arranged signal, there is no way for the bootstrap team to control who will be waiting for them on the beach. Will they be met by Holmgren's retainers, stationed here to await their arrival? Will the political situation have changed since the survey, with Holmgren overthrown and hostile troops waiting to ambush the bootstrap team? Perhaps there was some confusion about the proposed landing site, and they will land amid frightened, possibly xenophobic peasants who have no idea what is happening.

Holmgren has no radio. There is no way to find the answer to these questions without simply landing and finding out what will happen.

Roll 2D6 on the table to the right to determine the nature of the crowd which gathers at the landing site upon the Bootstrap team's arrival.

2D6	First Encounter
2	Nobles
3	Troops
4	Fishermen
5	Townspeople
6	Peasants
7	Peasants
8	Fishermen
9	Townspeople
10	Police
11	Troops
12	Mounted Troops

Nobles: The local Duke of Sudhaven and his retinue of 1D6 members of his household and 3D6 members of his household troops are on the beach waiting to greet the bootstrap team. They had been told by Holmgren to expect the team's arrival and they hurried to the landing site as soon as they saw the launch on approach.

Troops: Troops numbering 3D6 armed with spears and swords are drawn up in formation on the beach. Their commanding officer walks out to greet the team as they emerge from the launch.

Fishermen: 2D6 fishermen are sitting on and near their boats which are drawn up on the beach and were repairing their nets when the bootstrap team landed.

Townspeople: 4D6 curious townspeople from the nearby community of Sudhaven are standing on the beach as the bootstrap team lands.

Police: 1D6 members of the town watch are on the beach. They are



armed with thick staves that function as clubs. One is armed with a sword.

Mounted Troops: A cavalry detachment mounted on horseback armed with swords, lances, and composite bows ride on to the beach as the launch lands.

First Contact Interaction

Whenever groups of people meet for the first time, there are innumerable potentials for misunderstanding, and the fallout of such errors can have far-reaching effects. Such important moments should be roleplayed, allowing the players to experience the uncertainty guessing how best to respond to strange gestures or behaviors on the part of their counterparts. Are they drawing their weapons in honorary salute, or in preparation to attack? Should we draw ours to be safe, or will that frighten them?

These intangibles are the most dangerous when leaders cannot be present to attempt to maintain control of the proceedings, and to exert their leadership over potentially unsteady NPCs. This procedure may be used in any case when unfamiliar groups meet for the first time, such as here in the bootstrap campaign, but also in response to the "Native Encounter" random events result in the colony adventure (Chapter 7).

First, the referee rolls for the friendly team attitude on the table to the right. The result is the basic mental state of the team NPCs as they leave the launch. If PC leaders are present, one of these may attempt an Average: Leadership task to modify the team's attitude. Success indicates the result may be moved one level in any direction, Outstanding success allows two levels. (If Leadership assets are not possessed, Persuasion may be used, but the task becomes Difficult.)

1D6	*Team Attitude*
1	Hostile
2	Fearful
3	Wary
4	Relaxed
5	Open
6	Friendly

DMs on Team Attitude table: –1 if encounter is with troops; +1 if with civilians, +2 if with leaders (such as the local nobles on the table above). Apply a centering DM based on troop quality. A centering DM is one which works to bring the result to the center of the table: a result of 3 or 4. If the result is 4-6, the DM is used as a –DM. If the result is 1-3, the DM is used as a +DM. However, these +DMs will never raise the result to greater than four, and the –DMs will never lower the result to less than 3. Novice: no DM, Experienced: ±1, Veteran: ±2, Elite: ±3.

The local people who see the team on the beach will be able to sense their attitudes from the team's facial expressions, body language, and other non-verbal clues. This affects their own attitude to the team.

The leader of the friendly team must now attempt an Average Liaison Task to assure the locals' cooperation and positive attitude (if no Liaison skill, use Persuasion or Leadership, but difficulty level becomes Difficult). In the current example this would be a PC, or else Kaminski if the PCs are merely playing security troops. In the case of a random encounter between, say hunters and a local war party (in the case of the colony adventure), the referee must determine the talents of the group, but in most cases this will result in the use of the unskilled penalty (TNE page 108), and the outcome of the situation will be dicey.

Index the result of the task with the table to the right, modified by the attitude of the friendly party obtained above.

The reaction is modified by the team's attitude: +2 if Friendly, +1 if Open, –1 row if Wary or Fearful, –2 rows if Hostile. As an example, if the Liaison task is a success and the team is Friendly, go up two rows on the table to +1, Actively Cooperative. If the task is a failure and the team is hostile, the locals will be hostile and frightened and will flee and/or attack. (Because of the complexity of interpersonal and political relations, further developments after this initial contact are at the referee's discretion or according to scenario instructions, for example, immediately below.)

If the encounter goes smoothly, the locals will wait in place until Holmgren arrives, at which time they are escorted to Holmgren's palace in Kongsholm. How and where the meeting takes place is the referee's choice. If the team travels to Kongsholm, they should use local transportation to blend in and get the feel of Gotland and the Dawn Isles. The journey to Kongsholm would be a great opportunity for encounters and side adventures.

If the encounter goes badly, the team may have to retreat back to the ship. In that case, another attempt will have to be made to contact Holmgren, such as a covert mission to Kongsholm.

Meeting Holmgren

The leaders need to meet with Holmgren. His reaction will determine if the team is welcome in his nation or not. His reaction will be determined by another Liaison task as described above in First Contact Interaction. However, the result is modified by the final reaction of Holmgren's own people, and not the attitude of the bootstrap team.

HOLMGREN'S INITIAL REACTION

Task Result	*Reaction and Initial Level on Political Track*
+2	Totally Cooperative, Eagerly Welcomes Team. Level 2.
+1	Actively Cooperative, Friendly, appears to welcome team. Level 3.
Outstanding Success	Passively Cooperative, outwordly friendly, curious about team. Level 4.
Success	Neutral, cool and indifferent. Level 5.
Failure	Passively Uncooperative, seems agitated, worried, uncertain about team. Level 6.
Catastrophic Failure	Actively Uncooperative, seems very agitated, orders team back to ship. Level 7.
-1	Hostile, arrests team. Level 8.

Modifiers: +2 rows if local nobles eagerly welcomed team, +1 if local peasants or townspeople eagerly welcomed team or if nobles were friendly, -1 row if peasants/townspeople were uncooperative, -2 if nobles were uncooperative.

If the result is negative and unless the team is thrown in jail, they may attempt to win over Holmgren again 24 hours later with a Formidable test of Persuasion. If they are jailed, they will have to attempt to escape.

The notation of "Level" shows the initial position on the Political Track that corresponds to the result. See "Dealing with Holmgren," on the next page.

FIRST CONTACT REACTIONS

Task Result	*Reaction*
+2	Totally Cooperative, Eagerly Welcomes party.
+1	Actively Cooperative, Friendly, appears to welcome party.
Outstanding Success	Passively Cooperative, outwordly friendly, curious.
Success	Neutral, cool and indifferent.
Failure	Passively Uncooperative, seem agitated, worried.
Catastrophic Failure	Actively Uncooperative, seems very agitated, afraid; if troops may attack.
-1	Hostile and Frightened, if civilians will flee; if troops, will attack.



Holmgren, Lord of the Isles

Elite NPC

Combat Assets: Armed Martial Arts (Large Blade), Unarmed Martial Arts

Other Assets: Leadership 14, Persuasion 12, Bargain 10, Ground Tactics 10, Liaison 9, Streetwise 9, Willpower 9, Riding 9, History 8

Motivation:



Spade Ace: Holmgren is a charismatic and highly popular leader. He radiates charm in close company, and inspires all who hear him speak publicly. Holmgren is responsible for building his country's navy as a deterrent to aggressors from the mainland, and for improving the Dawn Isles' economy through shrewd trade pacts with other nations, particularly the Borean Enclave and the Aylward Islands.

Heart King: Holmgren is popular because he is honorable. He keeps his promises to his people by never promising what he cannot accomplish. His first act upon ascending to the throne was to fire the nation's corrupt tax collectors and appoint honest officials in their place.

Personality: Holmgren is genuinely interested in cooperating with the RC and the bootstrap team, but does have serious reservations the way that this should be done.

He will not stand for the RC coming in and doing everything for him, protecting him, defeating his enemies, and building new equipment that his people will not understand. This will not ultimately help his people; it will only make them dependent on outside protection, and will not allow them to help themselves. What is more, this will undermine Holmgren's political position with the Council of Nobles, who will see him as an impotent puppet of the off-worlders and will withdraw their support from him, invalidating his position as Lord of the Isles.

While he is open to and even eager for the benefits promised by the RC, he will irritate the PC leaders by insisting on knowing all of the details of every proposed action, and periodically make small, even cosmetic changes, just to prove that he is in control of the process. However, such cosmetic changes are important, as they will prove to the Council that the changes are under Holmgren's control, and that he must receive credit for them. The bootstrap team ignores these considerations at their peril, for if Holmgren loses power, there is no telling what his replacement will be like, and the ramifications for the unity of the Dawn Isles.

In these meetings, Holmgren will be fond of wagging his finger at the bootstrap team leaders and saying, "If you *give* a man a fish, he will eat for a day; if you *teach* a man to fish, he will eat for a lifetime."

While this remark gives insight into Holmgren's concerns, this is perhaps less important than the fact that it is true.

THE MISSION

Once contact is successfully made, the team and its equipment are brought down from orbit. They must establish a base camp and then set up plans for dispatching action teams throughout the Dawn Isles. Meanwhile in orbit, *Immanuel Kant* prepares to depart and puts together the orbiting station.

After the base camp is established, action teams fan out to sites where assistance is needed, as determined by the PCs and negotiated with Holmgren.

Dealing with Holmgren

As discussed in the Holmgren sidebar, Holmgren's success as Lord of the Isles depends on his walking the fine line between gaining the benefits of interstellar contact for his people without appearing to be too dependent upon them. While the Dawn Isles' Council of Nobles is not a particularly noxious pit of vipers as such bodies go, it is nevertheless full of ambitious leaders who will not miss a chance to see to their own power if Holmgren is squandering his own legitimacy.

Assisting Holmgren in walking this line is also part of the bootstrap team's job, as if he goes down in flames, their mission, in all likelihood, will as well.

All of this Byzantine and Machiavellian maneuvering is simulated by the use of a monthly die roll on a Politcal Table which drives the political position marked on a Political Track.

This is a modification of the political table and track presented in Chapter 4. In this bootstrap adventure, this political track combines the effects of two separate but related dynamics: 1) Holmgren's relationship with, and confidence in, the bootstrap team, and 2) Holmgren's power in, and support from the Council of Nobles as Holmgren's policies become more and more associated with those of the RC bootstrap team.

This means that each level on the Political Track has a dual function. First, it shows how willing Holmgren is to authorize further bootstrap activities. The higher the level, the happier he is with the team and their efforts, and the more willing he is to go along with more development.

Second, it shows how strong or precarious Holmgren's position is as Lord of the Isles. The higher the level, the stronger the bootstrap team has made his hold on power. The lower the level, the more the bootstrap team has botched their job, either by making Holmgren look like a fool for countenancing the efforts of bungling aliens, or by undermining Holmgren's power by making him look like a hollow, ineffectual puppet under the thrall of his "court magicians." Naturally it is this second function that explains Holmgren's willingness to further cooperate with the bootstrap team: their success in dealing with him goes hand in hand with their success in making Holmgren look good to his people and his power-hungry nobles.

Note that at the very beginning of the campaign, the political track only shows Holmgren's relationship with the bootstrap team, and has nothing whatever to do with his hold on power. It obtains both functions and retains them for the remainder of the campaign once the following two conditions are met.

1) The bootstrap team's relations with Holmgren on the political track rises to Level 3: Good, and

2) While the position is at Level 3, Holmgren agrees to allow at least one development operation, as explained in the "Lobbying for Permission" section which follows immediately.

Lobbying for Permission: Each month the bootstrap team leaders must present their requests for the upcoming team's operations. In general terms, the number of possible operations is one per A Team, based on the location of that team (i.e., if the A Team is assigned to train a military unit, the team must spend that month in the location where that unit resides, if the A Team is assigned to help the local miners, they must spend the month located where mining is taking place, etc.), four operations for the Base Team (again,



assuming that portions of their personnel are moved to the required location, or else that the persons being trained are brought to the base camp), and two operations for the command group (i.e., the PCs if they are the team leaders, with the same geographic caveat as discussed for the Base Team above). Thus the maximum total operations, and thus task rolls, per month is 14.

The details of these development operations tasks are described in "The Jobs" section on pages 59-60 below.

Each task desired by the bootstrap leaders requires a Persuasion roll. The difficulty level of this roll is shown on the Political Track, and is therefore based on the current level of these relations. Success indicates that Holmgren has granted permission for the indicated development task to be conducted during the current month. Failure and Catastrophic Failure both indicate that permission was denied.

PC bootstrap leaders should note that they may attempt these development tasks even if Holmgren denied permission, however, if these tasks fail, the –DMs on the political roll are *doubled*.

Bootstrap personnel who have had their operations for month cancelled may not be reallocated for other tasks that month.

If the request was approved, the group is transported to its required location and makes the indicated task roll. Success not only indicates that the team succeeded at its task (helping the locals to improve their agricultural, raw materials productivity, improved the training of local troops, etc.), but also succeeded in the altogether more ticklish aspect of handling the task so that it made Holmgren look good, and not just the bootstrap team. Failure can be either a failure to accomplish the basic task, or a successful task which somehow ended up making Holmgren look bad, ineffectual, weak, or somehow not in control of the bootstrap activities.

The Political Table: The political roll is made once per month, after the task rolls for all development tasks and random events for the turn have been made, as all of these items provide potential DMs for use on the table.

The Output roll DMs shown on the table are only used if the Economic Model is in use (see page 64 for details).

POLITICAL TABLE

D20	*Result and Output DMs*	*Track Movement*
–5	Dissolved, –5	Down 2 levels
–4	Coup Attempt, –4	Down 2 levels
–3	Censure, Assassination,–3	Down 1 level
–2	Caution, –3	Down 1 level
–1	Secession Threat, –2	Down 1 level
0	Secession Threat, –2	Down 1 level
1	Nobles Uncertain, –1	—
2	Nobles Uncertain, –1	—
3-18	No Effect	—
19	+1 DM, one random sector	—
20	+1 DM, one random sector	—
21	+1 DM, one random sector	Up 1 level
22	+1 DM, all sectors	Up 1 level
23	+1 DM, all sectors	Up 1 level
24	+1 DM, all sectors	Up 1 level
25	+2 DM, all sectors	Up 2 levels
26	+2 DM, all sectors	Up 2 levels

Nobles Uncertain: Small numbers of nobles express concern about the dangerous reliance on unreliable off-world support. –DM shown applies to only one sector (1-2: agriculture, 3-4: materials, 5-6: industrial)

Secession Threat: Small numbers of nobles begin to discuss the possibility of seceding from the Council along with their fiefs if the unacceptable reliance on off-world methods continues. –DM shown applies to only one sector.



Caution: Council of Nobles formally votes a Message of Caution to Holmgren, officially voicing their opposition to any further reliance on the off-worlders. –DM shown applies to materials and industrial only, not agriculture.

Censure, Assassination: Council of Nobles issues a Note of Censure to Holmgren, a stronger message than the Caution, above. As controversy continues to mount, small, disorganized group or individual attempts to kill Holmgren. If assassination is successful, Holmgren's replacement will order the bootstrap team out of the Dawn Isles on threat of death. Referee's discretion, low-level roleplay is recommended. –DM applies to all sectors.

Coup Attempt: Organized group of Nobles attempts to take over government from Holmgren. If successful, will place Bootstrap team under arrest. Referee's discretion, low-level roleplay is recommended. –DM applies to all sectors.

Dissolved: The Council votes to dissolve the position of Lord of the Isles, throwing Holmgren into jail to be tried for treason. The bootstrap team will be placed under arrest for eventual execution. Referee's discretion; if you don't start some low-level roleplaying now, you have to ask yourself what the heck you think you're doing playing this game, anyway. –DM applies to all sectors.

POLITICAL TRACK

Level	*DM*	*Diff Level*
Level 1: Excellent	+3	Easy
Level 2: Very Good	+2	Average
Level 3: Good	+1	Average
Level 4: Fair	—	Difficult
Level 5: Marginal	—	Formidable
Level 6: Poor	–1	Formidable
Level 7: Bad	–2	Impossible
Level 8: Terrible	–3	may not be attempted

DM: Die modifier applied to roll on Political Table on turns when that political level is in effect.

Diff Level: Difficulty level for Persuasion rolls when attempting to persuade Holmgren to allow development operations.

RCES SCOUTING REPORT

So Skire System

So Skire Subsector/Old Expanses 1732

Star System
Sector: Old Expanses
Subsector: 1732/So Skire
Star Type: M0V
Planetoid Belts: 0
Gas Giants: 4

Main World
Starport: X
Pre-Collapse Starport: E
Diameter: 9360 kilometers
Atmosphere: Standard
Hydrosphere: 71 percent
Population: 100,000,000
Pre-Collapse Population: 100,000,000
Government: Balkanized (Charismatic Dictator)
Law Level: 3
Tech Level: 1
Pre-Collapse Tech Level: 1
Bases: None
Trade Classification: None

NOTES

So Skire has been a stable backwater world unaffected by Virus and the Collapse because of its low pre-Collapse tech level. Normally, it would not draw much attention. However, a recent survey by a free-lance team found significant heavy metal mineral deposits on this dense, high gravity world and a relatively friendly native population near the survey site. Coupled with its position on the spinward edge of a dense cluster of worlds leading toward Hiver space, this makes So Skire worthy of intensive contact and bootstrap operations. With proper and timely development, So Skire could become a major source of vital minerals for the Reformation Coalition and a friendly "bridge" world between the Coalition and Hiver space.

Physical

So Skire occupys Orbit 0 around its M0V primary "Mymr." So Skire orbits toward the outer edge of the habitable zone (Orbital Factor 800). This, and its primary's relatively low luminosity result in cool temperatures on the planet's surface. Orbits 1 and 2 are empty, orbits 3, 4, 5, and 6 contain the system's four gas giants.

So Skire has a small (size S) rocky moonlet orbiting at 85,140 kilometers (9 diameters) and a ring system at 18,920 kilometers (2 diameters).

So Skire is classified as a habitable world but it's no paradise. It has a base surface temperature of 4°C and temperatures ranging from +29°C to -76°C. So Skire's temperate zone extend from 24° north to 24° south of the equator (three hex rows on standard global data view maps). Latitudes north and south of this line experience severe seasonal freezing or permanent glaciation. Weather factors for So Skire total 0.

It is an old world. Much of its original atmosphere has leaked away into space in spite of its 1.55G surface gravity. So Skire's atmosphere has a pressure of 0.9 atmospheres and a 20 percent oxygen concentration making it breathable without assistance. The axial tilt is 26 degrees giving the world pronounced seasons. So Skire's day is 24 hours long, and its year is rather short at 47 standard (and local) days, which is fortunate, given the severity of its winters.

Oceans cover 71 percent of the planet. Land masses consist of one major continent, three minor continents, seven major islands, and five archipelagoes.

The "freeze lines" on So Skire (three hex rows each side of the equator) marks the beginning of "the barrens," a land region that freezes every winter. The barrens are made up of rugged badlands with some glacier tongues extending from the ice cap. Vegetation is limited to lichens and other small growth, somewhat analogous to the Terran permafrost region. The "tropics," between the north and south freeze lines, do not freeze during the winter, except for some localized temporary freezing during the winter nights of hex row 3. The polar caps begin eight hex rows north and south of the equator. These are permanently frozen regions covered with a kilometers thick layer of ice.

The oceans poleward of the freeze lines experiences intermittent freezing depending on the latitude and season. During the summer and fall, ice floes and 'bergs calving off the polar caps are frequently encountered above the freeze line. Increasingly dense surface ice with pressure ridging forms during the winter and spring seasons.

The northern half of the major continent is ice-locked as are two of the three minor continents and most of the third. Most islands and archipelagoes are in temperate waters, however, and the human habitation is naturally concentrated here.

The Drakensberg mountain range which follows the west coast of Woden, the major continent, lie along the Draken fault line. These mountains experience major seismic and volcanic activity, and continuing geological uplift as the Western Marine tectonic plate perpetually rides up and over the Woden plate. Seismic activity along fault lines throughout the planet is frequent, thanks to tidal stresses caused by So Skire's proximity to its primary. The Spires of So Skire, five volcanoes towering more than 5000 meters above Cape Titan were tourist attractions during the Last Imperium. The few visiting sportspersons and tourists that traveled "off the beaten path" contributed a significant share of the planet's off-world income visiting the Spires and climbing nearby peaks during this period. Other income came from the occassional trader and from research teams studying the world's unusually primitive civilization.

Another source of income was a rare algae that only grows on the surface of tiny mountain lakes among the Spires of So Skire. The sulfur and other elements in the volcanic discharge made the algae and the microrganisms it hosts unique producers of wide-spectrum antibiotics. This was a primary export of the world during the Rule of Man and early in the Last Imperium. However, this pharmaceutical was later synthesized and reproduced in vast quantities in high tech pharmaceutical plants and the market for So Skire's product dried up.

Now that these mass production methods were lost in the Collapse, this algae may become a valuable export to the nearby Coalition worlds.

The Asgard Strait separating the major continent from Frig, the continent immediately south, is frozen solid about 16 days out of the year. The Strait is the major marine traffic route between the Aylward Islands in the Western Sea and the states on the eastern coast of Woden.

Other continents include Loki northwest of Woden, and Ragnar south of the Aylward Islands. Except for the extreme northern tip of Ragnar, both are uninhabited.

Other major inhabited regions include the Aland, Gotland, and Bjornholm Islands, know collectively as the Dawn Isles, east of Woden.

History

So Skire was settled during the rapid expansion of the Empire of Man following the defeat of the Vilani in the Interstellar Wars. Early records are few, indicating it was settled as a mining colony by colonists of Terran descent. It was abandoned during the Long Night and the technology level of its surviving inhabitants crashed to TL 0. Their technology had climbed to TL 1 when they were rediscovered about 560 by Last Imperium scouts. By then, other resource worlds closer to the Imperial core had been developed and So Skire was noted in IISS journals and bypassed. Harsh agricultural growing conditions and the lack of native technology combined to keep the planet's population at around 100 million. The IISS and later the Solomani Confederation Navy had provided and maintained communications technology which helped So Skire's people remain united and govern themselves as a representative democracy. Otherwise, the IISS declined to "interfere" with the local society although it did allow trade and contact with off-worlders under supervision of personnel from the Scout base at Keghe (1733). With the Collapse, however, the communications satellites and ground-based networks failed, the base at Keghe disappeared, and the world became balkanized.

RCES SCOUTING REPORT

So Skire System.
So Skire Subsector/Old Expanses 1732

So Skire Temperature Worksheet

				Highest Possible Temperature						Lowest Possible Temperature					
Col:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Hex Row	Base Temp	Latitude Mod	Cols. 1+2	Summer Plus	Ax. Tilt Factor	Cols. 4x5	Daytime Plus	Orbit Ecc Plus	Cols. 3+6+7+8	Winter Minus	Ax. Tilt Factor	Cols. 11x12	Night Minus	Orbit Ecc Minus	Cols. 3+12 +13+14
1	4	+18	22	+16	0.00	+0	+7	+0	29	-26	0.00	-0	-12	-0	10
2	4	+12	16	+16	0.00	+0	+7	+0	23	-26	0.00	-0	-12	-0	4
3	4	+6	10	+16	0.25	+4	+7	+0	21	-26	0.25	-7	-12	-0	-9
4	4	0	4	+16	0.50	+8	+7	+0	19	-26	0.50	-13	-12	-0	-21
5	4	-6	-2	+16	0.75	+12	+7	+0	17	-26	0.75	-20	-12	-0	-34
6	4	-12	-8	+16	1.00	+16	+7	+0	15	-26	1.00	-26	-12	-0	-46
7	4	-18	-14	+16	1.00	+16	+7	+0	9	-26	1.00	-26	-12	-0	-52
8	4	-24	-20	+16	1.00	+16	+7	+0	3	-26	1.00	-26	-12	-0	-58
9	4	-30	-26	+16	1.00	+16	+7	+0	-3	-26	1.00	-26	-12	-0	-64
10	4	-36	-32	+16	1.00	+16	+7	+0	-9	-26	1.00	-26	-12	-0	-70
11	4	-42	-38	+16	1.00	+16	+7	+0	-15	-26	1.00	-26	-12	-0	-76

Techno-Politico-Military

So Skire's technology level is the equivalent of Terra's circa 1200-1300 AD. Iron is the predominent metal, used for weapons, plate armor, nails and other fasteners, wagon wheels, and utensils. Homes and other buildings are sturdily build of wood and stone to resist the high winds and cold temperatures. The indigenous population wear homespun cloth and leathers and furs taken from local animals. Agricultural production is primitive, using plows drawn by Terran-descended domesticated musk oxen and local equivalent animals for cultivation, and hand implements for harvesting. Local plant life is edible but must be supplemented with Terran-descended plants in the diet ,or with vitamins.

Transportation consists of riding animals, usually Terran-descended horses and mules, and wagons drawn by mules, horses, or musk oxen over rough roads on land, or by river barges. Sea transportation is by sailing ships and sail and oar-powered coastal galleys.

Aside from the recent contact by the RCES-sponsored survey team, there has been no known off-world contact since the Collapse. The survey team discovered the world's population is divided among eight nations scattered across the face of So Skire. They include:

1. Dawn Isles: Ruled by the Lord of the Isles, a benevolent feudal monarch supported by his people, the Dawn Isles is the most prosperous of the So Skire nations. It includes Aaland to the north, Gotland in the center, and Bjornholm in the south. The survey team's landing site was at the south coast of Gotland, virtually on the equator. Gotland has some of the richest farmlands and highest crop yields on the planet. It also has a proven supply of sulfur enabling it to begin producing crude gunpowder, making it the equal of any rival powers. Its people seem the most open to off-world contact and influence. Gotland has therefore been chosen as the prime base site and initial objective of the bootstrap team.

2. South Dawn: An archipelago running between Bjornholm and the barren island Bifrost in the south, South Dawn is also a monarchy ruled by a nephew of the Lord of the Isles and is closely allied with its neighbor to the north.

3. Borean Enclave: A small nation in the northernmost habitable portion of the Woden Continent, the enclave is ruled by a representative democracy. It is an active trading partner with the Dawn Isles, and its only mainland ally. The Boreans trade mainland timber for Dawn Island farm products and manufactured goods.

4. Svensholm: A small coastal nation existing primarily from fishing the rich shallow banks offshore in the Crimson Sea. Svensholm is allied to and partially occupied by the Woden Empire to the south. There is an active resistance to the Wodenites supported by both the Boreans and the Dawn Isles.

5. Woden Empire: The Woden Empire is rich in timber resources, possessing the largest harvestable forests in the settled areas of So Skire. It is ruled by Rudolph the Bald, who believes he is destined to reunite So Skire under his crown. Rudolph is an absolute monarch whose word is life and death. He is supported by his wealthy nobility and, surprisingly, by his impoverished population, seduced by the promise of a better life when The Empire rules all of So Skire. The Empire's crop land is poor and has difficulty supporting its population. Timber is grudgingly traded with the Dawn Isles for their farm products and manufactured goods.The Dawn Isles' rich farmland is a priority target for inclusion in the Empire. So is the integration of Svensholm, the Borean Enclave and their fishing fleets. However, the Dawn Isles' powerful navy has thwarted these plans so far.

6. The Southern Republic: The Southern Republic control So Skire's major maritime trade route through the Asgard Straits. The Republic is ruled by the Brotherhood, a mystical band that believes some day the starmen will return with their marvelous speaking boxes and help them reunite So Skire. The Republic charges merchant vessels tolls for the privilege of passing through their waters and the Straits. So Skire's maritime nations would like to end this practice but have not mustered enough power to break the Republic's hold on the Straits.

7. Aylward: Aylward includes North and South Aylward Islands and is ruled by a representative democracy. The islands are rich in precious metal deposits which are sources of trade goods to be exchanged for manufactured products from the Empire and the Dawn Isles. A "White Fleet" sails eastward each spring blown by the prevailing winds from the west. After passing through the Straits and paying its tolls, the fleet calls at ports in the Empire and the Dawn Isles. Here precious metals and jewelry are exchanged for iron nails, wire, fasteners, wagon and ship fittings, and other manufactured products. The fleet then continues eastward, eventually arriving home after a voyage around the world.

8. The Polity of Ragnar: Despite its impressive sounding name, the Polity is little more than a council of tribal chiefs who rule the wild clans of Ragnar. Ragnar has the lowest tech level on the planet, effectively TL-0. Any TL-1 artifacts are acquired through theft and piracy. Their chief activity is raiding the Aylward Islands and the White Fleets as they depart and arrive home. The Aylwarders may eventually tire of this, and take Ragnar under their control.

So Skire's estimated current population broken down by nation is shown at right:

Nation	Population
Woden Empire	30,000,000
Dawn Isles	20,000,000
Southern Republic	15,000,000
Aylward Islands	10,000,000
Borean Enclave	8,000,000
Svensholm	11000000
South Dawn	5,500,000
Ragnar	500,000
Total	100,000,000

Date: 01-IX-1201

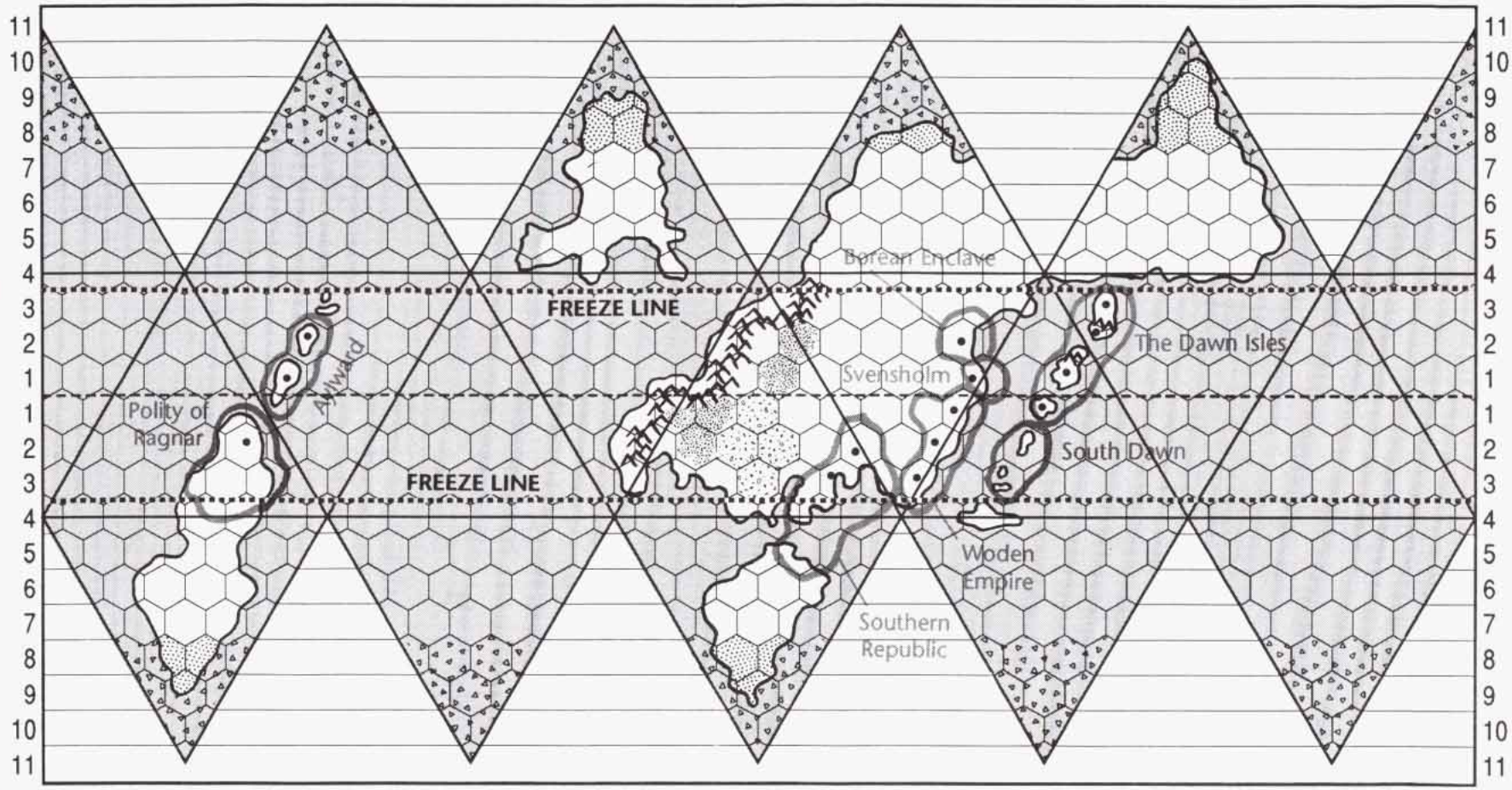
World Name: So Skire

UPP X667843-1

Hexagon Scale in Kilometers: 840

Subsector and Sector Location of World: 1732/So Skire/Old Expanses

GLOBAL DATA VIEW

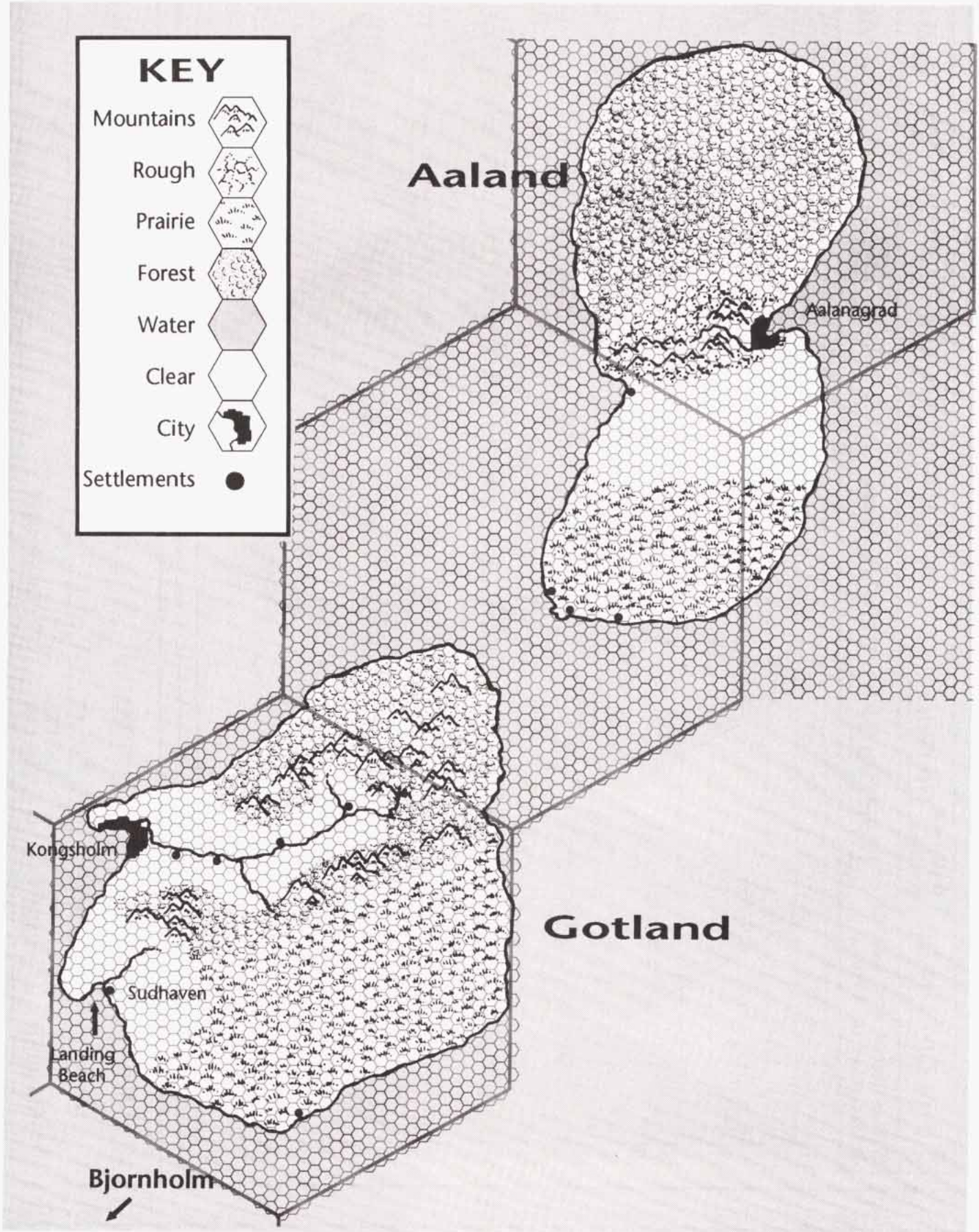


Open Sea | Steppe | Jungle

Mixed | Badlands | Tundra

Mountains | Desert | Ice cap/ Glacier | Settlement




KEY
Mountains
Rough
Prairie
Forest
Water
Clear
City
Settlements
Aaland
Aalanagrad
Kongsholm
Gotland
Sudhaven
Landing Beach
Bjornholm



The Jobs

The basic bootstrap Action Team (or "A Team" for short) of which there are eight on this mission, includes five personnel: a military advisor, an agronomist, a civil engineer, a medic and a security/commo specialist. All are armed with light weapons. Meanwhile, the Base or "B Team" at base camp includes specialists such as geologists, teachers, intelligence gatherers and analysts, security force members, and the air raft pilots. They are available for dispatch on special missions where their expertise is useful.

These are the jobs of the bootstrap specialists and the situations in which they work. If the PCs are low level characters, you can place them in one of these situations if they have the necessary skills, and have them roleplay with the local people on a day to day basis. If you are running a high level campaign, you can have the players travel from site to site and use "walk-around management" techniques to become personally involved. You can use these settings as starting points for "mini-campaigns" within the main campaign. Meanwhile, the main campaign will progress from month to month at high level with events that will positively or negatively impact the players. These events are described beginning on page 64.

Leaders: These are the players in a high level campaign, or they can be distant figures that occasionally appear to players in a low level campaign. Leaders have two basic jobs. First, they are diplomats, constantly working with Holmgren and his advisors to advance the work of the bootstrap team. Second, they plan and supervise the operations of their subordinate A and B Teams, seeing that their capabilities are used to the best possible effect. From time to time, these leaders will also appear personally to lend their skills or guidance to the low-level efforts of these teams. As always, leaders must also respond to and cope with events or emergencies that crop up and impact the mission.

Military Advisors: They work directly with key units of the Dawn Isles armed forces, training them in new tactics and methods of operations. Although there are no active hostilities as the team moves into place, there is always the chance of raids from the mainland. And, Holmgren might want advisors to accompany his troops on a raid against the Woden Empire.

A military advisor may attempt to raise the troop quality of a battalion by rolling a Formidable Instruction task. Six consecutive success results mean that the battalion being trained has risen one experience level. This higher level must be maintained by continuing to roll consecutive successes at a Difficult Instruction task each subsequent month. Only one quality level may be obtained this way, and this new level must be less than the experience level of the NPC instructor. For example, a Veteran military advisor could raise a Novice battalion to Experienced, but could not raise an Experienced battalion to Veteran.

Each monthly success on this roll adds +1 to the Political Roll, +2 if Outstanding Success. There is no penalty for basic failure, but Catastrophic Failure incurs a –1 DM on the Political Roll.

One military advisor is in each A Team, and the entire A Team must participate in this activity for the entire month, and may not conduct other development tasks during this time.

Geologists: They are to begin an immediate mineral survey of the three planetary hexes of the northernmost Dawn Isles (Aaland and Gotland). The data they can determine for the three hexes is found on page 48. After the Dawn Isles have been thoroughly surveyed, geologists may participate in covert survey missions to the mainland to look for useful mineral finds there.

A geologist may roll a Formidable Geology task each month to simulate the assistance of local miners in finding and accessing mineral wealth.

Each monthly success on this roll adds +1 to the Raw Materials output roll of the Dawn Isles (if using the economic model) and +1 on the Political Roll, or +2 on each roll if Outstanding Success. There is no penalty for basic failure, but Catastrophic Failure incurs a –1 DM on the Political Roll.

Geologists are part of the Base Team, and any such Geological tasks come under the maximum of four tasks per Base Team per month, but see also page 64 for survey requirements.

Agronomists: In many ways these specialists in farming science are the keys to the mission's success. They will probably be more intensely involved with the local civilian population than any other team members, except possibly the medics. They will visit farming villages near the A team camps and introduce new farming methods such as contour farming on hillsides and new implements such as an improved iron plow that should help increase crop yields and the income enjoyed by local farmers. At least one biologist who is an expert in fisheries is included among the agronomists and is assigned to improve the catch at one or more fishing villages.

An agronomist may roll a Formidable Farming and Instruction (i.e., lower of the two assets) task each month to simulate the assistance of local farmers in using advanced farming techniques to increase their yields.

Each monthly success on this roll adds +1 to the Agricultural output roll of the Dawn Isles (if using the economic model) and +1 on the Political Roll, or +2 on each roll if Outstanding Success. There is no penalty for basic failure, but Catastrophic Failure incurs a –1 DM on the Political Roll.

One agronomist is in each A Team, and the entire A Team must participate in this activity for the entire month, and may not conduct other development tasks during this time.

Civil Engineers: They also work with the local civilian population advising them how to build and improve roads, bridges, aqueducts, sewer systems and other public works to improve transportation and sanitation in the country. Civil engineers will also assist in the design and construction of public buildings as well as teach local farmers and townspeople improved architectural and construction methods.

A civil engineer may roll a Formidable Construction and Instruction (i.e., lower of the two assets) task each month to simulate the assistance of the local populace in improving their infrastructure.

Each monthly success on this roll adds +1 to the Industrial output roll of the Dawn Isles (if using the economic model) and +1 on the Political Roll, or +2 on each roll if Outstanding Success. There is no penalty for basic failure, but Catastrophic Failure incurs a –1 DM on the Political Roll.

One civil engineer is in each A Team, and the entire A Team must participate in this activity for the entire month, and may not conduct other development tasks during this time.

Metallurgists: Their job is to teach local metalworkers such as blacksmiths and smelters to make the best use of local metal deposits. Where the geologists find minerals such as nickel that can be used to make improved iron alloys, the metallurgist will teach the locals how to make and use the alloys. Improved farm implements, household goods, industrial products, and weapons all result from the metallurgists' work.

A metallurgist may roll a Formidable Metallurgy and Instruction (i.e., lower of the two assets) task each month to simulate the assistance of local craftsmen in improving their techniques and output.

Each monthly success on this roll adds +1 to the Industrial output roll of the Dawn Isles (if using the economic model) and +1 on the Political Roll, or +2 on each roll if Outstanding Success. There is no penalty for basic failure, but Catastrophic Failure incurs a –1 DM on the Political Roll.

Metallurgists are part of the Base Team, and any such Metallurgy tasks come under the maximum of four tasks per Base Team per month.



Doctors/Medics: A key element of the "Hearts and Minds" program, the A Team medic makes the rounds of villages near the A Team base taking care of wounds and diseases, and teaching local people basic medical skills and sanitation. The doctors back at the B Team headquarters not only take care of the bootstrap team members, they also are on call to assist the field medics with difficult cases especially when they affect important local individuals, such as the child of a village headman or a member of the nobility. One of the doctors is a veterinarian offering veterinary medical advice to livestock farmers.

Medical personnel are available to respond to medical requirements on the random events table, but also to conduct beneficial tasks each month.

A doctor/medic may roll a Formidable Medical (Diagnosis) task each month to simulate the treatment of the local populace in minor illnesses as well as administering innoculations against local diseases. This process increases the overall health and therefore productivity of the population.

Each monthly success on this roll adds +1 to all output rolls of the Dawn Isles (if using the economic model) and +1 on the Political Roll, or +2 on each roll if Outstanding Success. There is no penalty for basic failure, but Catastrophic Failure incurs a –1 DM on the Political Roll.

One medic is in each A Team, and the entire A Team must participate in this activity for the entire month, and may not conduct other development tasks during this time.

Doctors are part of the Base Team, and any such Medical tasks come under the maximum of four tasks per Base Team per month.

Teachers: The teachers have a "knowledge transfer" mission. They are to set up an academy for the brightest local inhabitants and teach them basic science, math, and language skills to foster improved communcation with the bootstrap team. They also teach the locals about the universe, So Skire's place in it, and the history and philosophy of the Reformation Coalition.

A teacher may roll a Formidable Instruction task each month to simulate the progressive education of the local population in basic concepts. By "raising the conciousness" of the society to the advantages of interstellar contact, these tasks have an enlarged influence on the Dawn Isles' political acceptance of interstellar contact.

Each monthly success on this roll adds +2 on the Political Roll, or +4 if Outstanding Success is rolled. There is no penalty for basic failure, but Catastrophic Failure incurs a –2 DM on the Political Roll.

Teachers are part of the Base Team, and any such Instruction tasks come under the maximum of four tasks per Base Team per month.

Intelligence Specialists: Based at B Team headquarters, the intelligence specialists are tasked with gathering political, military, and economic intelligence from throughout So Skire. They are also responsible for creating up-to-date, accurate maps of the planet. Orbital photography from the high station supplemented with local surveys are used for map making. As soon as the intel section arrives on planet, they begin setting up a network of informants in the Dawn Isles, and setting up electronic surveillance devices in key locations, including Holmgren's palace (they have brought along a large supply of gold and silver for payments to agents). Members of their section also work with Holmgren's own intelligence service in improving Holmgren's agent networks on the mainland, particularly in the Woden Empire and the Southern Republic.

Once their local agents are in place, the bootstrap intell section will conduct covert missions into the Empire and Republic and set up their own networks in these countries. The B Team intel shack is the most tightly guarded area on the headquarters base. These team members present perhaps the most interesting opportunites for low-level roleplaying that can be generated by the bootstrap campaign, and are an excellent choice for players that want to hire onto the bootstrap mission for low-level roleplaying.

Because of the tremendous diversity of these operations, there are no monthly development tasks that can be rolled, although the intel specialists are the characters that make the intelligence rolls vs. some of the results on the random events table. Rather, intel specialists are best handled by discussion between the referee and players on how they would best like to see them used.

Security Specialists: These are the "grunts" of the operation. This platoon-sized unit is split into three squads. 1st Squad is the quick reaction force aboard the orbital station. It is armed with light battle dress and standard Coalition TL-10 to -12 weapons (See the **Reformation Coalition Equipment Guide**, particularly pages 9-11, 18-19, 52-55, 60-71, 85-87, 93-99, and 106-108 for details on standard Coalition military equipment and weaponry). Its mission is to back up the team on the ground with an assault landing if they get into serious difficulty with the locals. 2nd Squad is the ground security force at the B Team headquarters. It is armed with TL-8 infantry weapons so as to not overly intimidate the local population. Its job is the hold the headquarters area until the team can be evacuated to orbit if the mission goes sour. It also backs up the field security squad. 3rd Squad is the field security squad. It is split with one member attached to each A Team in the field. The trooper doubles as the A Team's commo specialist. His or her primary job is the team bodyguard. The team could not withstand a determined assault, but usually, a firepower demonstration will be enough to calm restless locals. 1st and 2nd squads swap duties once a week.

Security specialists have no development tasks to roll, but are instead involved as body guards in the entire spectrum of such operations. PCs who seek a low-level *entré* into the bootstrap adventure will really get a chance to "see the world" by signing on as security specialists.

Air Raft Pilots: This includes two pilots who double as mechanics. The team has two convertible air rafts each with a capacity of six persons (one pilot and five passengers) and 1.86 tonnes of cargo, and a maximum speed of 630 kph at altitude and 158 kph at NOE. (For more details see the **Reformation Coalition Equipment Guide**, pages 114-115.) The chief job of these pilots is the rapid transportation of bootstrap team members to where they are most needed, such as in response to medical or military emergencies, to meetings with Holmgren, etc. It is no accident that the A Teams are sized to each fit in a single air raft.

So Skire Bootstrap Team Composition

Command Group	7
8 Action Teams	
Military Advisor	8
Agronomist	8
Civil Engineer	8
Medic	8
Commo/Security	8
Action Team Subtotal	40
Base Team	
Medical	4
Intelligence	8
Science	4
Education	4
Military	4
Security	13
Air Rafts	2
Base Team Subtotal	39
Orbital Group	
Security Quick Response	13
Lander Crews	9
Small Craft Crews*	(6)
Survey Lab Crew*	(3)
Orbital Group Subtotal	22 (+9)
Bootstrap Team Total	**108 (+9)**

*Parentheses indicate crewmembers from *Kant* crew; not included in Bootstrap Team Total.



INTEGRATING PCS AND DETAILED NPCS WITH THE MASS COMBAT SYSTEM

In the event that the campaign requires the armies of Woden and the Dawn Isles to face each other in the field, the influence of the Reformation Coalition military advisors, both PCs and NPCs, will be felt. These clashes will be resolved with either the standard **TNE** combat system (rarely, only for very small engagements) or, more often, with the mass combat system presented in Chapter 5 of this book. The following modifications are for use with the mass combat system to allow integration of character abilities.

These modifications are based on the assets of the character *in command* of the unit in question. For the purposes of this bootstrap adventure, this is also expanded to include the PC or NPC military advisor to a given unit.

Ground Tactics: If the Ground Tactics *asset* of the character in charge is higher than unit's asset based on NPC quality, use the Ground Tactics asset for all detection rolls.

In addition, when rolling for blocking movement, the Ground Tactics *skill level* is used as a DM on the D20 roll. If the unit itself is attempting to block an enemy unit, the skill is a –DM on the roll. If an enemy unit is attempting to block the unit, the skill is a +DM on the enemy's roll.

When attempting to withdraw before combat, or if an enemy is attempting to withdraw before combat, add the Ground Tactics *skill level* to the unit's movement factor to determine which unit is faster (the enemy unit should have this benefit granted as well).

For purposes of order of fire, the Ground Tactics *assets* of the opposing commanders is used as the final tie breaker to see who fires first.

For fire resolution, use *one half* (round fractions down) of the commander's Ground Tactics *skill level* as a +DM on the fire resolution roll.

Leadership: The Leadership asset is used to avoid adverse moral effects. Whenever a unit reaches its Retreat, Rout, or Surrender level, a PC or detailed NPC leader can make a roll against his or her Leadership asset. Success indicates that the morale effect is disregarded, failure indicates that the morale condition takes effect normally, and Catastrophic Failure indicates that the morale condition becomes one level worse (i.e., Retreat becomes Rout, Rout becomes Surrender, Surrender remains Surrender). Difficulty level is based on the morale level that has been reached: Retreat is Average, Rout is Formidable, and Surrender is Impossible.

Instruction: The sustained use of instruction skill on a body of troops can affect their troop quality as discussed on page 61 above.

Admin/Legal: For each level of skill (not asset), treat the unit as being one hex closer to its supply base for purposes of determining supply.

Mapping: Leaders with mapping skills may roll a Formidable task vs. Mapping each turn to find the best path through terrain for the turn. Outstanding Success multiplies the unit's movement allowance by 1.5 (round to the nearest whole number), success adds 1 to the movement rate for the turn, failure has no effect, and Catastrophic Failure subtracts 1 from the turn's movement rate (the unit got lost). Note that leg infantry units get no greater benefit for Outstanding Success than they do for basic success.

This works only for ground units, and not for lift (contra-grav) units.

Mass Combat Ratings

The mass combat ratings of the Woden and Dawn Isles armed forces are listed below, along with the rating for RC quick reaction squad.

Woden Empire:

3 divisions of foot (TL-1 Experienced)
Combat Value (each): 200; **Movement Rate:** 2/1

6 divisions of foot (TL-1 Novice)
Combat Value (each): 180; **Movement Rate:** 2/1

2 mounted divisions (TL-1 Veteran, with 5 cavalry squadrons each, 2 heavy and 3 medium)
Combat Value (each): 180; **Movement Rate:** 3/2

5 separate cavalry squadrons (TL-1 Veteran, light)
Combat Value (each): 18; **Movement Rate:** 3/2

1 Imperial Guard division (TL-1 Veteran)
Combat Value: 300; **Movement Rate:** 2/1

Dawn Isles:

5 divisions of foot (TL-1 Experienced)
Combat Value (each): 200; **Movement Rate:** 2/1
2 in Kongsholm, 2 in Aalanagrad, 1 in Sudhaven

2 cavalry brigades (TL-1 Experienced)
Combat Value (each): 60; **Movement Rate:** 3/2
1 each in Kongshold and Aalanagrad

1 amphibious brigade (TL-1Veteran)
Combat Value: 54; **Movement Rate:** 2/1
Kongsholm

2 Marine battalions deployed as ship's troops (TL-1 Veteran)
Combat Value (each): 18; **Movement Rate:** 2/1
Based out of Kongsholm and Aalanagrad, but mostly at sea

1 arquebusier battalion (TL-2 Elite)
Combat Value: 60; **Movement Rate:** 2/1
Kongsholm

Reformation Coalition:

1 Marine squad deployed as orbital quick reaction team (TL-11 Veteran)
Combat Value: 3; **Movement Rate:** 2/1





USING THE ECONOMIC MODEL

Some referees may wish to play out the bootstrap campaign with a full-up economic model. Because this model is designed primarily for the more manageable scale of a colony of a few hundred persons rather than a nation of a few million, this will require some additional preparation from the referee.

The map of the Dawn Isles on page 60 is already rendered with the 20-km mapping hex grid, but this will probably need to be enlarged to allow detailed inspection and use (GDW grants permission to owners of the **World Tamers Handbook** to make photocopies of this map for purposes of enlargement, etc., as required for play of the scenario). The population of the Dawn Isles is 20,000,000 persons, and referees can assume that all infrastructure for this population is already in place. The referee will have to place the population, capital goods, and determine which land is currently under use for agricultural and raw materials purposes. Population and industrial capital will be concentrated in the two main communities of Kongsholm and Aalanagrad, but there will also be smaller such pockets in Sudhaven and the other settlements indicated on the map. Agricultural and raw materials land will be scattered out around these cities and settlements, and all cities and settlements are connected by a minimal TL-1 road net.

The data used with the economic model is presented on page 50, but this is not available to the PCs until they complete goal-oriented surveys of these hexes. This task will require all four of the scientists detailed to the Base Team, and the PC leaders may wish to detail more personnel to the survey tasks to cut the time required. For purposes of the time reduction factors (see page 20), the ad hoc orbital station left by *Immanuel Kant* is considered to be a spacecraft.

Note that if the four B Team scientists are being used for a survey, the number of development operations that may be conducted by the B Team per month is reduced to 3 (from 4), and may not include geologist or metallurgist tasks.

The various tasks conducted by the members of the action and base teams also have an impact on the output rolls of the economic model as indicated in "The Jobs" section beginning on page 61. These DMs are used during monthly turns in which tasks were allowed by negotiation with Holmgren and were rolled as successes.

RANDOM EVENTS

Once the bootstrap team is settled in and begins functioning, the campaign moves to a high level. Events begin to happen once a month that affect the campaign.

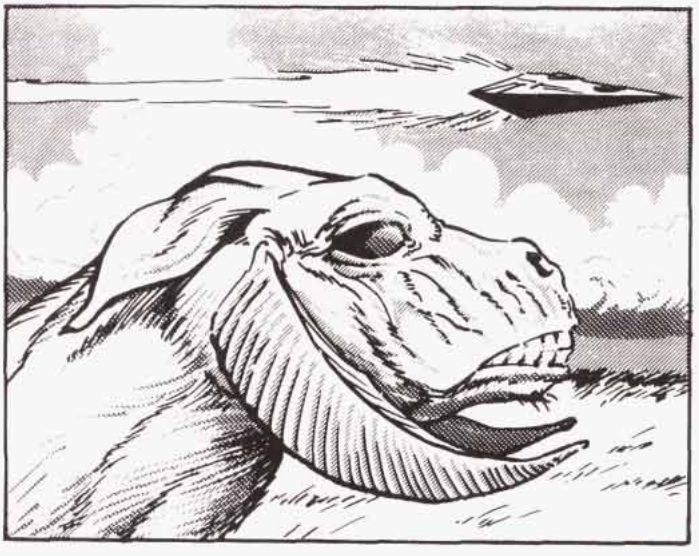
Weather Events

Use the weather events table found on page 36 of Chapter 4.

Scenario Specific Random Events

Use the table below for bootstrap campaign random events, in place of the Random Events table found in Chapter 4. As with the table in Chapter 4, roll 16+ on 1D20 to see if this table should be consulted. Otherwise skip this table for the month.

D20	*Result*	*Political Roll DM*
1	Disastrous Plague	See notes
2	Disastrous Livestock Disease	See notes
3	Serious Plague	See notes
4	Serious Livestock Disease	See notes
5	Holmgren Has Heir	+2
6	Holmgren raids Woden	See notes
7	Woden raids Dawn Isles	See notes
8	Holmgren invades Woden	See notes
9	Woden invades Dawn Isles	See notes
10	Personal Event	See notes



Disastrous Plague: Very serious disease strikes people of the Dawn Isles. 1D20×10 persons die each day until Impossible Medical (Diagnosis) task is completed. Referee must randomly determine settlement in which task breaks out, and task may not be rolled until a bootstrap medic arrives in the hex. Task may be rolled once per 24 hours thereafter. If plague is stopped before 500 persons die, +4 on Political roll for this turn, +3 if before 750, +2 if before 1000, +1 if before 2000. Otherwise –4.

Disastrous Livestock Disease: Very serious disease strikes livestock: Kills 1D20 units of livestock until Impossible Medical (Diagnosis or Veterinary Medicine) task is completed. Referee must randomly determine settlement in which task breaks out, and task may not be rolled until a bootstrap medic arrives in the hex. Task may be rolled once per 24 hours thereafter. Due to diseased meat, agricultural output cut in half for this turn. If disease stopped before 50 units die, +4 on Political roll for this turn, +3 if before 75, +2 if before 100, +1 if before 200. Otherwise –4.

Serious Plague: Serious disease strikes people of the Dawn Isles. 1D6×5 person die each day until Formidable Medical (Diagnosis) task is completed. Referee must randomly determine settlement in which task breaks out, and task may not be rolled until a bootstrap medic arrives in the hex. Task may be rolled once per 24 hours thereafter. –2 DM on all output rolls this turn. If disease stopped before 75 people die, +2 on Political roll for this turn, +1 if before 150. Otherwise –4.

Serious Livestock Disease: Serious disease strikes livestock: Kills 1D6 units of livestock until Formidable Medical (Diagnosis or Veterinary Medicine) task is completed (task may be rolled once per 24 hours). Due to diseased meat, agricultural output reduced by 25% for this turn. –1 on political roll. If disease stopped before 15 units die, +2 on Political roll for this turn, +1 if before 30. Otherwise –4.

Holmgren Has Heir: Holmgren's Queen Christina gives birth to a healthy son by cesarean section performed by a bootstrap doctor after a long and difficult labor. Holmgren is ecstatic with joy, and the people rejoice throughout the Dawn Isles, thanking the local diety for the heir and for the bootstrap team for saving him and the Queen. Holmgren and Christina have been married for more than a decade and nearly gave up hope of having a child.

Holmgren raids Woden: Holmgren wants to stage a raid on Woden to demonstrate the increasing effectiveness of his armed forces, and to raise the morale of his people (perhaps in response to event below). This raid will involve bootstrap team military advisors. He wishes to select a limited goal which will have a noticeable effect, but



which can be accomplished with a relatively small operation. This event proceeds at referee's discretion, as it should involve planning and participation by the bootstrap leaders (especially if they are PCs), and should be resolved using the mass combat system in Chapter 5.

A successful raid will yield +DMs on the political roll, while failure will yield –DMs.

Woden raids Dawn Isles: A small naval force from Woden will sortie to land troops and hit a Dawn Isles coastal settlement (perhaps in response to event above). Bootstrap intel team members will have an opportunity to get advance notice of the raid and prepare for it, either by agents in Woden, or via the coastwatcher network. Further details are up to the referee, but should involve PC participation, either as intel geeks, security specialists, military advisors leading Dawn Isles ground troops, or the bootstrap leaders. Event should be resolved using the mass combat system in Chapter 5.

Repulsing the raid with minimal losses, or maximum damage to Woden, will yield large +DMs on the political roll, while the reverse will yield the reverse.

Holmgren invades Woden: Holmgren wishes to stage a major invasion of the Woden mainland to attain major goals. The bootstrap team will be involved in all major aspects, from intelligence gathering to planning to accompanying the ground troops as advisors. Event proceeds at referee's discretion with low-level roleplaying, high-level planning, and resolution in accord with the mass combat system in Chapter 5.

DMs on political roll are commensurate with results, ranging from +10 (national defeat of Woden, capture of Rudolph the Bald) to –10 (loss of entire army in overseas operations).

Woden invades Dawn Isles: Major invasion by bulk of Woden army. Except for difference in scale, similar to notes for the Woden raid above.

DMs on political roll are commensurate with results, and should range up to +8. There is no lower limit, as the lower limit would be the utter defeat of the Dawn Isles and the destruction of its government, obviating the political track.

Personal Event: Roll 2D6 on the following table. Use the table as a random generator to set up low-level roleplaying situations. Low-level roleplaying can actually reverse or cancel the effects of these results.

2D6	*Event*	*Political Roll DM*
2	Rescue by native	+2
3	Rescue by team member	+2
4	Aid by native	-1
5	Aid by team member	-1
6	Friendship	0
7	Cooperation	0
8	Argument	0
9	Minor Crime by native	-1
10	Minor Crime by team member	-1
11	Major Crime by native	-2
12	Major Crime by team member	-2

Rescue by Native: A member of the bootstrap team is rescued from a dangerous situation by a local person.

Rescue by Team Member: A local person is rescued from dangerous situation by a member of the bootstrap team.

Aid by Native: A member if the bootstrap team is helped in a difficult situation by a local person. This may be an intellectual or "knowledge event" rather than an action event.

Aid by Team Member: A bootstrap team member gives a great deal of help to a local person which is greatly appreciated.

Friendship: Locals and team members strike up strong friendships including romantic relationships, possibly leading to marriage. Team members become part of the community rather than guests.

Cooperation: Locals and team members cooperate and work well with each other.

Argument: One or more arguments break out between team members and key members of the local population.

Minor Crime by Native: One or more natives commit a minor crime against a team member or team facility. Roll on the Minor Crime table for the crime.

Minor Crime by Team Member: One or more team members commit a minor crime against a local person. Roll on the Minor Crime table for the crime.

1D6	*Minor Crimes*
1	Brawl
2	Fight
3	Bribery
4	Petty Theft
5	Custom Violation
6	Insult

Reroll if the crime was committed by a native and the result was "5: Custom Violation." This result indicates a team member accidentally violated a native custom such as walking on sacred ground or knocking over a sacred statue, etc. The "Insult" result is not exactly a crime, rather it's an indication that one person's behavior was deliberately or accidentally insulting to another.

Major Crime by Native: One or more natives commit a major crime against a team member or team facility. Roll on the Major Crime table for the crime.

Major Crime by Team Member: One or more team members commit a major crime against a local person. Roll on the Major Crime table for the crime.

1D6	*Major Crimes*
1	Theft
2	Rape
3	Assault
4	Robbery
5	Kidnapping
6	Murder

Rudolph the Bald, Emperor of Woden



Experienced NPC

Combat Assets: Armed Martial Arts (Large Blade), Archery

Other Assets: Leadership 12, Persuasion 12, Ground Tactics 12, Riding 12, Willpower 10, Streetwise 10

Motivation:

Spade King: Rudolph and his bands rode out of the continental outback 20 standard years ago and conquered the coastal cities, establishing the Woden Empire. He will use every means in his power to satisfy his ambition, conquering all of So Skire. Two things stand in his way: Holmgren and the priests of the Southern Republic.

Club King: Rudolph enjoys watching others suffer and has fun inflicting pain. He doesn't care who is hurt as long as his lust for power is satisfied. He keeps his followers terrorized by his rages and by occasionally killing one of them in front of his court.

See **TNE** pages 210-212 and **Traveller Players' Forms** for more information on the use of animal encounter tables.

World: So Skire **UWP: X-657843-1** **Terrain Type: Prairie** **Other Information: Gotland**

D20	Category	Type	Name	Qty	Spec Att	Wt (kg)	Hits	Wpn	To Hit	Dam	Pen	Rng	Type of Melee Atk	Init	Armor	Behavior	Speed
1	Herbivore	Grazer	Arromoose	3D6	—	1600	57	Projectile	4	25	Nil	17	Thrown Weapon	1	—	F14, A4	7/14/27
2	Herbivore	Grazer	Stomper	3D6	—	100	23	Hooves	8	2	Nil	Short	Armed	1	—	F16, A9	8/16/32
3	Herbivore	Grazer	Stomper	3D6	—	100	23	Hooves	8	2	Nil	Short	Armed	1	—	F16, A9	8/16/32
4	Herbivore	Grazer	Stomper	3D6	—	100	23	Hooves	8	2	Nil	Short	Armed	1	—	F16, A9	8/16/32
5	Herbivore	Grazer	Stomper	3D6	—	100	23	Hooves	8	2	Nil	Short	Armed	1	—	F16, A9	8/16/32
6	Herbivore	Grazer	Stomper	3D6	—	100	23	Hooves	8	2	Nil	Short	Armed	1	—	F16, A9	8/16/32
7	Herbivore	Grazer	Rambuck	2D6	—	200	29	Tail	7	3	1	Short	Armed	2	—	F5, A9	6/11/22
8	Herbivore	Grazer	Rambuck	2D6	—	200	29	Tail	7	3	1	Short	Armed	2	—	F5, A9	6/11/22
9	Herbivore	Grazer	Rambuck	2D6	—	200	29	Tail	7	3	1	Short	Armed	2	—	F5, A9	6/11/22
10	Omnivore	Gatherer	Clubtail	1	—	1600	93	Tail	6	19	Nil	Long	Armed	1	—	F4, A10	7/13/26
11	Omnivore	Gatherer	Clubtail	1	—	1600	93	Tail	6	19	Nil	Long	Armed	1	—	F4, A10	7/13/26
12	Omnivore	Gatherer	Clubtail	1	—	1600	93	Tail	6	19	Nil	Long	Armed	1	—	F4, A10	7/13/26
13	Omnivore	Eater	Grinder	1D6	—	200	34	Horn	11	9	1	Short	Armed	2	½	F2, A8	8/15/30
14	Carnivore	Chaser	Wolfbat	2D6	F	12	3	Claws	13	8	Nil	Short	Armed	6	—	Am, F9	11/21/42
15	Carnivore	Chaser	Wolfbat	2D6	F	12	3	Claws	13	8	Nil	Short	Armed	6	—	Am, F9	11/21/42
16	Carnivore	Chaser	Rizzerbak	1D6	—	100	28	Claws & teeth	7	20	1	Short	Armed	4	½	Am, F7	9/18/35
17	Carnivore	Chaser	Rizzerbak	1D6	—	100	28	Claws & teeth	7	20	1	Short	Armed	4	½	Am, F7	9/18/35
18	Scavenger	Intimidator	Sirtlan	1D6	—	100	9	Acid	8	3	2	Short	Armed	5	—	F7, A9	6/12/24
19	Scavenger	Intimidator	Sirtlan	1D6	—	100	9	Acid	8	3	2	Short	Armed	5	—	F7, A9	6/12/24
20	Scavenger	Intimidator	Sirtlan	1D6	—	100	9	Acid	8	3	2	Short	Armed	5	—	F7, A9	6/12/24

World: So Skire **UWP: X-657843-1** **Terrain Type: Forest** **Other Information: Gotland**

D20	Category	Type	Name	Qty	Spec Att	Wt (kg)	Hits	Wpn	To Hit	Dam	Pen	Rng	Type of Melee Atk	Init	Armor	Behavior	Speed
1	Herbivore	Grazer	Rambuck	2D6	—	200	29	Tail	7	3	1	Short	Armed	2	—	F5, A9	6/11/22
2	Herbivore	Grazer	Rambuck	2D6	—	200	29	Tail	7	3	1	Short	Armed	2	—	F5, A9	6/11/22
3	Herbivore	Grazer	Rambuck	2D6	—	200	29	Tail	7	3	1	Short	Armed	2	—	F5, A9	6/11/22
4	Herbivore	Inter	Rocktail	1	—	200	48	Tail	5	2	Nil	Short	Armed	1	½	F4, A8	7/13/26
5	Herbivore	Inter	Rocktail	1	—	200	48	Tail	5	2	Nil	Short	Armed	1	½	F4, A8	7/13/26
6	Herbivore	Inter	Rocktail	1	—	200	48	Tail	5	2	Nil	Short	Armed	1	½	F4, A8	7/13/26
7	Herbivore	Inter	Rocktail	1	—	200	48	Tail	5	2	Nil	Short	Armed	1	½	F4, A8	7/13/26
8	Herbivore	Inter	Pricklepine	1	—	25	4	Quills	6	2	Nil	Short	(Def only)	3	—	F13, A10	4/7/13
9	Herbivore	Inter	Pricklepine	1	—	25	4	Quills	6	2	Nil	Short	(Def only)	3	—	F13, A10	4/7/13
10	Omnivore	Gatherer	Womrat	1	—	6	2	Horn	4	3	Nil	Short	Armed	8	—	F9, A7	5/9/18
11	Omnivore	Gatherer	Womrat	1	—	6	2	Horn	4	3	Nil	Short	Armed	8	—	F9, A7	5/9/18
12	Omnivore	Eater	Army Sheep	2D6	—	3	1	Horn & hooves	7	5	Nil	Short	Armed	7	—	F5, A9	4/7/13
13	Omnivore	Eater	Army Sheep	2D6	—	3	1	Horn & hooves	7	5	Nil	Short	Armed	7	—	F5, A9	4/7/13
14	Carnivore	Chaser	Wolfbat	2D6	F	12	3	Claws	13	8	Nil	Short	Armed	6	—	Am, F9	11/21/42
15	Carnivore	Chaser	Wolfbat	2D6	F	12	3	Claws	13	8	Nil	Short	Armed	6	—	Am, F9	11/21/42
16	Carnivore	Trapper	Glider	1	F	1	1	Teeth	6	1	Nil	Short	Armed	7	—	As, F9	1/2/4
17	Carnivore	Trapper	Glider	1	F	1	1	Teeth	6	1	Nil	Short	Armed	7	—	As, F9	1/2/4
18	Scavenger	Intimidator	Sirtlan	1D6	—	100	9	Acid	8	3	2	Short	Armed	5	—	F7, A9	6/12/24
19	Scavenger	Intimidator	Sirtlan	1D6	—	100	9	Acid	8	3	2	Short	Armed	5	—	F7, A9	6/12/24
20	Scavenger	Intimidator	Sirtlan	1D6	—	100	9	Acid	8	3	2	Short	Armed	5	—	F7, A9	6/12/24

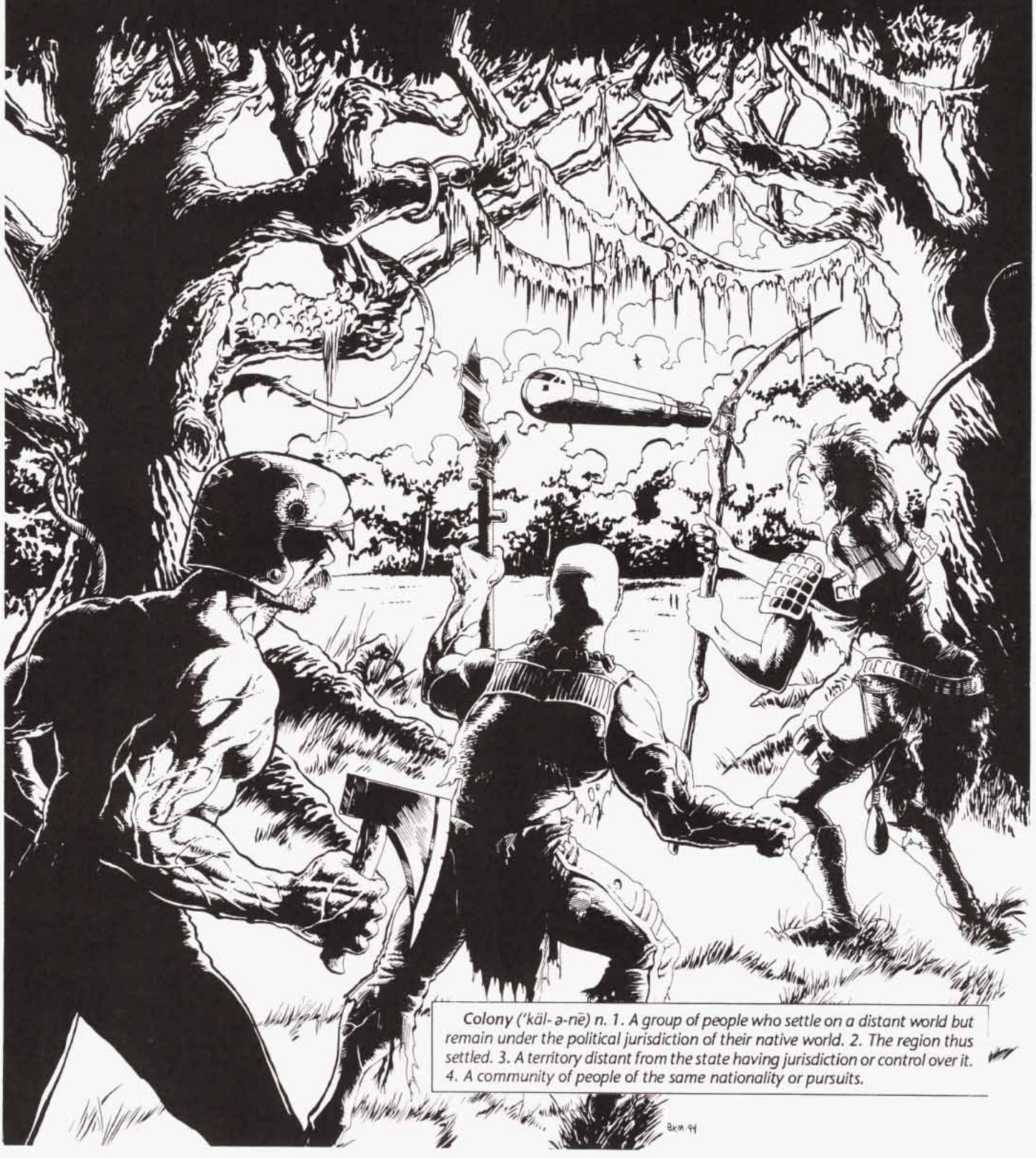
World: So Skire **UWP: X-657843-1** **Terrain Type: Mountains** **Other Information: Gotland**

D20	Category	Type	Name	Qty	Spec Att	Wt (kg)	Hits	Wpn	To Hit	Dam	Pen	Rng	Type of Melee Atk	Init	Armor	Behavior	Speed
1	Herbivore	Inter	Pricklepine	1	—	25	4	Quills	6	2	Nil	Short	(Def only)	3	—	F13, A10	4/7/13
2	Herbivore	Inter	Pricklepine	1	—	25	4	Quills	6	2	Nil	Short	(Def only)	3	—	F13, A10	4/7/13
3	Herbivore	Inter	Pricklepine	1	—	25	4	Quills	6	2	Nil	Short	(Def only)	3	—	F13, A10	4/7/13
4	Herbivore	Inter	Pricklepine	1	—	25	4	Quills	6	2	Nil	Short	(Def only)	3	—	F13, A10	4/7/13
5	Herbivore	Grazer	Stomper	3D6	—	100	23	Hooves	8	2	Nil	Short	Armed	1	—	F16, A9	8/16/32
6	Herbivore	Grazer	Stomper	3D6	—	100	23	Hooves	8	2	Nil	Short	Armed	1	—	F16, A9	8/16/32
7	Herbivore	Grazer	Stomper	3D6	—	100	23	Hooves	8	2	Nil	Short	Armed	1	—	F16, A9	8/16/32
8	Herbivore	Grazer	Stomper	3D6	—	100	23	Hooves	8	2	Nil	Short	Armed	1	—	F16, A9	8/16/32
9	Herbivore	Grazer	Stomper	3D6	—	100	23	Hooves	8	2	Nil	Short	Armed	1	—	F16, A9	8/16/32
10	Omnivore	Eater	Army Sheep	2D6	—	3	1	Horn & hooves	7	5	Nil	Short	Armed	7	—	F5, A9	4/7/13
11	Omnivore	Gatherer	Womrat	1	—	6	2	Horn	4	3	Nil	Short	Armed	8	—	F9, A7	5/9/18
12	Omnivore	Gatherer	Womrat	1	—	6	2	Horn	4	3	Nil	Short	Armed	8	—	F9, A7	5/9/18
13	Omnivore	Gatherer	Womrat	1	—	6	2	Horn	4	3	Nil	Short	Armed	8	—	F9, A7	5/9/18
14	Carnivore	Trapper	Glider	1	F	1	1	Teeth	6	1	Nil	Short	Armed	7	—	As, F9	1/2/4
15	Carnivore	Chaser	Wolfbat	2D6	F	12	3	Claws	13	8	Nil	Short	Armed	6	—	Am, F9	11/21/42
16	Carnivore	Chaser	Wolfbat	2D6	F	12	3	Claws	13	8	Nil	Short	Armed	6	—	Am, F9	11/21/42
17	Carnivore	Trapper	Glider	1	F	1	1	Teeth	6	1	Nil	Short	Armed	7	—	As, F9	1/2/4
18	Scavenger	Reducer	Razortail	1	—	25	3	Tail	9	5	1	Short	Armed	1	—	F3, A6	2/3/6
19	Scavenger	Reducer	Razortail	1	—	25	3	Tail	9	5	1	Short	Armed	1	—	F3, A6	2/3/6
20	Scavenger	Reducer	Razortail	1	—	25	3	Tail	9	5	1	Short	Armed	1	—	F3, A6	2/3/6

World: So Skire **UWP: X-657843-1** **Terrain Type: River** **Other Information: Gotland**

D20	Category	Type	Name	Qty	Spec Att	Wt (kg)	Hits	Wpn	To Hit	Dam	Pen	Rng	Type of Melee Atk	Init	Armor	Behavior	Speed
1	Herbivore	Grazer	Rambuck	2D6	—	200	29	Tail	7	3	1	Short	Armed	2	—	F5, A9	6/11/22
2	Herbivore	Grazer	Rambuck	2D6	—	200	29	Tail	7	3	1	Short	Armed	2	—	F5, A9	6/11/22
3	Herbivore	Grazer	Rambuck	2D6	—	200	29	Tail	7	3	1	Short	Armed	2	—	F5, A9	6/11/22
4	Herbivore	Grazer	Rambuck	2D6	—	200	29	Tail	7	3	1	Short	Armed	2	—	F5, A9	6/11/22
5	Herbivore	Grazer	Stomper	3D6	—	100	23	Hooves	8	2	Nil	Short	Armed	1	—	F16, A9	8/16/32
6	Herbivore	Grazer	Stomper	3D6	—	100	23	Hooves	8	2	Nil	Short	Armed	1	—	F16, A9	8/16/32
7	Herbivore	Grazer	Grunpig	2D6	—	50	11	Projectile	4	12	Nil	9	Thrown Weapon	1	—	F10, A5	11/21/42
8	Herbivore	Grazer	Grunpig	2D6	—	50	11	Projectile	4	12	Nil	9	Thrown Weapon	1	—	F10, A5	11/21/42
9	Herbivore	Grazer	Oklukirpi	3D6	A	100	6	Quills	6	1	Nil	Short	(Def only)	1	—	F7, A9	9/17/33
10	Omnivore	Hunter	Acidvaark	1D6	—	100	4	Acid	6	2	1	Short	Armed	7	—	F7, A16	6/11/22
11	Omnivore	Hunter	Acidvaark	1D6	—	100	4	Acid	6	2	1	Short	Armed	7	—	F7, A16	6/11/22
12	Omnivore	Gatherer	Womrat	1	—	6	2	Horn	4	3	Nil	Short	Armed	8	—	F9, A7	5/9/18
13	Omnivore	Gatherer	Womrat	1	—	6	2	Horn	4	3	Nil	Short	Armed	8	—	F9, A7	5/9/18
14	Carnivore	Chaser	Wolfbat	2D6	F	12	3	Claws	13	8	Nil	Short	Armed	6	—	Am, F9	11/21/42
15	Carnivore	Pouncer	Mugger	1	S	800	46	Claws & teeth	14	6	1	Long	Armed	5	—	As, Fs	9/17/33
16	Carnivore	Pouncer	Mugger	1	S	800	46	Claws & teeth	14	6	1	Long	Armed	5	—	As, Fs	9/17/33
17	Carnivore	Chaser	Wolfbat	2D6	F	12	3	Claws	13	8	Nil	Short	Armed	6	—	Am, F9	11/21/42
18	Scavenger	Hijacker	Sinzju	1	—	12	4	Claws & teeth	10	20	1	Short	Armed	1	—	A8, F10	4/8/15
19	Scavenger	Hijacker	Sinzju	1	—	12	4	Claws & teeth	10	20	1	Short	Armed	1	—	A8, F10	4/8/15
20	Scavenger	Hijacker	Sinzju	1	—	12	4	Claws & teeth	10	20	1	Short	Armed	1	—	A8, F10	4/8/15

CHAPTER 7: COLONY



Colony ('käl-ə-nē) n. 1. A group of people who settle on a distant world but remain under the political jurisdiction of their native world. 2. The region thus settled. 3. A territory distant from the state having jurisdiction or control over it. 4. A community of people of the same nationality or pursuits.



BALDUR

Life is tough on Baldur. Ask any Balduri. They spend day after day inside a dome on the seabed of a poisonous ocean. Some say that the only thing between a Balduri and boredom is the fight to survive. The only way Balduri ever see the sky and stars is aboard an outbound starship. Life is tough, disciplined, and crowded. The Balduri are tough, disciplined, and dependable. But even the toughest Balduri feel the urge to walk freely under an open sky. No wonder people say they appear to have their bolts screwed in a little tight.

THE VENTURE

Your group is on Baldur after a long series of freelance recovery and scouting operations into the Shenk and So Skire subsectors. Your ship is in Baldur's orbital yard for a long overdue annual maintenance and refit. You thought you would have made more than enough cash from the recovered jump drive you sold at Auction to pay for the maintenance, but with a splendid display of irony, the yard master's office just gave you the news that you need a new jump drive of your own. 80 years of shoving a scout through jump space has just worn out the old one. Clansman *isn't going anywhere for a long time. So, you order her put into orbital storage, arrange to have your personal belongings shuttled down, and you start looking for "honest work."*

Referee's Note: If the PCs played the "Survey" campaign in Chapter 3 of this book, the referee may have had them produce the survey results for Poyzen (So Skire 1736) themselves and sell it to the Balduri government. Naturally the means by which the players arrive at the outset of this venture must be adjusted for each PC group.

One evening at dinner, the group overhears two Balduri government officials talking about the new Colonial Office. If the group is interested in what they are hearing, they may make an attempt to join in. Since they are dining in a convivial atmosphere with plenty of wine and good food, the two Balduri are curious about the off-worlders and welcome their company (Carousing or Liaison: Easy). The characters meet Dimitri Rostov and Stefan Burg, a Balduri and Oriflammen, respectively, both newly appointed as senior managers in the Colonial Office. After some initial small talk during dinner, the table is cleared, brandy is ordered all around, and the conversation proceeds to weightier matters.

"Baldur is a member of the Reformation Coalition, but cannot allow others to be the guarantors of its future. Although the Coalition stands for many of the things we Balduri support, we need the means to stand on our own if need be, because we have unique needs which the Coalition may not be able to meet. At the same time, any growth in our strength means that we will be able to provide that much more energy and leadership to assist the Coalition as a whole," Rostov explains.

"Our government has formed the Colonial Office, a government department tasked with finding worlds suitable to the establishment of colonies. These colonies will allow Baldur to meet more of its own needs in terms of raw materials, as well as providing materials to trade for the things that we need. In addition, the establishment of these colonies will advance the goals of the Coalition to expand the benefits of trade and civilization as rapidly as possible. And rather than suffering through interminable Assembly debates about how such colonies should be established under joint RC leadership, by proceeding on our own we can start the job more quickly, and therefore earn the benefits more quickly as well.

"This venture is co-sponsored by Oriflamme, which like Baldur has been frustrated by the lack of priority that the RC has given to the development of the trailing frontier," says Burg. "Both worlds feel that if this half of the Coalition is to prosper, it needs to take matters into its own hands. Not only will these colonies provide bases for further expansion and defensive buffers against threats from the Wilds, but they should prove to be profitable trading partners and sources of valuable raw materials. This might include rare earths and radioactives, or pharmaceuticals from plants and fungi, or especially for Balduris, naturally-produced luxury foods such as fresh meat."

"As you know from the prices in this restaurant," chimes in Rostov, "a steak is a rare and expensive treat on Baldur after a lifetime of eating processed yeast proteins. Whoever set up a food raising and export venture or dug a lanthanum mine on a colony world could get rich very quickly with the right exports."

"However," Rostov continues, "Baldur does not have a large body of experienced explorers, scouts, and leaders, 'world tamers,' I believe they are called."

"And Oriflamme's resources have been prioritized for other areas," Burg adds.

"The Colonial Office is looking for people to participate in or lead these colonial expeditions, people with plenty of off-planet experience and a multitude of talents," says Burg as Rostov nods approvingly. "Perhaps your group would be qualified, and interested."

If the PCs are interested, Rostov and Burg can collect information and credentials from them which will allow the Colonial Office to assess the group's qualifications.

The Offer

Several days later, the players go to the Colonial Office to discuss the mission. Once again, they meet with Rostov and Berg, who explain that they are satisfied that the group meets the Office's qualifications.

"This is a one year assignment," they explain. "It's not without its risks. After recruiting and training, you'll be loaded aboard *Cumulus*, a relic freighter we recently recovered in Alpha Crucis. She's capable of jump 4 if her drives hold together."

"This job does have its rewards. If you stick it out for one year and have begun shipping out exports by the end of that time, you will find Cr100,000 in each of your bank accounts on Baldur, and *Clansman* will have a new jump drive. Of course, we will have used *Clansman* for some of our own work while you're away.

"We'd like to offer you each a berth in the expedition. If you accept, here is where you will be going." says Berg, projecting the data for Poyzen on the wall behind him.

Referee: Hand out copies of the pages 77-79 (located at the end of the chapter) for the players to examine. These pages represent the data which the characters are being shown in the briefing. After the players have reviewed the data, the briefing is concluded.

"Want to sign up?" asks Rostov, handing the characters a contract and a pen.

PLAYERS: DO NOT READ BEYOND THIS POINT.

REFEREES' NOTES ON POYZEN

1. The Balduri planners have already selected the intended colony site, the island marked on the global data view, and shown in more detail on the close-up map. Unless the players prefer to pick their own colony location, they will be given data on the intended colony location on the island. The economic model data for this planetary hex is as follows.

Agricultural Richness: 1.5
Agricultural Useable Area: 80%
Raw Materials Richness: 120
Raw Materials Useable Area: 25%
Fossil Fuels: Yes
Radioactives: Yes
Extractable Hydro Power: 1050 kW per 20-km mapping hex
Extractable Wind Power: 157.5 MW per 20-km mapping hex
Base Latitude Temperature: +28°C
Summer Maximum Temperature: +40°C
Winter Minimum Temperature: +11°C
Weather Factors: 0



2. Contrary to the survey data, Poyzen is inhabited. The Scout base staff was cut off from Cobham and the base was destroyed by a Vampire raid. The survivors fled into the nearby mountains and reverted to a base sustainable tech level of 0. Living in caves, they have managed to develop communities totaling some 5000 people. The largest community of about 2000 people is run by the Chief Scout, a TED armed with the base's few remaining working laser rifles and a solar cell recharger. His authority is on the wane as other inhabitants move off into distant communities, mostly in the mountains and jungle of the continent's west coast (the continent is indicated on the map with the symbol for the old scout base, and is just to the west of the planned colony location). Everyone else is armed with spears and clubs.

PROCEEDING WITH THE CAMPAIGN

At this point, the adventure can proceed in one of two ways, depending on your players' capabilities and interests, and whether you will be running a primarily high level or low level campaign. Throughout this campaign at appropriate locations you'll see suggestions for using your players in a high or low level campaign. In the first example below, high level players can become involved in the complexities of recruiting NPCs. Low level players simply sign on with the expedition under the leadership of NPCs.

High Level: If your group is to be the leaders of the colony expedition, they make a deal with Rostov and Berg to lead the operation. The next step will be finding and recruiting some 100 colonists and traveling to Poyzen.

Low Level: If your group is looking for jobs on the expedition, Rostov and Berg are doing the recruiting. They will also be leading the operation. For players with a military background, there is plenty of opportunity for work as members of the expedition's security team and police force.

GETTING THERE

The colonial expedition has been given the use of the relic freighter *Cumulus*. *Cumulus* will load the characters and the voluntary colonists and depart for Oriflamme. Here, *Cumulus* will load additional colonists and livestock and equipment for the expedition. *Cumulus*' specifications can be found on page 107. Two other starships useful for colony transport can also be found in the equipment section. These can be used in other colony adventures, or enterprising PCs can perhaps convince the colony sponsors to allocate additional shipping to establish the colony.

Colonial transports like *Cumulus* are not luxury liners. They are designed to provide relatively cheap transportation to a large number of people, their personal possessions, livestock, equipment, and provisions for the colony. Colonists are carried in a portion of the cargo hold fitted with half-bunks. The half bunk is a light frame bunk stacked two-high with just enough adjacent locker space for the individual's personal possessions. Each half bunk displaces seven cubic meters, weighs 250 kilograms, and costs Cr25.

Once *Cumulus* is finished loading at Oriflamme, she will jump to Tuer, refuel, and make the short Jump-1 hop to Poyzen.

COLONISTS

Colonists are a diverse group of people who settle a new world for a number of reasons. Some go to start a new life with new opportunities. Others are running from their past, or to escape from a poor environment. Still others relocate because they have no choice. These people range from highly motivated, highly skilled professionals through yeoman farmers to shiftless ne'er do wells and forced deportees who may be criminals or chronic malcontents. The PCs will have to deal with them all.

The sections below deal with the colonists on a fairly detailed level, in order to allow low-level roleplaying in the colony campaign. However, these colonists will also be described in terms of the Chapter 4 economic model.

Voluntary Colonists

The characters must spend at least two weeks advertising for voluntary colonists. The number of colonists available depends on on the planet's population (the method used below to calculate these numbers can be used for any planet; Baldur's statistics are noted below for use with this particular campaign) and the type of colonist willing to emigrate to a new world. Each voluntary colonist will pay steerage passage plus Cr1000 to join the expedition. The number of colonists that can join the expedition depends on the passenger capacity of the transport. This is the hold capacity remaining after space has been allocated for rations, capital, weapons, and whatever equipment is being carried.

Recruiting Voluntary Colonists: There are four categories of voluntary colonists to be recruited. These include *professionals*, *artisans*, *farmers*, and *others*.

The detailed recruiting described below is included for a campaign that will have the capacity for high and low-level play. The high-level play is demonstrated by the fact that the PC leaders are having to make the choices of who to bring along. The low-level *potential* is demonstrated by generating colony members in sufficient detail to allow meaning roleplaying opportunities later on, and can actually be turned into immediate low-level play by conducting interviews with the prospective colonists.

However, if the PC colony leaders are not particularly interested in the potential for low-level play, and simply want to run a colony solely via the high-level economic model presented in Chapter 4, there is no need to go through with any any detailed interviews or creation of templates. However, unless the PC group is confident that they possess all skills that may be needed to respond to random events (Medical and Veterinary skills, etc.) they should still recruit a handful of professionals with known skill levels to meet these needs.

Professionals: These are volunteer colonists with useful professional skills. They would be commissioned characters (where appropriate) drawn from careers such as Law Enforcement, Medicine, Veterinary Medicine, and Science. Individuals with Engineer skills, and retired Army or Marine officers would also be included in this category. Professionals are primarily used as important NPCs with crucial skills, and are therefore intended for low-level roleplaying, and cannot really be easily classified in terms of the economic model.

The number of professional individuals interested in joining the colony equals the home world's population number (Baldur's is 7) plus the highest Recruiting skill level in the PC group. The referee should roll up professionals as detailed NPCs for the players to consider as colonists. In addition to considering their career qualifications, the players may wish to interview these professionals. See Chapter 6, Bootstrap, for the interviewing procedure.

In addition to the recruiting procedure, the referee should secretly consider the attitude of each of the professionals reaction to the PCs. Do they support what the PCs are doing? Will they attempt to subvert the PCs and attempt to take over the colony? Will they simply not get along and sow discord? The referee can simply establish these conditions based on his or her plans for the unfolding campaign, or can determine these things randomly by drawing motivation cards or rolling 2D6. The table below gives an example of how this could be done, but referees should feel free to expand the detail of this table. Naturally the PCs can determine these details only by a successful interview process which includes successful rolls on Interview, Interrogation, or Psychology.

2D6	*NPC Professional's Attitude toward PC Leaders*
11-12	Identifies with and strongly supports PCs' goals, and the PCs' interpretations of them
9-10	Supports the PCs' goals and will not actively oppose the PCs, but may sometimes in good faith publicly disagree with the PCs on how best to accomplish these goals
6-8	Willing to be led by the PCs, but will respond accordingly to good or poor treatment



4-5 Agrees with the PCs' goals, but will attempt to subvert the PCs' leadership in order to take over leadership of the colony

2-3 Is opposed to the PCs as well as their goals



Artisans: Each year living in the domes became more oppressive, as she tried to keep running the business that she had founded with her husband—machining and repairing replacement parts for the relic high-tech machinery. Ever since her husband had been killed in a bulkhead collapse three years ago, that life had become increasingly grim. She missed his stories about the worlds beyond the murky sea and murky sky, and his gentle advice on recreating the precise countours of power shafts and transfer gears. She needed a fresh start, someplace where she could be reminded of something besides what she had lost. Last night, she saw it on the news video. A colonial expedition was heading out into the Wilds to settle the empty garden planet discovered six months ago. She could have her own shop, fixing and taking care of all of the colony's tools, and building new implements from the native metals she smelted herself. She could see for herself the worlds he had told her about and practice her trade in a new way. With her skills as a metallurgist, she knew she could do it.

These are volunteer colonists with useful technical skills. These may come from any career but must have a skill from the Technician, Artisan, or Engineer skill clusters. In the economic model, artisans would primarily be industrial and materials laborers, although there are some exceptions to this. For example, a Hunter would be considered a special type of Artisan, and would be included under agricultural laborers or armed forces laborers, depending upon how the colonial leaders intended to use his or her skills.

The number of artisans interested in joining the colony equals two times the quantity of the home world's population number plus the highest Recruiting skill level in the PC group (for Baldur this is 2×[7+Recruiting]). The referee should determine the statistics and skills of these individuals using the NPC templates assigning them skills from the Technician or Artisan skill cascades. If desired, the players can select higher skilled individuals and generate complete UPP statistics and skills as well as interview them using the bootstrap interview procedure.



Farmers: We hadn't had a good harvest in three years, and the crops we did grow we had to sell to the technarchs at their prices. Sure, the barony provided materials to keep putting crops into the ground, but you pay them back one way or another, and I was close to losing my freedom and becoming tied to the land. It's hard to throw away a lifetime of work, but at least if I leave now I can leave—call it breaking even by walking away with my freedom, and that of my wife and kids. I hear there's a chance for a fresh start, though. A starman came to the grange hall last week, telling us of a new world they want to settle with farmers just like us. A world so rich you can get four crops a year. Crops that we sell for money that goes in our pockets. And land that's almost endless, a place to expand where my kids can have their own land some day. Is there any question about the right thing to do? Let's go! To the stars!

Farmers are colonists with experience farming the land and handling domestic animals. They will have at least Farming skill and be the backbone of any colony. (*Note*: farmers are not available on Baldur; these will have to be recruited from Oriflamme. The nearest thing the Balduri have to farming is tending yeast vats.) Farmers are obviously considered to be agricultural laborers for the economic model.

To determine the number of farmers interested in joining the colony, roll a number of D6 equal to four times the quantity of the world's population number plus the highest Recruiting skill level in the PC group (for Oriflamme, 4×[8+Recruiting]). Each will have at least Farming **1**. The players may wish to interview one out of ten farmers to determine their UPP statistics and skills using the NPC templates. Additional skills come from the Animal Handling skill cluster, including Veterinary Medicine, but may optionally include Gun Combat or Mechanic. If desired, the players can interview higher skilled individuals and generate complete UPP statistics and skills for them.

Families: *There's a lot of talk about the dawn of a new era and how the universe is starting over again, like a little baby. Well it doesn't look much different from where I'm sitting. The bulkheads still creak at night, and people are still scrounging to keep the old machines working for just one more month.*

I suppose I'm used to it, but I didn't take a wife just to doom her to more of the same until she's old and tired of waiting for a brighter future. She deserves better, and our kids deserve better, and I'm going to see that they get a look at this bright new dawn that people are building.

They're recruiting people for this new colony and we're going to be part of it. I don't know how to farm, but I can learn. That's what fathers and husbands are for, is to do what needs to be done, and I'm going to be a good one. I don't have all the money for our fare, but I'll get the rest of it somehow. Me and my family are going to build a new world—a world for us, a world for everyone.

Most colonists will have families, and this is allowed for in the economic model by treating each laborer as 1/4 of an actual full-time worker. Therefore it is simple to calculate that, on average, the colony consists of four-person families each with one full-time worker.

For low-level roleplaying purposes, however, important families who will interact with the PCs on a detailed and regular basis should be generated in detail. Roll 1D6 for the number of adults in the family: 1 = 1, 2-5 = 2, 6 = 3. Roll 1D6–2 for the number of children. Ages, sexes, and other details of children and adults is at the referee's discretion.

Others: Colonists with any background. They are mostly city dwellers with no particular useful skill. Unskilled colonists with military backgrounds would be useful as security specialists and members of the colonial militia. (If your characters are playing a low level campaign, this is probably where they will fit in.) For the economic model, these are laborers who can be assigned to any sector, as they will be able to learn what they need to do their jobs.

Roll a number of D6 equal to eight times the world's population number plus the highest Recruiting skill level in the PC group to determine the number of other voluntary colonists interested in joining the expedition (for Baldur this is 8×[7+Recuiting]). The players may wish to interview one out of ten individuals in the other category to determine their UPP statistics and skills using the NPC template system. Their skills may come from any career or skill cluster.

Involuntary Colonists

When *Cumulus* reaches Oriflamme, she'll be taking on more than farmers, livestock and equipment. Conveniently not mentioned by Burg (assuming that he even knew) when the characters were recruited were the Oriflammen colonists that were coming aboard—not of their own free will.

For a number of years there has been a small but growing resistance movement against the feudal technocracy governing Oriflamme. The recent growth in this movement was sparked by Marines returning from the Wilds where their experiences have turned their political sentiments against any sort of feudalism. Whole cities on the planet have become hotbeds of anti-government feeling. Some direct action, such as bank robberies in the name of the resistance, provocative graffiti painted on public walls, and an occasional letter bomb have taken place. However, open revolt has not yet broken out. Nonetheless, there have been wholesale roundups of suspected ringleaders and sympathizers. And what better way to eliminate troublemakers but to send them to the stars?

After the farmers are loaded at Oriflamme, any remaining free passenger space in the cargo holds—but not exceeding 50 percent of the total colony population—will be filled with involuntary colonists



and their families by the Oriflamme security apparatus. 90% of these involuntary colonists are undesirables and their families (no point in making people angry and leaving them on Oriflamme), 10% are criminals. As the Oriflamme government is attempting to quietly "dump" these people, it provides no documentation about their actual circumstances to the colony leaders.

Note that from the point of view of the economic model, the PCs will not be able to distinguish these colonists from the "Other" colonists generated above. The "Other" colonists will simply be added together with the Involuntaries for a total number of laborers which the PCs will have to assign to economic sectors without being able to distinguish between the reliable and unreliable workers. PC colonly leaders will only be able to tell the voluntary "Others" from the involuntaries by making a specific effort to do so, such as interviewing (conducting regular Observation, Psychology, Interview/Interrogation, and Admin/Legal tasks) or via low-level roleplaying, at the referee's discretion. Even in this case, the PCs may not be able to tell the criminals from the undesirables.

Undesirables: *I was walking home after looking for work and minding my own business when the cops sprung a snap trap on the street. Lines of them sealed off the block and moved in, questioning anyone standing there. If you gave them any lip or made a sudden move, you'd get a crack on the head and thrown in the wagon. The sergeant said I looked healthy, and two of his men grabbed me and threw me into the prisoner van. After a long ride in the dark, we were emptied into a holding pen full of people. Some were crying, others were sick, waking up from the blows. We could look through the wire and see the blast berms and concrete landing pads of the downport. There was a large shuttle on one of the pads. The guards had strung a barbed wire corridor between our pen and the shuttle. "There's your new home," one of the guards said. "You're off to a new world."*

"But what about my wife?" I said.

"Oh, sorry," he answered. "We'll round her up and send her along next time."

Treat these as Others listed above. They may be from any career. These persons will not necessarily be opposed to the player characters' goals, but the circumstances of their inclusion in the colony may well make them uncooperative. These may be assigned to any economic sector.



Criminal: *Me 'n' the guys just finished knocking over this mom 'n' pop store when the reds and blues came on and we wound up inside the pigs' van faster'n we could blink. The judge gave us a choice: jail or some jerkwater colony where they don't even have running water. I'd been in jail before, too many times. Maybe the colony would work out, full of hicks that are easy pickin's. Maybe a couple of the guys would like to come along and we could set up a real nice operation. After all, the judge called the colony a land of opportunity.*

These may be from the Criminal, Tough, or Bureaucrat careers. At some point during colonization, these individuals will resume their criminal careers on the colonial world and actively work against the player characters. These may be assigned to any economic sector.

THE COLONY

Two weeks and two jumps out of Oriflamme, *Cumulus* enters the Poyzen system. After a quick fuel stop at the outer gas giant, she heads in-system and enters orbit around Poyzen. The colonists fidget aboard *Cumulus* while her captain and the colonists' command group meet and confer about the landing site. Although the leaders will have chosen a site before this, there is always a chance for a last-minute change, should anything appear amiss. The first survey crew recommended that the colony be established on a large island near the equator. There was fresh water evident both from orbit and confirmed by the ground survey. The colony site is on a sheltered bay which could eventually become a seaport. The terrain was open and rolling, with pockets of forest, assuring a supply of wood and farmland. Most importantly, there is no sign of any indigenous habitation.

PC leaders or security teams may wish (or be ordered) to conduct a final reconnaissance of the ground before commencing the irrevocable debarkation. If they haven't thought to do this before, they should make sure that they have arrived at the correct time of year: at the beginning of the local growing season. It would be a shame to arrive as the first snow is falling with only a month of rations...

Debarkation

As soon as the landing zone is secured, the ship's crew will begin shuttling down the colonists along with their rations, capital goods, and tents for temporary shelters.

Start-Up: See page 36 for start-up assumptions.

Mapping: It is at this point that the PC colony leaders should prepare their sketch map of the colony's placement, showing the location of agricultural land, housing and industrial capital, materials capital, roads, food storage areas, power generating facilities, and the like (these should all be within the same 20-km hex). This detail is not necessary for the economic model so long as they are all in the same hex, but will be essential for low-level roleplaying.

Reviving Livestock: This is the responsibility of the colony's veterinarians (usually recruited as professionals). Each low berth worth of livestock (10 rations worth of livestock are carried per livestock low berth) is rolled as a discrete task: Average: Veterinary Medicine. Failure indicates that the revival failed and the livestock is dead. Be sure to keep records on how much livestock is successfully revived, as this will affect the output of the agricultural sector.

Starport

The colony's starport will be a bare area of ground, or a lake or ocean bay if the land is too rugged for a safe landing. Other than a navigation beacon, it will have no facilities until the colony develops beyond its first primitive state, and will be treated as Class X. By purchasing (either by local manufacture or by import) a fuel purification plant, the colony can upgrade this to Class E. Until then, incoming starships will have to refuel at local gas giants or use oceanic refueling.

THE FIRST YEAR

The first year of any colony's existence is critical to its survival. This year teaches the colonists how to survive the rigors of a new world including severe seasonal weather, contact with indigenous people, native wildlife, and the compatibility of local soil and plant life with the colonists' crops and livestock. This is also a testing time of the PCs' leadership abilities. How the players govern and cope with various problems as they arise may mean the difference between a stable, cohesive colony and one that is broken into fighting factions.

The first year is played out on two levels. PCs and NPCs go about their jobs on the low level of day-to-day interactions that can be played out face to face. On the high level, the colony's leaders deal with the more abstract aspects of the colonial economic model, dealing with major events month to month, and tracking such vital statistics as livestock survival, food production, and gains and losses in the colony's population through deaths and births.

Jobs

Colonists have a wide variety of jobs that suggest adventure scenarios which can be played out in low-level roleplaying. These include:

Farmers (Agricultural Laborers): These are the backbone of the colony. They may or may not have farming skill or experience. Farmers plow the fields, plant, cultivate, and harvest the crops, and care for the livestock. Farming is usually mundane work, but now and then man or nature intervenes and the farmer must cope with an emergency. Farms by their nature tend to be isolated, and farmers often have to face a hostile environment on their own.



TEMPLATE NPCS

Here are a number of template NPCs used for low-level roleplaying as the PC leaders establish and run the colony. As noted above, professional voluntary colonists are generated as detailed NPCs. The remaining voluntary colonists—artisans, farmers, and others, as well as involuntary colonists and a few additional types, are presented here as template NPCs.

Artisan

Artisans provide the colony with useful technical skills. They may be blacksmiths, carpenters, masons, or if the colony's tech level is high enough, machinists or mechanics. These are the people who build the buildings, machinery, and artifacts that enable a colony to function.

Economic Model: Industrial or Materials Laborer

Level: Novice

Combat Assets: Armed Martial Arts (Club), using trade tools, hammers, axes, etc.

Other Assets: Bargain 8, any two of Carpenter, Jeweler, Mason, or Metallurgy, one at 12, the other at 6. If the local tech level supports these skills, add Electronics, Machinists, and Mechanic to the possible skill list.

Hunter

Hunters may be recruited to help the colonists locate and kill local game during the colony's initial stages. They may also serve as scouts and trackers, particularly if indigenous inhabitants are discovered on the colony world.

Economic Model: Agricultural or Armed Forces Laborer

Level: Veteran

Combat Assets: Choose two from Slug Weapon (Slug Rifle), Archaic Weapons (Archery), Armed Martial Arts (Small Blade), Unarmed Martial Arts.

Other Assets: Any four from **Perception, Acrobat, Explore, Animal Handling** (Riding, Guard/Hunting Beasts), Small Watercraft; one at 14, three at 10

Farmer

The farmer is the backbone of the colony. He or she grows the food the colony must have to survive and prosper. The more efficient the farming, the more labor can be freed up to produce export goods, be it luxury foodstuffs, raw materials, or even manufactured goods. The farmer is a highly skilled individual with the knowledge to grow the maximum amount of crops the land will provide and to care for a wide variety of livestock.

Economic Model: Agricultural Laborer

Level: Novice

Combat Assets: Slug Weapon (Slug Rifle), Armed Martial Arts (Club).

Other Assets: Farming 14, Riding 10, Guard/Hunting Beasts 8, Biology 9, any three from **Perception, Technician, Explore, Determination**; one at 12, two at 9.

Veterinarian

Veterinary Medicine is the skill used in caring for diseased and injured animals and in assisting domesticated animals in various important activities such as becoming impregnated and giving birth to their offspring Veterinary doctors and technicians also inspect freshly killed meat for any diseases that may be harmful to consumers. They are also necessary to guarantee the successful revival of animals transported in low berths.

Economic Model: None; professional detailed NPC

Level: Novice

Combat Assets: *Slug Weapon*

Other Assets: Medical (Veterinary Medicine) 14, Biology 12, any two from **Animal Handling** at 10, any other two Physical Science at 8, Research 4.

Miner/Prospector

If you find resources, you need the people to exploit them. That's the job of the professional miner who digs the hydrocarbons and ores the colony needs to build its infrastructure.

Economic Model: Materials Laborer

Level: Experienced

Combat Assets: Armed Martial Arts (Club) using mining tools such as shovels, pry bars, and picks; Unarmed Melee Combat.

Other Assets: Construction, Excavation, Combat Engineer, all at 12; any one of the following: Technician, Geology, Carpenter, Metallurgy at 10.

Mercenary/Security Specialist

Any colony being established on a potentially hostile world will want one or more mercenaries or ex-military types along to train a colonial militia and form the backbone of any security force.

Economic Model: Armed Forces Laborer

Level: Veteran

Combat Assets: *Energy Weapon* or *Slug Weapon*, Unarmed Martial Arts, *Armed Martial Arts*, Autogun, Grenade Launcher

Other Assets: Leadership, Instruction, Recruiting, Ground Tactics, Muscle Transport, all at 12.

Other

The "Other" class of voluntary colonists are willing workers and support the colonization effort. However, they lack farming and survival skills, and may have never lived outside a city before. However, city dwellers possess a native intelligence which suits them to rapidly picking up whatever skills they might need.

Economic Model: May be assigned to any economic sector

Level: Novice

Combat Assets: Unarmed Melee Combat

Other Assets: Any two from the following: Service, Streetwise, **Technician**, Admin/Legal, Bargain, Willpower; one at 10, one at 8.

Undesirable

These are also individuals without farming, survival, or artisan skills. However, they've been press-ganged into the colony against their will for a variety of political or economic reasons. Although not criminals in the strict sense, they may have anti-social tendencies and come from the lower strata of society.

Economic Model: May be assigned to any economic sector, are usually indistinguishable from "Other," above

Level: Novice

Combat Assets: Unarmed Melee Combat

Other Assets: Any two of the following: Streetwise, Leadership, Carousing, Persuasion, Bribery, Gambling, Bargaining, Act/Bluff, one at 10, one at 8.

Criminal

Sometimes governments will sweep petty criminals out of their jails and dump them on colonial expeditions. Or, they may be rounded up on the street and given the choice of a jail term or exile. Either way, they spell trouble for any colony.

Economic Model: May be assigned to any economic sector, are usually indistinguishable from Undesirable, above

Level: Experienced

Combat Assets: Slug Pistol, Armed Martial Arts (Small Blade), Unarmed Martial Arts.

Other Assets: Any three from the following: Leadership, **Vice, Crime, Charm, Vehicle**, Admin/Legal; one at 12, two at 10.

Resistance Fighter

Ex-Oriflamme Marine charged with treason. However, because of an excellent combat record and service to the Reformation Coalition, this person is allowed to live in exile. (Roll 1D6: on 5-6 this NPC was an officer.)

Economic Model: May be assigned to any economic sector, are usually indistinguishable from "Other," above

Level: Veteran (Officer: Elite)

Combat Assets: Slug Weapon (Slug Rifle), Slug Weapon (Slug Pistol), Armed Martial Arts (Large Blade), Unarmed Martial Arts, Autogun, Grenade Launcher

Other Assets: Survival 10 (Officer: add Leadership 13, Ground Tactics 12).



Livestock

The accompanying table is presented to assist the referee in fleshing out the abstract livestock requirements from the economic model. Assume that one ration equivalent of living livestock equals about 100 kg of animal. These equivalencies are intended to be helpful for roleplaying *color*; as the economic model contains many abstractions about food as labor vs. food as mass, food as slaughtered animals vs. food as produced by animals, players and referees should not attempt to read too much into these figures.

Animal	*Weight (kgs)*	*Volume (m^3)*	*Cost (Credits)*	*Terran Equivalent*
Draft Animal	1000	10	2000	Percheron Draft Horse
Riding Animal	600	6	3000	Quarter Horse
Dairy Animal	600	6	500	Holstein Cow
Large Meat Animal	1000	10	400	Hereford Steer
Medium Meat Animal	50	0.5	100	Meat Swine
Small Meat Animal	10	0.1	10	Rabbit
Guard/Herding Animal	50	0.5	100	German Shepherd Dog
Small Pest Control Animal	7	0.1	free	House Cat
Egg Producing Animal	4	0.1	1	Chicken

Artisans (Industrial and Materials Laborers): On a colonial expedition, these are the "village smithies." Artisans are the metal smiths that produce plow blades, scythes, horse shoes, pots and pans, and most importantly nails: all the metal tools and implements needed by the colony. Early on, this is produced from bar iron imported aboard the colony transport. Native metal sources must soon be found, however, or vital metal artifacts cannot continue to be produced.

Artisans also include the carpenters, stone masons, and brick layers who build the buildings, fences, and other structures needed by the colony to build a permanent home. Others weave cloth from local fibers and produce plates and cups from local clays.

Miner/Prospector (Materials Laborer): These find the vital fuels and metals that enable the colony to survive and grow. Although they may have to bust sod with the rest of the colony for the first few months in order to eat, prospectors also head into the wilderness looking for coal, oil, phosphates, nitrates, and ores of all kinds. Prospectors should have Geology skills to enhance their ability to find an ore body or hydrocarbon deposit, but anyone might get lucky and strike it rich.

Mercenary/Security Specialists (Armed Forces Laborers): These have two jobs: internal security and external security. Security specialists have the full time job of keeping law and order in the colony. They also supply security against any external threat. In addition, security specialists should have enough military and training experience to serve as the cadre for the colonial militia, which might be needed if any indigenous people become hostile or if a hostile party lands from off-planet.

Explorers (PCs or Detailed NPCs): As the colony grows, it will need new land for its people. Explorers have the job of finding and mapping new colony sites and transportation routes for anticipated expansion. They also are the people who answer the question, "What's out there?" Although the colony has a gross picture of Poyzen's many continents from orbital surveys, only the explorers travelling overland or by sea can fill in the fine-grained details.

Hunters (Agricultural Laborer): During the early days of the colony, local wildlife may be a valuable resource for protein. It may also be valuable for its hides and furs. Hunters are colonists who head into the outback to harvest wildlife, taking care to preserve enough life so it will renew itself.

Leadership: If the players are playing the roles of the colony leaders in a high level campaign, they will have one basic job, that of supervising, inspiring and encouraging the colony members to do their best for the good of the colony. The leaders must also respond to and cope with events that affect the colony as a whole.

Veterinary Medicine

Veterinary Medicine is a cascade skill of Medicine that may be chosen as a specialty in the Medicine career. In an emergency, Veterinary Medicine may be substituted for Medical skill using the normal cascade guidelines. The reverse is also true. Individuals who specialize in Veterinary Medicine may be commissioned as a Doctor of Veterinary Medicine, otherwise they work as a veterinary technician. There are no ranks nor promotions.

Individuals who choose a skill from Animal Handling or Physical Science clusters may receive skill in Veterinary Medicine in place of one of the skills listed in these clusters in the basic TNE rules. You may use the Veterinarian Template NPC or generate your own as the colony's "vet."

Scenario Specific Events

The events and tables which follow are supplemental to the random event tables found in Chapter 4, and reflect the specific details of this colony campaign.

Explanation of Scenario-Specific Results: Certain of the new entries on the table on the facing page require elaboration as follows.

Friendly Starship: A friendly starship arrives and assists or trades with the colony. Roll 1D6 on the table below to determine the ship type and its action.

1	Colonial Transport
2	Far Trader
3	Scout
4	Warship
5	Far Trader
6	Scout

Colonial Transport: *Cumulus* arrives with another load of colonists sent to join the existing colony. These are Agricultural and Materials Laborers with a handful of Professionals, well equipped to survive and thrive on a new world. Capital goods and livestock sufficient to employ all embarked, as well as two months of rations for those embarked. Political roll DM +1

Far Trader: A Far Trader arrives with a load of high tech tools, weapons and other trade goods useful to the colony (referee's discretion). The captain wants to sell these in exchange for fresh fruit, vegetables, grain, and meat (i.e., rations). These goods will be traded to the colony for direct cash value, without having to devalue the colony's money by dealing with exchange rates. Political roll DM +1.

Scout: A Scout arrives with news and mail from Baldur and offers to carry news and mail back home. Political roll DM +1.

Warship: An RC warship arrives in the star system. Ship's officers land at the colony and tell the colonial administrators that their ship will be on patrol in the system for a month, and will pay direct cash value (not devalued by exchange rates) for rations equal to five times the crew size. Members of the crew will also land to enjoy shore leave at regular intervals and uphold the naval tradition of freely spending credits: Agricultural sector output roll +1 this turn, Industrial output roll +3. However, on a 1D10 roll of 7+ there will be a brawl requiring 1D6×500 credits of construction industry production to repair.

If a hostile ship arrives while the warship is on patrol, the warship will attempt to protect the colony. The warship is a Victrix-class sloop (crew 26) on 1-3, a mercenary cruiser (crew 72) on 4, and a clipper (crew 150) on 5-6. Political roll DM +2 (+1 if brawl).

1	Colonial Transport
2	Corsair
3	Slaver
4	Warship
5	Vampire Cruiser
6	Slaver

Hostile Starship: A hostile starship arrives and threatens the colony. Roll 1D6 on the table at left to determine the ship type and its action.

Colonial Transport: *Cumulus* appears with 1D10×10 involuntary colonists and criminals, and no additional capital goods, live-



Random Events: This table is a slightly modified replacement for the generic random events table in Chapter 4. Some of these events are more elaborate versions of events on the original charts, in order to provide more suggestions and opportunities for low-level roleplaying.

D20	*Result*
1	Natives Encountered
2	Unfavorable Government Development, see below
3	Plague strikes populace: 1D6 person die each day until Formidable Medical (Diagnosis) task is completed (task may be rolled once per 24 hours). –2 DM on all output rolls this turn. –1 on political roll.
4	Disease strikes livestock: Kills 1D6 units of livestock until Formidable Medical (Diagnosis or Veterinary Medicine) task is completed (task may be rolled once per 24 hours). Due to diseased meat, agricultural output reduced by 25% for this turn. –1 on political roll.
5	Hostile Starship, see below
6	Vermin eat 1D10×5% of stored rations. –2 on political roll.
7	Blight destroys crops. Agricultural output for turn cut in half. –2 on political roll.
8	Earthquake: 1D6×10% of housing destroyed. –1 on political roll.
9	Vermin eat 1D6×5% of stored rations. –1 on political roll.
10	Major crime, see below
11	Minor crime, see below
12	Native animal attack, see below
13	Indigenous animals stampede, destroy 1D20 units of agricultural capital. –1 on Political roll.
14	Major crime, see below
15	No traders arrive this month, no exports sold this turn, all rations set aside for export spoil.
16	Friendly Starship, see below
17	Discovery of hardy, edible, local life form. Permanently add +2 to all future agricultural output rolls. +2 on political roll this turn only.
18	Population explosion of local edible lifeforms. Multiply agricultural output by 2 for this month. +2 on political roll.
19	Favorable Government Development, see below
20	Natives Encountered

stock, or rations. These are dumped into the new colony's economy and social structure with criminal tendencies and no useful skills. –1 on Political roll.

Corsair: A Corsair attacks the colony with a small landing force attempting to seize whatever valuables are on hand. Low-level roleplaying negotiation results may allow them to be placated by donations of colony exports. If the colony elects to fight, this must also be roleplayed using the **TNE** combat rules. In this case, the corsairs will bombard the colony from orbit, killing 1D10×5 colonists and 1D10×5 units of livestock, and destroying 1D10×5 units of capital machinery and 1D20×50 cubic meters of housing before withdrawing. –2 on Political roll.

Slaver: A Far Trader arrives and lands a raiding force to seize colonists for sale in the slave markets of the Wilds. If they resist, the slaver will bombard the colony from orbit doing damage as the corsair above. They will then take 1D6×10 of the colonists as slaves. Any attempts to modify or thwart this result must be roleplayed using the appropriate combat rules. –3 on Political roll.

Warship: A warship from the Wilds arrives (referee's discretion whether it is a vampire, hostile power, mystery ship, etc.). It bombards the colony from orbit destroying 1D6×10% of housing, 1D6×10% of capital machinery, and killing 1D6×30% of the colonists and 1D6×10% of the livestock. The warship is a Close Escort on a roll of 1-4 on 1D6; a Mercenary Cruiser on a roll of 5-6. –3 on Political roll.

Vampire Cruiser: A Vampire Cruiser arrives. On a 2D6 roll of 1-3, the cruiser threatens to destroy the colony unless the colonists provide 1D10×10 replacements to join its crew. If the colonists refuse, the cruiser bombards the colony, causing the damage shown under Warship above. –3 on Political roll.

Native Encounters: NPC colonists have encountered natives. When this result is obtained, roll on the First Encounter table to determine what type and how many natives have been encountered by the colonists. Note from the world map that the former starport and scout base was located on the continent immediately to the west of the proposed island colony site. If the colony is located on this island, roll 1D6 on the table below. If the colony is located on the continent with the former starport, roll 2D6. If located elsewhere on the world, disregard the Native Encounter result.

Once the composition of the native group is established, consult the Interaction section of the Bootstrap Chapter to determine the attitudes of the colonist group and the native group upon meeting.

2D6	*First Encounter*
2	Chieftain
3	Warriors
4	Fishermen
5	Fishermen
6	Warriors
7	Peasants
8	Peasants
9	Fishermen
10	Fishermen
11	Warriors
12	Mounted Warriors

Chieftain: A native chieftain and 3D6 members of his household troops are encountered on an exploration expedition. Their boats are drawn up on the beach nearby.

Warriors: Warriors numbering 3D6 armed with spears and bows are encountered nearing the colony.

Fishermen: 2D6 fishermen are sitting on and near their boats which are drawn up on the beach and are repairing their nets when a group of colonists stumble upon them.

Peasants: 2D6 peasants are encountered by a colonial exploration team tilling their fields. Further investigation will reveal a village with 2D5×10 inhabitants.

Mounted Warriors: A mounted group armed with swords, lances, and composite bows on riding beasts is encountered by a colonial exploration team.

Favorable Government Development: Due to changes in the political situation on Baldur, the colonial program becomes a popular and growing concern. Exports from the colony become highly sought-after. Multiply monthly export monetary value by 1.25

Unfavorable Government Development: Changes in the political situation on Baldur adversely affect the colony, roll 1D6 below.

1	Funding Cut
2	Government Takeover
3	Criminal Charges
4	Colony Terminated
5	Colony Abandoned
6	Hostile Colony Established

Funding Cut: A reallocation of government funding results in a decline to the shipping dedicated for colonial support. Roll 1D10 each month for 4+ to see if shipping arrives to allow the shipping of exports. If no ships arrive, no exports may be made, and no revenue generated. A second result of this event is the same as "Colony Abandoned." –2 on Political roll.

Government Takeover: Political maneuvering on Baldur causes the colonial administration to change its colonial policy and replace the current colony leaders under allegations of incompetence. A warship arrives to return them to Baldur where they are once again unemployed. The players may avoid replacement by succeeding at a legal appeal (Formidable: Admin/Legal). If they fail, they are replaced with inexperienced government lackeys. If they succeed, there is still a –2 DM on the political roll. If they refuse to return, they will be left on their own.

Arrest Warrant: As above, but political maneuvering requires trumped-up charges against the colony leaders to deflect attention from malfeasance elsewhere. A warship and a detachment of Marines arrive with a warrant to arrest the world tamers and return them to Baldur where they are charged with fraud and embezzlement. They are



replaced with inexperienced government lackeys. If they run, they will be hunted by the Marines.

Colony Terminated: A change of governmental priorities results in the abandonment of the colonial program as an unnecessary drain on resources, and shipping is sent to take the colonists home. If PC leaders attempt to convince them to stay, this will require low-level roleplaying, Persuasion tasks, etc., at the referee's discretion. The main criteria should be the current position on the Political Track, with high levels making most colonists favorably inclined to stay, and so on.

Colony Abandoned: A change of governmental priorities results in the abandonment of the colonial program as an unnecessary drain on resources, and the colony is simple abandoned. The shipping which had previously been sent to the colony is cut off, and the colony must now rely on other shipping. Roll 8+ on 1D10 each month for shipping to arrive and allow exports to be shipped. Roll randomly each month to find the world that the cargo will be shipped to, in order to calculate proper exchange rates. Once this result has been obtained, results of 1-5 on this table are treated as no effect. –2 on the Political roll.

Hostile Colony Established: Another colony is established on the world. Source of colony is at referee's discretion, and the two may end up competing for resources or access to export markets, referee's discretion. Alternately, it may be a different type of colony such as a penal colony, or a colony of slaves working a mine.

Native Animal Attack: Native animals attack colonists or their livestock. Roll 1D6. On a roll of 1-3, livestock are attacked. On a roll of 4-5, colonists are attacked. On a roll of 6, one or more player characters are attacked. Use the animal encounter table to logically or randomly determine kind and number of animal attackers. If the attack is by a large number of herbivores, it is a stampede that could damage a large amount of property and kill people and livestock, particularly if the herbivores are large. An attack by a solitary animal would probably be an attack by a pouncer, however, there are other possibilities depending on the attack's circumstances. These are up to the referee.

Minor Crime: Minor crime occurs in the colony, damaging morale to the tune of –1 on the Political roll for the turn. Roll 1D6 to determine the offense for purposes of low-level roleplaying. These are suggestions to help jog the imagination; disregard inappropriate results.

1	Brawl
2	Fight
3	Bribery
4	Petty Theft
5	Custom Violation
6	Insult

Brawl: 2D6 colonists overindulge at a tavern, get into an argument, and a major fist fight breaks out.

Fight: A fist fight breaks out between two colonists on the colony's main street.

Bribery: A colonist attempts to bribe a colonial leader for extra seed grain, a larger meat ration, or other unusual benefit.

Petty Theft: Petty thefts of tools and small valuables begin to occur. At the referee's option, the thefts may be the result of a small native animal attracted to shiny metal objects who takes it back to its nest as a "treasure."

Custom Violation: This occurs only when colonists and natives are interacting. Possible causes include:

Territory: The colonists have settled on native lands considered hereditary property by the local people.

Hunting Rights: The colonists have settled on native hunting lands, disrupting the local game population and threatening the natives with starvation.

Religion: Colonists accidentally defile sacred land or a terrain feature.

Insult: A colonist accidentally insults a native with a minor customs violation. Other possibilities are up to the referee.

Major Crime: Crimes are being committed in the colony, damaging cohesion to the tune of –2 on the Political roll. Roll 1D6 to determine the type for low-level roleplaying purposes; DM+2 if criminals are among involuntary colonists. These are suggestions to help jog the imagination; disregard inappropriate results.

1	Theft
2	Livestock Theft
3	Extortion
4	Robbery
5	Kidnapping
6	Murder

Theft: Seed grain is being stolen. The seed grain thefts may be the result of small vermin eating the grain, or at referee's option a colonist stealing the grain for consumption or later resale. Seed grain theft during the first year is a threat to the survival of the colony and may be a capital offense.

Livestock Theft: The colony's animals begin disappearing. Scouts find one or more badly butchered carcasses several days later. Are native animals responsible or are hungry colonists?

Extortion: Shopkeepers and artisans complain that they are being forced to pay protection money after an arsonist torches a shop. Shopkeepers begin to be beaten at random if they don't pay up.

Robbery: Colonists start being robbed of money and valuables late at night. At the referee's discretion, if farmhouses are located on homesteads, a gang of 1D6 armed raiders rob farmers of their livestock, grain, and tools.

Kidnapping: A colonial professional is kidnapped by an armed gang and is held in a remote hideout for ransom. The characters must organize a search and rescue mission.

Murder: One or more colonists are murdered. Roll 1D6. A single person is murdered in a result of 1–4. 1D6–3 persons are killed in a result of 5–6. The single victim may be the result of a crime of passion or a domestic dispute. The single person may also be killed during a robbery or other crime. Multiple murders may be the result of vicious criminal gangs such as the farmhouse raiders mention under "Robbery." The exact circumstances are up to the referee.

SUBSEQUENT YEARS

Assuming the characters and colony survive the first year and the exports are flowing, the characters will receive their Cr100,000 world tamer fee deposited in the bank of their choice on Baldur. The players now have two choices: resign to return home and collect their fee, or stay on at the colony, let the fee accumulate interest, and collect the 10 percent royalty on the value of shipments to the home world.

Taking the Money

This is a "sure thing" choice if the colony has succeeded in shipping exports. It lets the characters move on to new adventures with a lot of cash in their pockets. It also ends this campaign.

Staying On

If the characters have not made the first shipment by the end of the first year or they like the challenge of life on an untamed wilderness planet and they are leading a thriving colony, they may decide to stay on for additional years.

In these subsequent years, the PCs may wish to delegate routine administrative responsibilities to key NPCs and concentrate their efforts on exploring nearby territory and opening it for settlement. If the world has proven to be hospitable, the colonists will begin to spread out and form new settlements nearby. This can happen in an organized fashion under the control of the original colony or individually as bands of pioneers trek over the horizon seeking their independence from high level PCs' government. How the PCs deal with this can be the substance of a subsequent campaign.

Additional Rewards

There are a number of rewards the players can earn beyond the simple monetary payment discussed above. Successful leaders who stay on may well be given permanent land grants by the Baldur government, and the colony may win eventual membership in the Reformation Coalition. Under these circumstances, PCs may find themselves standing for seats in the RC Assembly of Worlds, to become involved in some truly high-level roleplaying.

Or, with their new-found riches and experience, the PCs may decide to start their own colony world farther out in the Wilds and set themselves up as rulers of an independent power, beholden to none, (or maybe just get killed dead by vampires).

The possibilities are limitless.

RCES SCOUTING REPORT
POYZEN SYSTEM SO SKIRE SUBSECTOR (1736 OLD EXPANSES)

Star System
Sector: Old Expanses
Subsector: 1736/So Skire
Star Type: G3V
Planetoid Belts: 0
Gas Giants: 3

Main World
Starport: X
Pre-Collapse Starport: C
Diameter: 11,140 kilometers
Atmosphere: Dense
Hydrosphere: 69%
Population: None (estimated)
Pre-Collapse Population: 200
Government: None
Law Level: None
Tech Level: 0
Pre-Collapse Tech Level: 5
Bases: None
Trade Classification: Barren

RCES Scouting Report
Poyzen System So Skire Subsector (1736/Old Expanses)

NOTES
Poyzen served as a scout base and refueling stop along the So Skire Main during the Third Imperium. However, its heavily tainted atmosphere (believed to be the source of the planet's name) made it a low priority for development compared with other more habitable worlds nearby. Shortly before the Rebellion and subsequent Collapse, the volcanic outgassing that was the source of the taint slowed, then ceased. The sulfuric compound taint has since settled out, and in a rare instance in recorded planetological history, a world's atmosphere has become clean. Poyzen is now a virtually Earth-like virgin garden world, ripe for settlement.

The Poyzen System
Poyzen occupies Orbit 3 around an unnamed G3V primary known only by its sector coordinate designation. It is almost centered in its life zone, giving the world moderate temperatures in its equatorial and temperate regions.

Orbit 0 is contains a sun-blasted chunk of rock less than 500 km in diameter. Orbit 1 has a tidally-locked ball of rock about 3000 km in diameter. Orbit 2 is occupied by a 7000 km desert world with a thin carbon dioxide atmosphere. Orbit 4 contains a small gas giant. Orbit 5 has an ice ball planet consisting of frozen water and ammonia ices along with crystalline formations that make it sparkle like a giant snowball in the starlight. Orbit 6 has a large gas giant, and Orbit 7 a small gas giant.

Poyzen has an airless, rocky moon 2000 kilometers in diameter, orbiting 145,000 kilometers out.

Physical
Now that its atmosphere has cleaned itself up, Poyzen is a garden world in every respect. It has a base surface temperature of 8°C and a temperature range of from +40°C to -69°C. Because of its relatively severe axial tilt of 35°, Poyzen's polar caps melt during their summers and freeze solid during their winters. Poyzen has a 369 day year and days that are 30 hours long. Surface gravity is average at 0.9 G. The atmosphere is surprisingly dense at 2.4 standard atmospheres in pressure with an oxygen concentration of 20 percent. The extreme heating and cooling at the poles leads to frequent violent weather. The dense atmosphere makes high winds extremely dangerous on Poyzen.

Oceans cover 69% of the planet. There are ten small continents fairly evenly distributed around the globe. Four major islands and nine archipelagoes complete the land masses. Much of the land on and near the equator is covered with jungle. Two major volcanic mountain ranges are found on two of the equatorial continents while a large desert occupies the wind shadow on the largest. The balance of the land is relatively open fertile grassland and forest. Note that the two northern continents, the northern-most portion of the western-most continent, and the southern polar continent experience frequent glaciation and severe erosion. Because of the lack of human habitation, none of the continents have been named. Previous surveys have used numbers or Greek letter designations beginning with the western-most continent.

History
Poyzen had a scout base and a class-C starport frequently used as a refueling stop by free traders and other small starships traveling the So Skire main beginning about 570. The world was never settled on a permanent basis. The starport and Scout base was staffed by a 200-person crew on tours of duty from the nearby Scout base on Cobham (So Skire 1835). The starport and Scout base was destroyed by unknown causes during the Collapse. The fate of the staff is unknown. Poyzen is presently believed to be uninhabited.

Poyzen Temperature Worksheet

			Highest Possible Temp							Lowest Possible Temp					
Col:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Hex Row	*Base Temp*	*Latitude Mod*	*Cols. 1+2*	*Summer Plus*	*Ax. Tilt Factor*	*Cols. 4×5*	*Daytime Plus*	*Orbit Ecc Plus*	*Cols. 3+6+7+8*	*Winter Minus*	*Ax. Tilt Factor*	*Cols. 11×12*	*Night Minus*	*Orbit Ecc Minus*	*Cols. 3+12 +13+14*
1	16	+18	34	+23	0.00	+0	+6	+0	40	–35	0.00	–0	–8	–0	26
2	16	+12	28	+23	0.25	+6	+6	+0	40	–35	0.25	–9	–8	–0	11
3	16	+6	22	+23	0.50	+12	+6	+0	40	–35	0.50	–18	–8	–0	–4
4	16	0	16	+23	0.75	+17	+6	+0	39	–35	0.75	–26	–8	–0	–18
5	16	–6	10	+23	1.00	+23	+6	+0	39	–35	1.00	–35	–8	–0	–33
6	16	–12	4	+23	1.00	+23	+6	+0	33	–35	1.00	–35	–8	–0	–39
7	16	–18	–2	+23	1.00	+23	+6	+0	27	–35	1.00	–35	–8	–0	–45
8	16	–24	–8	+23	1.00	+23	+6	+0	21	–35	1.00	–35	–8	–0	–51
9	16	–30	–14	+23	1.00	+23	+6	+0	15	–35	1.00	–35	–8	–0	–57
10	16	–36	–20	+23	1.00	+23	+6	+0	9	–35	1.00	–35	–8	–0	–63
11	16	–42	–26	+23	1.00	+23	+6	+0	3	–35	1.00	–35	–8	–0	–69

Date: 01-IX-1201

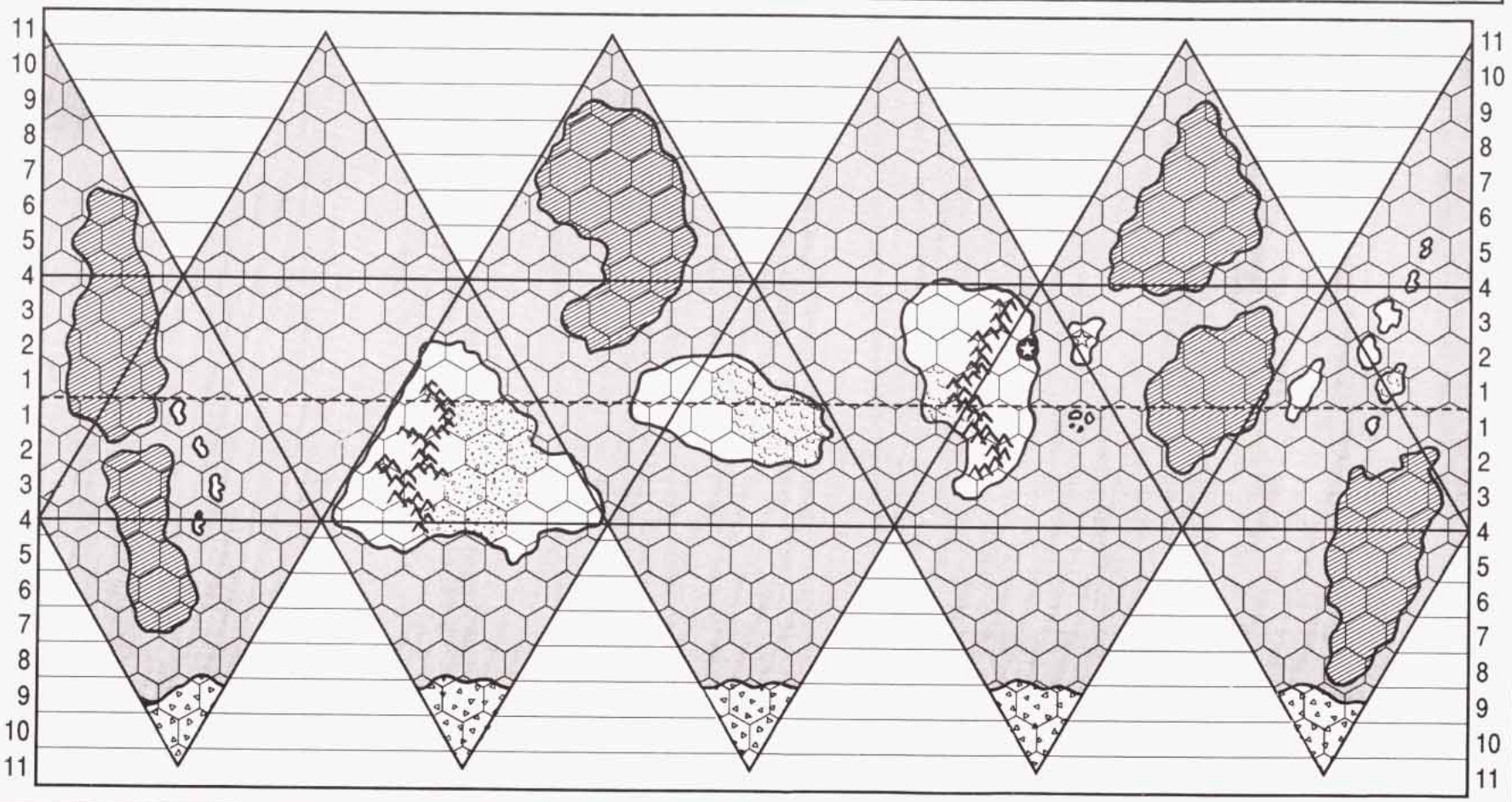
World Name: Poyzen

UPP X787000-0

Hexagon Scale in Kilometers: 1000

Subsector and Sector Location of World: 1736/So Skire/Old Expanses

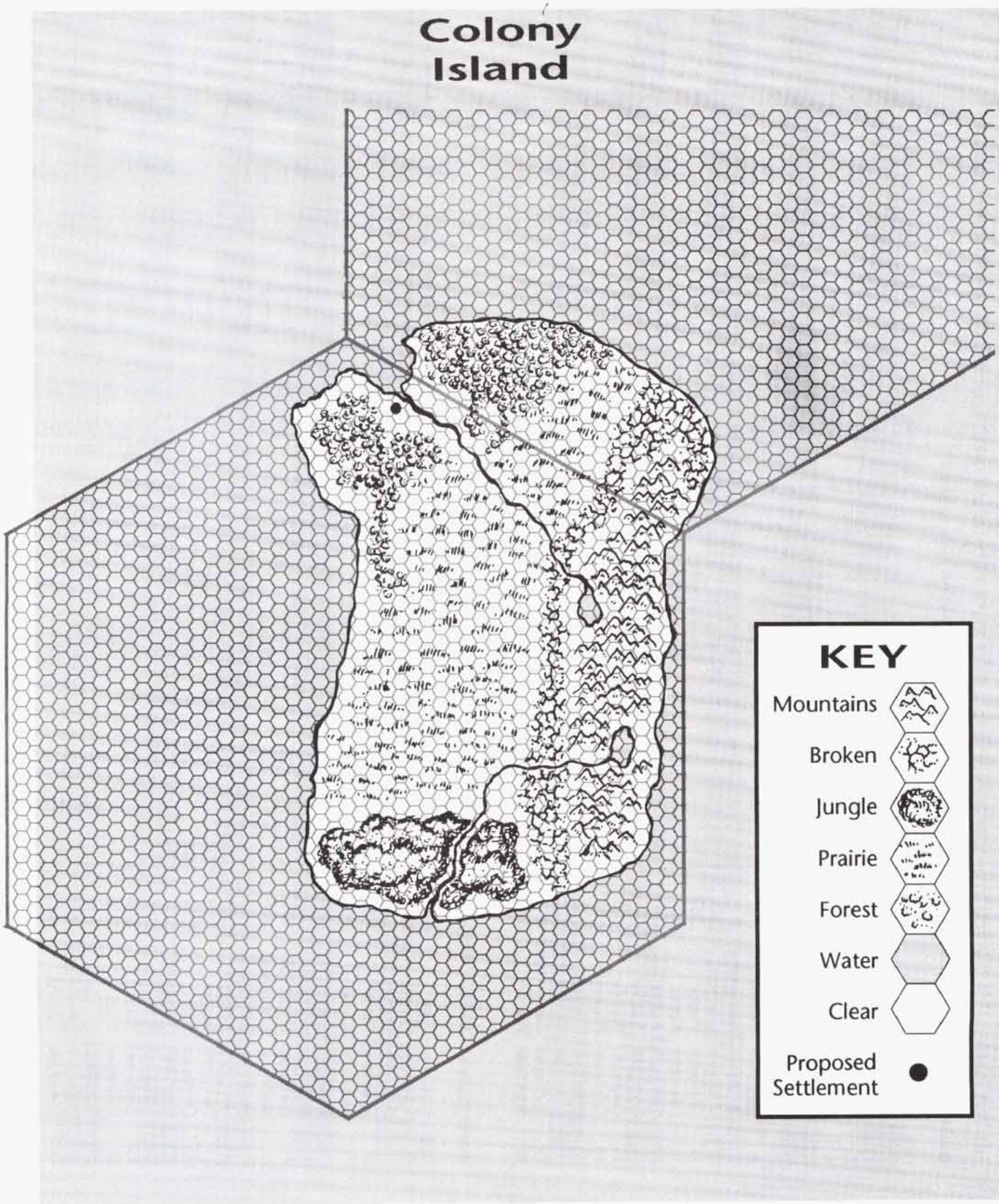
GLOBAL DATA VIEW



Open Sea
Steppe
Jungle
Colony
Mixed
Badlands
Tundra
Former Scout Base
Mountains
Desert
Ice cap/ Glacier
Unknown (Not yet surveyed)



Colony Island



See **TNE** pages 210-212 and **Traveller Players' Forms** for more information on the use of animal encounter tables.

World: Poyzen UWP: X-787000-0 Terrain Type: Forest Other Information: Colony Island

D20	Category	Type	Name	Qty	Spec Att	Wt (kg)	Hits	Wpn	To Hit	Dam	Pen	Rng	Type of Melee Atk	Init	Armor	Behavior	Speed
1	Herbivore	Filter	H01	1D6	—	50	11	Tail	4	3	1	Short	Armed	4	—	F2, Ap	3/5/10
2	Herbivore	Intermittent	H02	1	F	25	9	Hooves	2	4	Nil	Short	Armed	1	—	F4, A4	4/8/15
3	Herbivore	Intermittent	H02	1	F	25	9	Hooves	2	4	Nil	Short	Armed	1	—	F4, A4	4/8/15
4	Herbivore	Intermittent	H02	1	F	25	9	Hooves	2	4	Nil	Short	Armed	1	—	F4, A4	4/8/15
5	Herbivore	Intermittent	H02	1	F	25	9	Hooves	2	4	Nil	Short	Armed	1	—	F4, A4	4/8/15
6	Herbivore	Intermittent	H03	1	—	100	13	Quills	7	4	Nil	Short	(Def only)	3	—	F7, A8	5/10/20
7	Herbivore	Intermittent	H03	1	—	100	13	Quills	7	4	Nil	Short	(Def only)	3	—	F7, A8	5/10/20
8	Herbivore	Intermittent	H03	1	—	100	13	Quills	7	4	Nil	Short	(Def only)	3	—	F7, A8	5/10/20
9	Herbivore	Intermittent	H03	1	—	100	13	Quills	7	4	Nil	Short	(Def only)	3	—	F7, A8	5/10/20
10	Omnivore	Gatherer	O01	1	—	3	1	Tail	3	2	Nil	Short	Armed	5	½	F10, A5	6/11/21
11	Omnivore	Hunter	O02	1D6	—	25	4	Claws & teeth	5	15	1	Short	Armed	2	—	F8, A7	4/8/16
12	Omnivore	Hunter	O02	1D6	—	25	4	Claws & teeth	5	15	1	Short	Armed	2	—	F8, A7	4/8/16
13	Omnivore	Hunter	O02	1D6	—	25	4	Claws & teeth	5	15	1	Short	Armed	2	—	F8, A7	4/8/16
14	Carnivore	Trapper	C01	1	F	50	8	Teeth	13	6	1	Short	Armed	8	—	As, F9	2/3/6
15	Carnivore	Pouncer	C02	1	—	3	1	Claws & teeth	13	1	Nil	Short	Armed	7	—	As, Fs	11/21/42
16	Carnivore	Pouncer	C02	1	—	3	1	Claws & teeth	13	1	Nil	Short	Armed	7	—	As, Fs	11/21/42
17	Carnivore	Trapper	C01	1	F	50	8	Teeth	13	6	1	Short	Armed	8	—	As, F9	2/3/6
18	Scavenger	Carrion-Eater	S01	2D6	F	1	1	Tail	6	1	Nil	Short	Armed	1	—	F13, A9	11/22/43
19	Scavenger	Carrion-Eater	S01	2D6	F	1	1	Tail	6	1	Nil	Short	Armed	1	—	F13, A9	11/22/43
20	Scavenger	Reducer	S02	1	F	1	1	Coils	9	2	Nil	Short	Strangle	4	—	F4, A2	5/9/17

World: Poyzen UWP: X-787000-0 Terrain Type: Prairie Other Information: Colony Island

D20	Category	Type	Name	Qty	Spec Att	Wt (kg)	Hits	Wpn	To Hit	Dam	Pen	Rng	Type of Melee Atk	Init	Armor	Behavior	Speed
1	Herbivore	Grazer	H04	4D6	—	12	3	Hooves	5	2	Nil	Short	Armed	2	—	F12, A6	6/12/24
2	Herbivore	Grazer	H04	4D6	—	12	3	Hooves	5	2	Nil	Short	Armed	2	—	F12, A6	6/12/24
3	Herbivore	Grazer	H04	4D6	—	12	3	Hooves	5	2	Nil	Short	Armed	2	—	F12, A6	6/12/24
4	Herbivore	Grazer	H05	3D6	F	3	1	Trample	4	1	Nil	Short	Diving Blow	5	—	F10, A9	11/22/44
5	Herbivore	Grazer	H05	3D6	F	3	1	Trample	4	1	Nil	Short	Diving Blow	5	—	F10, A9	11/22/44
6	Herbivore	Intermitent	H02	1	F	25	9	Hooves	2	4	Nil	Short	Armed	1	—	F4, A4	4/8/15
7	Herbivore	Intermitent	H02	1	F	25	9	Hooves	2	4	Nil	Short	Armed	1	—	F4, A4	4/8/15
8	Herbivore	Intermitent	H02	1	F	25	9	Hooves	2	4	Nil	Short	Armed	1	—	F4, A4	4/8/15
9	Herbivore	Intermitent	H03	1	—	100	13	Quills	7	4	Nil	Short	(Def only)	3	—	F7, A8	5/10/20
10	Omnivore	Hunter	O03	1D6	F	6	2	Tail	6	2	Nil	Short	Armed	6	—	F3, A17	11/21/41
11	Omnivore	Hunter	O02	1D6	—	25	4	Claws & teeth	5	15	1	Short	Armed	2	—	F8, A7	4/8/16
12	Omnivore	Hunter	O02	1D6	—	25	4	Claws & teeth	5	15	1	Short	Armed	2	—	F8, A7	4/8/16
13	Omnivore	Hunter	O02	1D6	—	25	4	Claws & teeth	5	15	1	Short	Armed	2	—	F8, A7	4/8/16
14	Carnivore	Killer	C03	1	F	12	2	poison/claw	8	1D3p3	Nil	Short	Armed	4	—	A2, F13	8/16/31
15	Carnivore	Killer	C03	1	F	12	2	poison/claw	8	1D3p3	Nil	Short	Armed	4	—	A2, F13	8/16/31
16	Carnivore	Siren	C04	1	F	25	1	Coils	7	6	Nil	Short	Strangle	8	—	As, F5	4/7/14
17	Carnivore	Siren	C04	1	F	25	1	Coils	7	6	Nil	Short	Strangle	8	—	As, F5	4/7/14
18	Scavenger	Reducer	S02	1	F	1	1	Coils	9	2	Nil	Short	Strangle	4	—	F4, A2	5/9/17
19	Scavenger	Reducer	S02	1	F	1	1	Coils	9	2	Nil	Short	Strangle	4	—	F4, A2	5/9/17
20	Scavenger	Carrion-Eater	S01	2D6	F	1	1	Tail	6	1	Nil	Short	Armed	1	—	F13, A9	11/22/43

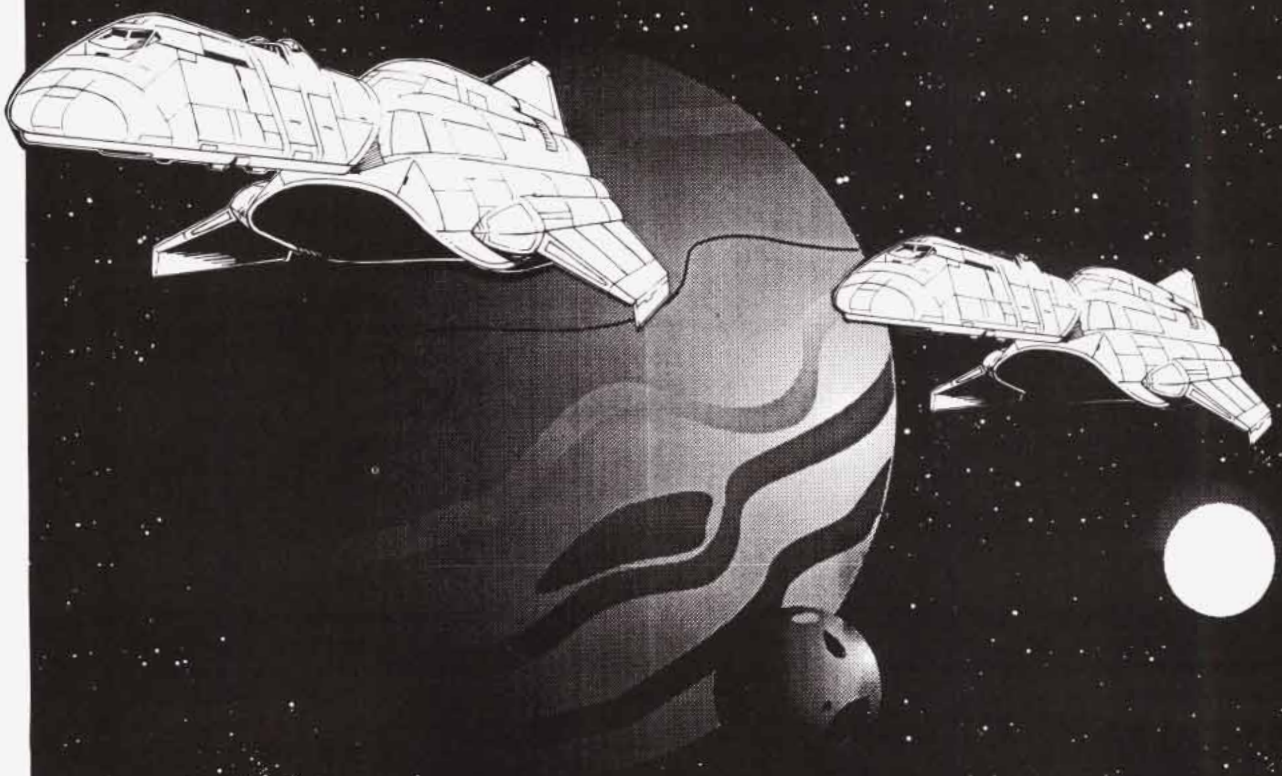
World: Poyzen UWP: X-787000-0 Terrain Type: River Other Information: Colony Island

D20	Category	Type	Name	Qty	Spec Att	Wt (kg)	Hits	Wpn	To Hit	Dam	Pen	Rng	Type of Melee Atk	Init	Armor	Behavior	Speed
1	Herbivore	Grazer	H06	2D6	—	200	15	Horn	6	8	1	Short	Armed	1	—	F8, A6	7/13/25
2	Herbivore	Grazer	H06	2D6	—	200	15	Horn	6	8	1	Short	Armed	1	—	F8, A6	7/13/25
3	Herbivore	Grazer	H06	2D6	—	200	15	Horn	6	8	1	Short	Armed	1	—	F8, A6	7/13/25
4	Herbivore	Grazer	H05	3D6	F	3	1	Trample	4	1	Nil	Short	Diving Blow	5	—	F10, A9	11/22/44
5	Herbivore	Grazer	H05	3D6	F	3	1	Trample	4	1	Nil	Short	Diving Blow	5	—	F10, A9	11/22/44
6	Herbivore	Intermittent	H07	1	—	50	20	Tail	1	3	Nil	Short	Armed	1	½	F13, A3	10/19/38
7	Herbivore	Intermittent	H07	1	—	50	20	Tail	1	3	Nil	Short	Armed	1	½	F13, A3	10/19/38
8	Herbivore	Grazer	H08	1	F	50	3	Tail	8	4	1	Short	Armed	4	—	F12, A6	6/12/23
9	Herbivore	Grazer	H08	1	F	50	3	Tail	8	4	1	Short	Armed	4	—	F12, A6	6/12/23
10	Omnivore	Hunter	O04	1	F	1	1	Projectile	5	1	Nil	2	Thrown Weapon	5	—	F10, A8	8/15/30
11	Omnivore	Hunter	O04	1	F	1	1	Projectile	5	1	Nil	2	Thrown Weapon	5	—	F10, A8	8/15/30
12	Omnivore	Gatherer	O05	1	—	6	2	Projectile	6	4	Nil	8	Thrown Weapon	7	—	F11, A11	10/19/37
13	Omnivore	Gatherer	O05	1	—	6	2	Projectile	6	4	Nil	8	Thrown Weapon	7	—	F11, A11	10/19/37
14	Carnivore	Killer	C03	1	F	12	2	poison/claw	8	1D3p3	Nil	Short	Armed	4	—	A2, F13	8/16/31
15	Carnivore	Killer	C03	1	F	12	2	poison/claw	8	1D3p3	Nil	Short	Armed	4	—	A2, F13	8/16/31
16	Carnivore	Killer	C05	1	F	50	20	Claws	17	12	1	Short	Armed	6	—	A14, F5	9/17/33
17	Carnivore	Killer	C05	1	F	50	20	Claws	17	12	1	Short	Armed	6	—	A14, F5	9/17/33
18	Scavenger	Reducer	S02	1	F	1	1	Coils	9	2	Nil	Short	Strangle	4	—	F4, A2	5/9/17
19	Scavenger	Carrion-Eater	S01	2D6	F	1	1	Tail	6	1	Nil	Short	Armed	1	—	F13, A9	11/22/43
20	Scavenger	Carrion-Eater	S01	2D6	F	1	1	Tail	6	1	Nil	Short	Armed	1	—	F13, A9	11/22/43

World: Poyzen UWP: X-787000-0 Terrain Type: Broken Other Information: Colony Island

D20	Category	Type	Name	Qty	Spec Att	Wt (kg)	Hits	Wpn	To Hit	Dam	Pen	Rng	Type of Melee Atk	Init	Armor	Behavior	Speed
1	Herbivore	Intermittent	H09	1	F	1	1	Horn	6	3	Nil	Short	Armed	1	—	F11, A4	7/17/28
2	Herbivore	Intermittent	H09	1	F	1	1	Horn	6	3	Nil	Short	Armed	1	—	F11, A4	7/17/28
3	Herbivore	Intermittent	H09	1	F	1	1	Horn	6	3	Nil	Short	Armed	1	—	F11, A4	7/17/28
4	Herbivore	Intermittent	H09	1	F	1	1	Horn	6	3	Nil	Short	Armed	1	—	F11, A4	7/17/28
5	Herbivore	Intermittent	H09	1	F	1	1	Horn	6	3	Nil	Short	Armed	1	—	F11, A4	7/17/28
6	Herbivore	Intermittent	H09	1	F	1	1	Horn	6	3	Nil	Short	Armed	1	—	F11, A4	7/17/28
7	Herbivore	Filterer	H10	1	—	3	1	Hooves & teeth	9	6	Nil	Short	Armed	4	—	F3, Ap	1/2/4
8	Herbivore	Intermittent	H11	1	F	1	1	Quills	6	3	Nil	Short	(Def only)	1	—	F13, A12	5/10/20
9	Herbivore	Intermittent	H11	1	F	1	1	Quills	6	3	Nil	Short	(Def only)	1	—	F13, A12	5/10/20
10	Omnivore	Gatherer	O06	1	—	12	1	Quills	4	4	Nil	Short	(Def only)	7	—	F8, A8	5/10/19
11	Omnivore	Gatherer	O06	1	—	12	1	Quills	4	4	Nil	Short	(Def only)	7	—	F8, A8	5/10/19
12	Omnivore	Hunter	O03	1D6	F	6	2	Tail	6	2	Nil	Short	Armed	6	—	F3, A17	11/21/41
13	Omnivore	Hunter	O03	1D6	F	6	2	Tail	6	2	Nil	Short	Armed	6	—	F3, A17	11/21/41
14	Carnivore	Pouncer	C06	1	—	6	10	Acid	6	5	1	Short	Armed	4	½	As, Fs	7/13/25
15	Carnivore	Pouncer	C06	1	—	6	10	Acid	6	5	1	Short	Armed	4	½	As, Fs	7/13/25
16	Carnivore	Killer	C03	1	F	12	2	poison/claw	8	1D3p3	Nil	Short	Armed	4	—	A2, F13	8/16/31
17	Carnivore	Killer	C03	1	F	12	2	poison/claw	8	1D3p3	Nil	Short	Armed	4	—	A2, F13	8/16/31
18	Scavenger	Carrion-Eater	S03	1	—	50	9	Tail	9	6	1	Short	Armed	3	½	F10, A9	9/17/34
19	Scavenger	Carrion-Eater	S01	2D6	F	1	1	Tail	6	1	Nil	Short	Armed	1	—	F13, A9	11/22/43
20	Scavenger	Carrion-Eater	S01	2D6	F	1	1	Tail	6	1	Nil	Short	Armed	1	—	F13, A9	11/22/43

CHAPTER 8: STARS & PLANETS



STARS

These are generated in accordance with the rules presented on TNE page 192, when not using published pregenerated sectors. These can be generated in advance or on a hex-by-hex basis, allowing the universe to be generated randomly as the campaign proceeds.

PLANETS

Planets are generated according to the system found on pages 192-195 of the TNE rulebook. This generation system provides the standard UWP data for such worlds, but planets that are to be surveyed for potential habitation require a closer level of detail, produced in the following section, "Detailing Planets." For the purposes of a world tamer campaign, survey missions will concentrate on worlds within the habitable zones of star systems, so referees should concentrate on detailing those worlds. Details for the remaining (inner and outer zone) worlds of the system may or may not be required in further adventures.



DETAILING PLANETS

This section provides the level of detail required for world tamer survey, colony, and bootstrap missions. This detail need not be generated for all worlds in a campaign, but only those for which detailed exploration or colonization is intended or likely.

I. Years and Days

Calculating a planet's orbital period around its star, which yields the length of its year in days, and calculating the length of the planetary day is a multi-step procedure. To calculate both, you need to know the mass of the primary star the planet is orbiting, and the distance in kilometers from the primary star.

1. Determine the primary star's mass from the Stellar Mass table by cross indexing the star's spectral type with its luminosity class. The resulting value is in solar masses (Sol = 1).

STELLAR MASS

Spectral Type	*Luminosity Class* II	III	IV	V	D
A0	14	12	6	3.2	0.36
A5	11	9	4	2.1	—
F0	10	8	2.5	1.7	0.42
F5	8.1	5	2	1.3	—
G0	8.1	2.5	1.75	1.04	0.63
G5	10	3.2	2	0.94	—
K0	11	4	2.3	0.825	0.83
K5	14	5	—	0.570	—
M0	16	6.3	—	0.489	1.11
M5	16	7.4	—	0.331	—

2. Determine the distance of the planet's orbit from the central star in AUs using the Orbital Distance table.

ORBITAL DISTANCE

Orbit	*AUs*	*Million Kilometers*
0	0.2	29.9
1	0.4	59.8
2	0.7	104.7
3	1.0	149.6
4	1.6	239.4
5	2.8	418.9
6	5.2	777.9
7	10.0	1495.9
8	19.6	2932.0
9	38.8	5804.0
10	77.2	11,548.0
11	154.0	23,038.0
12	307.6	46,016.0
13	614.8	91,972.0
14	1229.2	183,885.0
15	2548.0	367,711
16	4915.6	735.363.0
17	9830.8	1,470,666.0
18	19,661.2	2,941,274.0
19	39,322.0	5,882,488.0

3. Compute the orbital period using this formula:

$$P = \sqrt{D^3 + M}$$

P= Period in standard years. Multiply by 365.25 to convert to standard days.

D= Distance in AUs. Multiply by 149.6 to covert to millions of kilometers.

M= Mass of central star in solar masses (from the Stellar Masses table).

4. Compute the planet's rotation period in hours using this formula:

$$P = 4A + 5 + (M+D)$$

P= Rotation period in hours (Divide by 2 to determine the length of the local day and local night at the equator in hours, and divide by 24 to get rotation period in standard days.)

A= Dice Roll 2D6-2.

M= Mass of the central star in solar masses.

D= Distance from the central star in AUs.

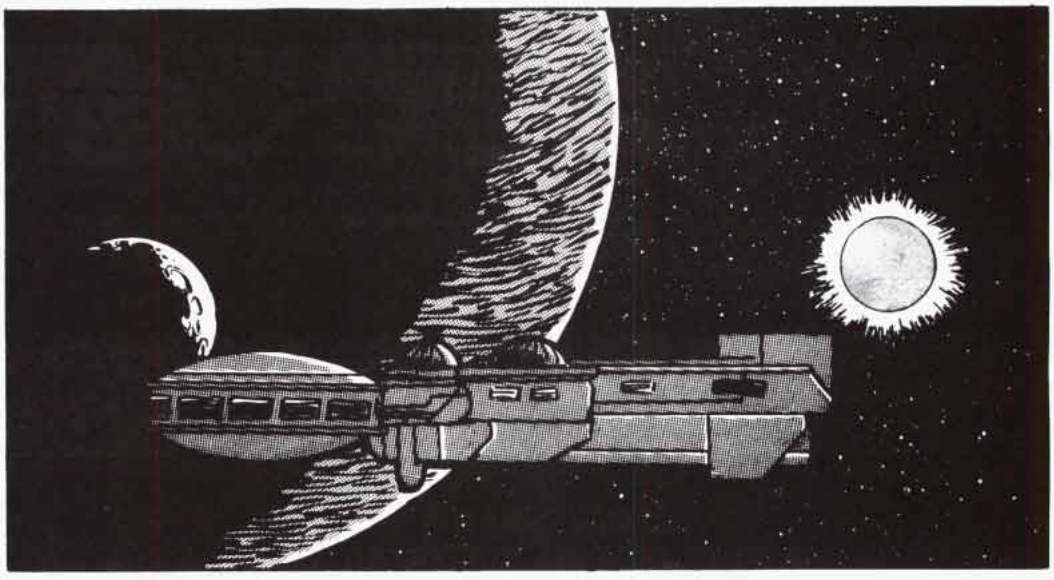
If the result is greater than 40, roll 1D10 for 6+ for the world to be tidally locked. See further discussion below on pages 86 and 90.

If the central star is a K type star roll 1D6. The planet is tidally locked on a result of 4-6.

If the central star is an M type star, and the planet is in the habitable zone, roll 1D6. It is tidally locked on a result of 3-6; if it is in the inner zone it is automatically tidally locked.

5. Determine the planet's orbital eccentricity with the following table. This will be used to compute temperature below.

2D6	*Orbital Eccentricity*
2-7	0.000
8	0.005
9	0.010
10	0.015
11	0.020
12	Roll 1D6 below:
	1 0.025
	2 0.050
	3 0.100
	4 0.200
	5 0.250
	6 extreme (referee's choice)





II. Base Mean Surface Temperature and Variation

Compute the base surface temperature of the world using this formula:

T=L×O×E×G

T = World's base mean surface temperature (Kelvin; subtract 273 to get Celsius)

L = Luminosity of the primary star (From the Luminosity Table).

O = Orbital factor for the world (from the Orbital Factor Table).

G = Greenhouse effect for the world (from The Greenhouse Effect Table).

E = Energy absorption factor for the world (from the Energy Absorption Table). Within each atmosphere type, the column HZ indicates a world with that atmosphere type in the habitable zone, and the column NHZ indicates a world with that atmosphere type not in the habitable zone (i.e., in the inner or outer zone)

LUMINOSITY

Spectral Type	Luminosity Class II	III	IV	V	D
A0	6.85	4.09	3.53	3.08	0.27
A5	5.40	3.08	2.47	2.00	—
F0	4.95	2.70	2.09	1.69	0.13
F5	4.75	2.56	1.86	1.37	—
G0	4.86	2.66	1.60	1.05	0.09
G5	5.22	2.94	1.49	0.90	—
K0	5.46	3.12	1.47	0.81	0.08
K5	7.04	4.23	—	0.53	—
M0	8.24	4.65	—	0.45	0.07
M5	11.05	6.91	—	0.29	—
M9	11.28	7.20	—	0.18	

ORBITAL FACTOR

Orbit	Factor
0	836.345
1	591.385
2	447.045
3	374.025
4	295.693
5	223.523
6	164.021
7	118.277
8	84.484
9	60.046
10	42.569
11	30.140
12	21.326
13	15.085
14	10.668
15	7.544
16	5.335
17	3.772
18	2.667
19	1.886

ENERGY ABSORPTION

UWP Hydro Digit	UWP Atmos 0-3 NHZ	HZ	UWP Atmos 4-9 NHZ	HZ	UWP Atmos A-E NHZ	HZ	UWP Atmos F NHZ	HZ
0	0.800	0.900	0.800	0.900	0.680	0.740	0.800	0.900
1	0.744	0.829	0.811	0.900	0.646	0.697	0.811	0.900
2	0.736	0.803	0.789	0.860	0.635	0.672	0.807	0.882
3	0.752	0.811	0.799	0.860	0.644	0.676	0.817	0.883
4	0.738	0.782	0.774	0.820	0.625	0.648	0.813	0.866
5	0.753	0.789	0.747	0.780	0.599	0.613	0.809	0.850
6	0.767	0.795	0.718	0.740	0.570	0.577	0.805	0.836
7	0.782	0.802	0.687	0.700	0.537	0.539	0.800	0.821
8	0.796	0.808	0.654	0.660	0.500	0.500	0.794	0.807
9	0.810	0.814	0.619	0.620	0.500	0.500	0.787	0.793
A	0.818	0.818	0.619	0.619	0.500	0.500	0.773	0.773

GREENHOUSE EFFECT

Atmos Code	Greenhouse Effect	Atmos Code	Greenhouse Effect
0	1.00	7	1.10
1	1.00	8	1.15
2	1.00	9	1.15
3	1.00	D	1.15
4	1.05	E	1.00
5	1.05	F	1.10
6	1.10		

IIa. Effects of Orbital Eccentricity: The eccentricity of the orbit as calculated above will cause higher temperatures at closest approach to the primary star and lower temperatures at farthest separation from the primary star, as follows:

Tc = O×30
Tf = O×–30

Tc = Temperature modifier at closest approach
Tf = Temperature modifier at farthest separation
O = Orbital eccentricity

IIb. Effects of Latitude: Determine the temperature modification effects of latitude from the following table; noted in terms of hex rows on the global data view planetary map.

LATITUDE TEMPERATURE MODIFIERS

Hex Row	UWP Size Digit Size 1	Size 2, 3	Size 4, 5	Size 6, 7	Size 8, 9	Size A
1	+9	+12	+15	+18	+21	+24
2	+6	+8	+10	+12	+14	+16
3	+3	+4	+5	+6	+7	+8
4	0	0	0	0	0	0
5	–3	–4	–5	–6	–7	–8
6	–6	–8	–10	–12	–14	–16
7	–9	–12	–15	–18	–21	–24
8	–12	–16	–20	–24	–28	–32
9	–15	–20	–25	–30	–35	–40
10	–18	–24	–30	–36	–42	–48
11	–21	–28	–35	–42	–49	–56



III. Seasons

A planet's seasons and corresponding variation in temperature depend primarily on its axial tilt. A planet with no tilt has no seasons, rather it has a constant basic climate all year round. A planet with a high degree of tilt has massive temperature variations between seasons and consequent violent weather, as the atmosphere constantly attempts to equalize the extremes between the seasonal hemispheres. To determine the variations between seasons, follow this procedure:

1. Determine the planet's axial tilt. Roll on the Axial Tilt table.

2. If necessary, roll on the Secondary Axial Tilt table.

Axial Tilt

2D6	Axial Tilt (in degrees)
2-3	0° +(2D6-2)°
4-5	10° +(2D6-2)°
6-7	20° +(2d6-2)°
8-9	30° +(2d6-2)°
10-11	40° +(2d6-2)°
12	Use Secondary table

Secondary Axial Tilt

1D6	Axial Tilt (in degrees)
1-2	50° +(2D6-2)°
3	60° +(2D6-2)°
4	70° +(2D6-2)°
5	80° +(2D6-2)°
6	90°

3. Use the following formula to determine the maximum increase in base temperature during the planet's summer season.

$$T = 0.6A$$

T = the base temperature increase during the summer.

A = axial tilt in degrees.

4. Use the following formula to determine the maximum decrease in base temperature during the planet's winter season.

$$T = A$$

T = the base temperature decrease during the winter.

A = axial tilt in degrees.

5. The above base seasonal temperature changes are modified by latitude as shown on the table below, where latitude is noted as the hex row on the global data view planetary map. For example, in hex row 5 on a world with an axial tilt of 28 degrees, these base temperature changes would be multiplied by 0.75.

IV. Day/Night Temperature Variation

First compute the length of daytime or nighttime by dividing the world's rotational period by 2. Then compute the rotation-luminosity factor R with the following formula:

$$R = L+\sqrt{D}$$

R = Rotation-luminosity factor

L = Luminosity of the primary star as used in the base temperature step above

D = Distance from the primary star in AUs as found on the Orbital Distance table on page 83

The value R is then used to calculate the daytime temperature increase and nighttime temperature decrease below.

Daytime Temperature Increase: The average temperature increase during the world's day is computed based on R above and the length of the local day in hours (as on Daytime Temp Increase table). The plus temp may never exceed the absolute maximum plus temperature.

Nighttime Temperature Decrease: The average temperature decrease during the world's night is computed based on the length of the local night in hours. Minus temp per hour of night is in Celsius degrees (as on Nighttime Temp Decrease table). The minus temp may never exceed the absolute maximum minus temperature.

Daytime Temp Increase

UWP Atm Digit	+Temp per hour of Daylight	Absolute Maximum +Temp
0	1.0°×R	0.1×Max
1	0.9°×R	0.3×Max
2, 3, E	0.8°×R	0.8×Max
4, 5	0.6°×R	1.5×Max
6, 7	0.5°×R	2.5×Max
8, 9	0.4°×R	4.0×Max
D, F	0.2°×R	5.0×Max

Nighttime Temp Decrease

UWP Atm Digit	–Temp per hour of Night	Absolute Maximum –Temp
0	20.0 C	0.80×Base
1	15.0 C	0.70×Base
2, 3, E	8.0 C	0.50×Base
4, 5	3.0 C	0.30×Base
6, 7	1.0 C	0.15×Base
8, 9	0.5 C	0.10×Base
D, F	0.2 C	0.05×Base

Max : the Base Mean Surface Temperature (Kelvin) as calculated earlier × R

Base : the Base Mean Surface Temperature (Kelvin) as calculated earlier

V. Axial Tilt Effects

Hex Row	Degree of Axial Tilt: 0	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-45	46-60	61-84	85+
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.50	0.75	1.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.50	0.75	1.00	1.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.50	0.75	1.00	1.00	1.00
4	0.00	0.00	0.00	0.00	0.00	0.25	0.50	0.75	1.00	1.00	1.00	1.00
5	0.00	0.00	0.00	0.00	0.25	0.50	0.75	1.00	1.00	1.00	1.00	1.00
6	0.00	0.00	0.00	0.25	0.50	0.75	1.00	1.00	1.00	1.00	1.00	1.00
7	0.00	0.00	0.25	0.50	0.75	1.00	1.00	1.00	1.00	1.00	1.00	1.00
8	0.00	0.00	0.50	0.75	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
9	0.00	0.25	0.75	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
10	0.00	0.50	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
11	0.25	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00



VI. Temperature Worksheet

Creation of a temperature worksheet as follows allows rapid consultation of maximum and minimum temperatures for all planetary hex rows.

Note that column 3 shows the base temperature for all hex rows in Celsius degrees, column 9 shows the highest possible temperature for each hex row (Celsius), and column 15 shows the lowest possible temperature for all hex rows (Celsius).

The upper worksheet may be photocopied by owners of this book to assist in detailing their own worlds.

The lower worksheet is a sample, filled out for a UWP size 8 world with a dense atmosphere, 26° axial tilt, 25 hour rotational period, and orbital eccentricity of 0.020. The temperature values used are: base temperature of 9°C, summer plus of 16°C, winter minus of 26°C, daytime plus of 5°C, nighttime minus of 7°C, and orbital eccentricity plus/minus of 1°C.

				Highest Possible Temp						Lowest Possible Temp					
Col:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Hex	*Base*	*Latitude*	*Cols.*	*Summer*	*Ax. Tilt*	*Cols.*	*Daytime*	*Orbit*	*Cols.*	*Winter*	*Ax. Tilt*	*Cols.*	*Night*	*Orbit*	*Cols. 3+12*
Row	*Temp*	*Mod*	*1+2*	*Plus*	*Factor*	*4×5*	*Plus*	*Ecc Plus*	*3+6+7+8*	*Minus*	*Factor*	*11×12*	*Minus*	*Ecc Minus*	*+13+14*
1															
2															
3															
4															
5															
6															
7															
8															
9															
10															
11															

				Highest Possible Temp						Lowest Possible Temp					
Col:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Hex	*Base*	*Latitude*	*Cols.*	*Summer*	*Ax. Tilt*	*Cols.*	*Daytime*	*Orbit*	*Cols.*	*Winter*	*Ax. Tilt*	*Cols.*	*Night*	*Orbit*	*Cols. 3+12*
Row	*Temp*	*Mod*	*1+2*	*Plus*	*Factor*	*4×5*	*Plus*	*Ecc Plus*	*3+6+7+8*	*Minus*	*Factor*	*11×12*	*Minus*	*Ecc Minus*	*+13+14*
1	9	+21	30	+16	0.00	+0	+5	+1	36	–26	0.00	–0	–7	–1	22
2	9	+14	23	+16	0.00	+0	+5	+1	29	–26	0.00	–0	–7	–1	15
3	9	+7	16	+16	0.25	+4	+5	+1	26	–26	0.25	–7	–7	–1	2
4	9	0	9	+16	0.50	+8	+5	+1	23	–26	0.50	–13	–7	–1	–12
5	9	–7	2	+16	0.75	+12	+5	+1	20	–26	0.75	–20	–7	–1	–25
6	9	–14	–5	+16	1.00	+16	+5	+1	17	–26	1.00	–26	–7	–1	–39
7	9	–21	–12	+16	1.00	+16	+5	+1	10	–26	1.00	–26	–7	–1	–46
8	9	–28	–19	+16	1.00	+16	+5	+1	3	–26	1.00	–26	–7	–1	–53
9	9	–35	–26	+16	1.00	+16	+5	+1	–4	–26	1.00	–26	–7	–1	–60
10	9	–42	–33	+16	1.00	+16	+5	+1	–11	–26	1.00	–26	–7	–1	–67
11	9	–49	–40	+16	1.00	+16	+5	+1	–18	–26	1.00	–26	–7	–1	–74

VII. Temperature on Tidally Locked Planets

Worlds which are tidally locked to their primary stars have their temperatures computed differently.

The base temperature applies to the twilight region between the world's light and dark side, rather than hex row 4. By convention, the twilight region is in hex row 1 on the map (both rows on either side of the equator). Also by convention, the top hexrows are the permanent dayside, and the bottom hexrows are the permanent nightside.

Use the maximum plus for the daytime plus, since daytime is effectively infinite.

To determine the latitude mod per hexrow on the dayside, divide the daytime plus by the world's UWP size digit (but the dayside plus temperature must never exceed the maximum daytime plus in any hex row, however).

Use the maximum minus for the nighttime minus, since nighttime is effectively infinite.

To determine the latitude mod per hexrow on the nightside, divide the nighttime minus by the world's UWP size digit (but the nightside temperature minus must never exceed the maximum nighttime minus in any hex row, however).

Axial tilt has no effect, as the world does not rotate.

Orbital eccentricity works normally.



VIII. Density & Gravity

Use these tables to determine the density of the planet, and from that information, the planet's surface gravity.

WORLD DENSITY

1D6	Density
1	Low
2-4	Average
5-6	High

DMs: -2 if the world is in the outer zone. Modified rolls of less than 1 are treated as 1.

DENSITY EQUIVALENT

Density	Density Equivalent in Earths (Terra = 1)
Low	.55
Average	1.0
High	1.55

IX. World Mass

If the planet has a satellite, the world's mass must be calculated in order to calculate the satellite's orbital period. To determine world mass, use this formula.

$$M=K\times(R+8)^3$$

M= Mass in standard masses (Terra = 1)
K= Planet's density in Earths (see Density Equivalent table).
R= UWP size digit (use 0.6 for size S).

WORLD GRAVITY

Diameter	Density: Low	Average	High
1600 (1)	.10	.15	0.3
3200 (2)	.15	.25	0.5
4800 (3)	.30	.40	0.8
6400 (4)	.35	.50	1.0
8000 (5)	.45	.60	1.2
9600 (6)	.55	.80	1.6
11,200 (7)	.60	.90	1.8
12,800 (8)	.70	1.0	2.0
14,400 (9)	.70	1.1	2.2
16,000 (A)	.80	1.3	2.6

Satellites

Many planets will have satellites, and some gas giants located in the habitable zone will have satellites that are habitable and which can serve as the main world of a system. The presence and characteristics of satellites are determined using the procedures in **TNE**, pages 194-195.

Orbital Period: To determine the orbital period of a satellite around its central planet, follow this procedure:

1. Multiply the planet's radius (half the diameter listed in the UWP World Size table on Page 188 of **TNE**) by the orbit number (**TNE** page 195) to calculate the satellite's distance from its planet in kilometers.
2. Calculate the mass of the central planet as described in the previous section.
3. Use the following formula to compute the orbital period:

$$P=\sqrt{([D+400{,}000]^3\times 793.64)+M}$$

P= Period in standard days
D= Distance in kilometers
M= Mass of central planet in standard masses

Satellite Rotation Period: Compute the satellite's rotation period in hours using this formula:

$$P = (4A) + 5 + (M+D)$$

P= Rotation period in hours (Divide by 2 to determine the length of the local day and local night at the equator in hours, and divide by 24 to get rotation period in standard days.)
A= Dice Roll 2D6-2
M= Mass of the planet in standard masses
D= Distance from the planet in kilometers divided by 400,000

If the result is greater than 40, the satellite is tidally locked to its central world on a 1D10 roll of 6+.





MAPPING A WORLD

This section describes how to draw a map based on the detailed data generated so far. **Traveller** uses a hex grid in the form of a flattened icosahedron (a 20-sided solid the same shape as 20-sided die) for mapping the surface of a world. The map is divided into 20 interlocking triangles of 25 hexes each, totaling 500 hexes per map. These hexes are called "planetary hexes." The equator is 35 planetary hexes long. Blank copies of this standard map format, called the "global data view," are available in the **Traveller Players' Forms** book.

Note that the following material is presented as guidelines only. As such, they are intended to be aids to creativity, and not boundaries upon it. Within the parameters of the previously generated UWP data, referees and world designers should feel free to create world maps using whatever methods are comfortable for them.

Planetary Hex Size

The Survey chapter of this book contains a discussion of planetary hexes and their relationship to 20-kilometer mapping hexes as used in the Survey, Colony, and Bootstrap chapters. Page 20 contains a table showing the dimensions of planetary hexes for each of the UWP world sizes. Note that these figures are based on the average world diameter for that UWP size, not the entire possible range. (For example, a UWP size code of 8 indicates worlds whose diameters range from 12,000 km to 13,599 km, with an average diameter of 12,800 km. See **TNE** page 188 for more details.)

For conversion to 20-km mapping hexes, it is best to stick with the average diameter figure which is used on the page 20 table. For those who prefer to know the exact actual size of each hex based on the world's actual diameter, use the following procedure.

1. Calculate the circumference of the world by multiplying its diameter in kilometers by 3.1416.
2. Divide the resulting circumference by 35.

This is the width (between opposite hexsides) of the planetary hex.

Tectonic Plates

Multiple tectonic plates occur on worlds with average and high densities (low density worlds have only a single tectonic plate). Multiple plates are the solid world crust floating atop the planet's molten mantle, and separated by fault zones. They may be converging, traversing, or diverging.

Converging tectonic plates cause heavy seismic activity and build mountains as they collide.

Traversing plates are relatively stable, but slide against each other causing seismic activity.

Diverging plates are separating, creating vast trenches in the planet's crust.

Number of Plates: To calculate the number of tectonic plates on a planet:

Add the world's UWP size and UWP hydrosphere digits and subtract 2D6.

Note that it is possible for world to have only one tectonic plate (as is already the case with low density worlds). This world would have little or no seismic activity.

Tectonic Plate Size	
1D6	*Size in Hexes*
1	2D×5
2	2D×10
3	2D×15
4	2D×20
5	2D×25
6	2D×30

Size of Plates: For mapping purposes, calculate the number of hexes per tectonic plate. To do this, roll 1D6 on the Tectonic Plate Size table

By default, the last tectonic plate placed is the largest, and is always as large as the remaining number of hexes on the world map grid. Exact placement of the plates is up to the referee or world designer. Sketch them lightly in pencil on the map grid; they won't appear on the final map, but they'll be useful in determining the layout of continents and oceans, establishing seismic effects, and locating some terrain features.

Plate Movement: For each plate boundary, roll on the table at the right to determine plate movement.

Tectonic Plate Movement	
2D6	*Movement*
2	Converging
3	Converging
4	Converging
5	Converging
6	Traversing
7	Traversing
8	Traversing
9	Diverging
10	Diverging
11	Diverging
12	Diverging

Continents & Oceans

Once the tectonic plates are located, the designer can begin outlining continents and oceans. This depends on the planet's UWP hydrographic code. If it is 5 or less, map oceans first, and all leftover hexes will be land masses. If it is 6 or greater, map continents first, with all leftover hexes becoming oceans and other bodies of water. If no water is present (code 0), go directly to determining terrain.

Mapping Water Hexes

First calculate the actual hydrographic percentage. See the World Hydrographics table on **TNE** page 188 to see the minimum and maximum hydrographic percentage for each code. For example, a digit of 4 indicates a value between 35 and 44 percent. Use 1D10 to find the exact number in this range by adding the 1D10 result to the minimum number, and treating results of "10" as "0."

To calculate the total number of water hexes on the planet, multiply the actual hydrographic percentage by 5. Thus a world with a hydrographic percentage of 42% has 210 water hexes out of 500 total hexes.

To calculate the number of land hexes, subtract the water hexes from 500. Our sample world has 290 land hexes (500-210 = 290).

If the planet has 49% or less water, determine exactly how many lakes, seas and oceans are present. To do this:

1. Multiply the planet's UWP hydrographic code by 3.
2. Roll 1D6 and add the result to the result in step 1.
3. Compare the result to the Oceans Table.

Oceans			
Result	*Major Oceans*	*Minor Oceans*	*Other Bodies of Water*
1	0	0	No Significant Water Surface
2	0	0	No Significant Water Surface
3	0	0	Scattered Lakes
4	0	0	Scattered Lakes
5	0	0	1D6-3 Small seas, 2D6 scattered lakes
6	0	0	2D6-3 Small seas, 2D6 scattered lakes
7	1D6-4	1D6-3	3D6-3 Small seas, 2D6 scattered lakes
9	1D6-3	1D6-2	3D6-3 Small seas, 2D6 scattered lakes
10	1D6-3	1D6-1	3D6-3 Small seas, 2D6 scattered lakes
11	1D6-2	1D6-1	3D6-3 Small seas, 2D6 scattered lakes
12	1D6-2	2D6-2	3D6-3 Small seas, 2D6 scattered lakes
13	1D6-1	1D6-1	3D6-3 Small seas, 2D6 scattered lakes
14	1D6-1	2D6-2	3D6-3 Small seas, 2D6 scattered lakes
15	1D6-1	3D6-3	3D6-3 Small seas, 2D6 scattered lakes
16	1D6	2D6-2	3D6-3 Small seas, 2D6 scattered lakes
17	1D6	3D6-3	3D6-3 Small seas, 2D6 scattered lakes
18	1D6	1D6-1	3D6-3 Small seas, 2D6 scattered lakes
19	1	1D6-1	3D6-3 Small seas, 2D6 scattered lakes
20	1	2D6-2	3D6-3 Small seas, 2D6 scattered lakes
21	1	3D6-3	3D6-3 Small seas, 2D6 scattered lakes



Scattered Lakes: Scattered lakes are very small bodies of water; a hex containing scattered lakes is considered to be 1/2 of a hex of water surface. Determine the location of scattered lakes before placing other bodies of water. Divide the number of scattered lakes by two and subtract that valve from the water hex total.

Small Sea: Small seas cover roughly one hex of water surface. The number of small seas is in the Oceans Table "Other Bodies of Water Column." Deduct the small sea hexes from the water hex total before determining the size of major and minor oceans.

Major Oceans: A major ocean is a body of water that covers 15% or more of the world's water surface area. As an example, if a world has 160 water hexes, each major ocean must cover at least 24 hexes. If there is only one major ocean, it will include almost all of the planet's water surface area.

Minor Oceans: Any water surface area left after major oceans are placed is divided into minor oceans. A minor ocean covers less than 15% of the planet's water surface area.

Any body of water can have major islands (1 hex) and archipelagoes (1/2 hex).

Mapping Land Hexes

If the actual hydrographic percentage of a world is between 50 and 100%, map the land hexes first. The remaining hexes are water hexes. If the hydrographic percentage is 100%, any land will be incidental islands.

To calculate the number of land hexes, subtract the water hexes from 500.

If the planet has 51% or more water, determine exactly how many major and minor continents and islands are present. To do this:

1. Multiply the planet's UWP hydrographic code by 3.
2. Roll 1D6 and add the result to the result in step 1.
3. Compare the result to the Continents Table.

CONTINENTS

Result	Major Continents	Minor Continents	Other Land Masses
16	2D6+1	1D6-1	3D6-3 Major Islands, 2D6 Archipelagoes
17	2D6+1	2D6-2	3D6-3 Major Islands, 2D6 Archipelagoes
18	2D6+1	3D6-3	3D6-3 Major Islands, 2D6 Archipelagoes
19	2D6	1D6-1	3D6-3 Major Islands, 2D6 Archipelagoes
20	2D6	2D6-2	3D6-3 Major Islands, 2D6 Archipelagoes
21	2D6	3D6-3	3D6-3 Major Islands, 2D6 Archipelagoes
22	1D6	1D6-1	3D6-3 Major Islands, 2D6 Archipelagoes
23	1D6	2D6-2	3D6-3 Major Islands, 2D6 Archipelagoes
24	1D6	3D6-3	3D6-3 Major Islands, 2D6 Archipelagoes
25	1D6-1	1D6	3D6-3 Major Islands, 2D6 Archipelagoes
26	1D6-1	2D6	3D6-3 Major Islands, 2D6 Archipelagoes
27	1D6-1	3D6	3D6-3 Major Islands, 2D6 Archipelagoes
28	1D6-2	1D6-1	3D6-3 Major Islands, 2D6 Archipelagoes
29	1D6-3	1D6-2	3D6-3 Major Islands, 2D6 Archipelagoes
30	1D6-4	1D6-3	2D6 Major Islands, 2D6 Archipelagoes
31	0	0	1D6-3 Major Islands, 2D6 Archipelagoes
32	0	0	Archipelagoes
33	0	0	Archipelagoes
34	0	0	Archipelagoes
35	0	0	No significant land surface
36	0	0	No significant land surface

Archipelagoes: Archipelagoes are groupings of small islands, considered to be 1/2 of a hex of land surface. Archipelagoes are placed prior to major islands and larger land masses. Divide the number of archipelago hexes by 2 and subtract the result from the total number of land hexes.

Major Islands: Major islands are land areas covering roughly one hex. The "Other Land Masses" column on the Continents Table indicates how many major island hexes are present on a world. Deduct the number of major island hexes from the total number of land hexes before determining the size of major or minor continents.

Major Continents: A major continent covers at least 15% of the land surface area of a world. The Terran equivalents of major continents are Eurasia (37%), Africa (20%), and North America (16%). The other continents are minor continents.

Minor Continents: Any land surface remaining after major continents have been placed are divided up between minor continents. A minor continent covers less than 15% of the world's land surface.

Note that any land mass can have land-locked small seas (1 water hex each) and scattered lakes (1/2 water hex each).

Placement

Next, place the land and water bodies determined above, using the tectonic plates as guides. When placing continents, divide them up as evenly as possible among the tectonic plates. Ideally, there should be one continent per plate. Plates may also underlie oceans. Plates overlap when there is more than one plate per continent, or when a continental plate lies next to an oceanic plate. These are active seismic zones.

Continents separated by only one hex may be joined by a narrow strip of land called an isthmus. Likewise, oceans only one hex apart may be joined by a strait. Decide these options either by personal preference or with a random die roll (9 or above on 2D6 indicating the presence of an isthmus or strait).

Terrain

Once the land masses are placed, it is time to map the planet's terrain. This includes surface feature terrain such as ice caps, tundra, steppes, mountains, badlands, and open terrain; life influenced terrain including deserts, jungles, and forests; and terrain affected by civilization: cities and farmlands.

Ice Caps: These are frozen wastes covered with ice. To determine how far from the poles ice caps extend and where tundra is located, use the axial tilt and temperature determination procedure in the "Seasons" section of this chapter. The temperatures generated by this procedure will indicate how many hex bands from each pole have below 0° Celsius freezing conditions all year round.

Tundra: Tundra is marshy, semi-frozen open terrain located usually within one hex next to the polar icecaps (if any).

Steppes: Steppes are open grasslands with very few trees, if any. Steppes may be placed anywhere except in the polar regions or in coastal hexes.

Mountains: Mountains are created by plate tectonics. Place mountain ranges along tectonic plate boundaries on land hexes. Mountain ranges are represented by two or more contiguous mountain hexsides. (Island chains—which are the tops of mountains rising from the seabed—may be placed along undersea tectonic plate boundaries.)

Badlands: Badlands occur next to mountain hexsides, much like tundra occurring next to ice caps. This is rugged, high terrain with broken ground, gullies and cliffs.

Deserts: There are three types of desert:

Continental Deserts: Continental deserts are placed on any continent where ten or more contiguous, non-tundra, non-badland hexes are present and a 2D6 dice throw of greater than or equal to the planet's UWP code is made. If a desert result occurs, roll 2D6-1 for the number of desert hexes present. When only one continent is present, check once per map triangle with 10 or more contiguous open hexes.



Wind Shadow Deserts: Wind shadow deserts occur because mountain barriers block movement of moisture in the atmosphere. There are wind shadow desert hexes equal to the planet's UWP hydrographic code–1D6. Place them next to mountain or badlands hexes.

Coastal Deserts: Coastal deserts occur because prevailing winds blow moisture out to sea. There are coastal desert hexes equal to the planet's UWP hydrographic code -2D6. They may be placed in any coastal hex within four hexes of the polar caps.

All desert terrain is dry and supports very little to no life.

Jungles: Jungle hexes are placed in regions where temperatures range between 20° and 40° Celsius. If a group of 10 contiguous, non-desert, non-badlands hexes exist on a continent with this temperature range, and a throw of less than or equal to the UWP hydrographic code is made on 2D6, a jungle is present. Islands and archipelagoes may also have jungle terrain. Roll 2D6-1 for the number of island jungle hexes. Jungle hexes must be within three hexes of an ocean or sea. They may not be next to desert hexes.

Jungles teem with life, but are difficult to cultivate or travel through.

Mixed: All remaining hexes are mixed hexes. These are forested if in a wild state, or cultivated farmland if settled. Cities and other settlements are generally located in mixed terrain hexes, usually along rivers or on seacoasts for access to transportation or to a water supply.

Starports: Starports are usually located in mixed terrain, on or near the equator. The equatorial location enables departing ships to take advantage of the planet's rotational velocity at liftoff.



Tidally Locked Worlds

A tidally locked world always has one hemisphere facing its primary star in perpetual daylight and the other facing away in perpetual night. Habitable regions are generally located in the twilight band between the center of the hot hemisphere and the center of the cold hemisphere.

When mapping a tidally locked world, designate the top of the map grid as the starward side or "hot pole" and the bottom of the grid as the nightside or "cold pole." The equator becomes the twilight band where most inhabitants live.

The world's hottest temperature is located at the hot pole, and the coldest temperature at the cold pole. The base surface temperature is found in the center of the twilight band, where the primary star perpetually lingers on the horizon.

Ice sheets cover the cold pole while sun-baked deserts cover the hot side. Any oceans would be found near the equator, fed by drainage from the melting cold polar cap.

ATMOSPHERIC COMPOSITION

This section is intended as an optional tool for referees who wish to add specific detail to **Traveller** worlds. It is not intended as a substitute for the standard UWP atmosphere guidelines discussed elsewhere in this book (Chapter 3, Survey) or in other **Traveller** products.

The mix of gases that make up a world's atmosphere depends on their molecular weight and the minimum molecular weight retained by the world's gravity. The Minimum Molecular Weight Retained table shown here contains values for Low, Average, and High Density worlds with UWP sizes ranging from 1 to A. Note that this density refers to the density of the planetary body, not the planet's atmosphere.

MINIMUM MOLECULAR WEIGHT RETAINED

UWP	*Low Density*	*Average Density*	*High Density*
1	vac	vac	vac
2	vac	vac	90
3	91	45	32
4	63	31	22
5	35	17	12
6	28	14	10
7	18	9	6
8	13	6	4
9	11	5	3
A	8	3	1



Compare the minimum molecular weight retained figure with the molecular weight of gases shown in the Molecular Weight of Gases table. The world's atmosphere will retain gases which have a molecular weight of at least the figure shown for the world's UWP size figure and density. As an example, an average density UWP size 8 world will retain gases in its atmosphere with a molecular weight of 6 or higher.

Molecular Weight of Gases

Constituent	*Molecular Weight*
Molecular Hydrogen (H_2)	2.00
Helium (He)	4.00
Methane (CH_4)	16.00
Ammonia (NH_3)	17.00
Water Vapor (H_2O)	18.00
Neon (Ne)	20.20
Molecular Nitrogen (N_2)	28.00
Carbon Monoxide (CO)	28.00
Nitric Oxide (NO)	30.00
Molecular Oxygen (O_2)	32.00
Hydrogen Sulfide (H_2S)	34.10
Argon (Ar)	39.00
Carbon Dioxide (CO_2)	44.00
Nitrous Oxide (N_2O)	44.00
Nitrogen Dioxide (NO_2)	46.00
Ozone (O_3)	48.00
Sulfur Dioxide (SO_2)	64.10
Sulfur Trioxide (SO_3)	80.10
Krypton (Kr)	83.80
Xenon (Xe)	131.30

Notes on Selected Atmospheric Gases

Ammonia (NH_3): An irritant gas, ammonia requires protective measures even in mild concentrations. Unlike methane, ammonia has a sharp, pungent odor, and leaks are quickly noticed.

Worlds with ammonia are much like those with methane: large, cold, and with standard to very dense pressure. Ammonia is postulated as an alternative to oxygen as a life-supporting gas.

Carbon Dioxide (CO_2): A non-irritant gas, CO_2 occurs commonly, either by itself or in various combinations. Worlds with carbon dioxide in the atmosphere may be in the early stages of developing carbon-based life (although within a few hundred million years the atmosphere will have changed completely). On the other hand, the local life may be evolving in a totally alien direction.

Carbon dioxide atmospheres have the property of trapping heat, causing a greenhouse effect, which may force the world's temperature far above the range in which humans can survive without protective equipment. A runaway greenhouse effect can turn a world into a hostile inferno, and thus be rated as a corrosive or insidious atmosphere.

Hydrogen (H_2): A non-irritant gas, hydrogen is not poisonous. However, like methane, hydrogen combines explosively with oxygen. A spark can cause an explosion, followed by the precipitation of water, the product of the combination of these two elements. Hydrogen will make up a significant proportion of the atmosphere on large, cold worlds, and is often found in combination with methane and ammonia.

The smallest and lightest of atoms, hydrogen poses a special problem that can require an atmosphere containing any significant amount of it to be rated insidious. The atoms are so small that they can seep right through fabrics, plastics, and even solid metal in a process called diffusion. An airtight seal is not necessarily hydrogen-tight. Starship hulls and the walls of buildings can be sealed against hydrogen leakage; vac suits, however, cannot.

Methane (CH_4): A non-irritant gas, methane (also known as "natural gas") is dangerous if mixed at a low (7-14%) concentration with a standard oxygen-nitrogen atmosphere. Any spark can cause the methane to explode and burn fiercely. This can pose a hazard to adventurers if methane leaks into their habitat, space ship, or vac suit. Pure methane is an odorless, colorless gas, making detection almost impossible.

It is unlikely that free oxygen will be found in an atmosphere containing a significant amount of methane. Methane generally occurs as an active component of the atmosphere on large, cold worlds.

Nitrogen (N_2): a semi-irritant gas, nitrogen is relatively inert in atmospheres with standard temperatures and pressures. If nitrogen and oxygen are present in an atmosphere with more extreme temperature and pressure conditions, the atmosphere becomes more hostile, forming nitrides (nitrogen-oxygen compounds) or nitric acid (NHO_3). Nitrogen occurs in world atmospheres more often than any other gas.

Sulfur Compounds: A variety of sulfur compounds can be found in various atmospheres, from non-irritant to corrosive.

Sulfur compounds in the atmosphere can result from prolonged heavy industrialization, or can occur naturally from heavy volcanic activity. Sulfur compounds are a possible alternative to the more usual carbon-based organic chemistry. Such life forms would be totally alien.

Oxygen Percentage

The percentage of free oxygen in a planet's atmosphere depends on the percentage of water covering the world. For purposes of this rule, worlds with a UWP atmosphere code of 0-9 have hydrospheres consisting of water, while worlds with atmosphere codes of A-C have hydrospheres consisting of fluids other than oxygen (and, by definition, do not themselves consist of oxygen in any case). The Oxygen Percentage table shows the percentage of free oxygen in a world's atmosphere based on its UWP hydrographic code.

Oxygen Percentage

UWP Hydrographic Code	*Percentage of Free Oxygen*
0	5
1	10
2	12
3	14
4	16
5	18
6	19
7	20
8	22
9	24
A	26

Note that if the roll for an atmospheric taint (see page 16 of the Survey chapter) results in either a high oxygen or low oxygen taint, the taint results override the Oxygen Percentage table, indicating that some unknown external factors have caused this taint.

CHAPTER 9: DESIGN SEQUENCES



BLACK POWDER FIREARM DESIGN

This design sequence is aimed at designing "primitive" firearms, by which we mean weapons firing black powder ammunition. This ammunition consists solely of a bullet and a quantity of black powder. Sometimes the ammunition is included in complete cartridges, wrapped in paper, while at other times the bullets and loose powder are carried and loaded separately.

Due to the tremendous variety of weapons available in a relatively narrow technological band, the following rules make reference to tech levels 2M and 3M ("mature TL-2" and "mature TL-3", where TL-2M is more advanced than TL-2 but not as good as TL-3, and TL-3M is better than TL-3 but not as good as TL-4). The items available at these tech levels represent more mature versions of weapons used at the main tech levels. All tech level 3 weapons designed using the standard design sequence in **Fire, Fusion & Steel** (including tech level 3 brass cartridge ammunition) should be considered 3M technology. Whether or not mature technology items are available on a world or at a given tech level is entirely up to the referee.

The following design sequence parallels that provided in **Fire, Fusion and Steel**, but does not require that product to use. As classic firearms are defined almost as much by their ammunition as by their own construction, small arms design consists of two parts: ammunition design and weapon design.

PART I: Ammunition Design

Ammunition is defined by five characteristics: the tech level, the diameter of the bullet in millimeters (also refered to as caliber), the type of the bullet (spherical, conical, or shot), the length of the cartridge in millimeters, and the type of cartridge (paper or loose powder).



Tech Level: Black powder small arms are available at tech levels 2 and 3. By tech level 4 virtually all firearms use smokeless powder and fixed metallic cartridge cases.

Bullet: The diameter of the bullet in millimeters is called its caliber, and weapons are commonly referred to by their caliber, such as 18mm. Although standard weapons listed in the game are usually in increments of 0.5 millimeters (such as 5.5mm, 7.5mm, etc.) weapons may be designed in any caliber desired, such as 11.43mm or 4.71mm. Small arms may be made in any caliber up 20mm. (Weapons of 20mm and above are usually considered to be cannons.)

Bullet Type: Spherical bullets and shot are available at tech level 2. Conical bullets are available at tech level 3M. Prior to the adoption of conical bullets, rifles fire "patched spherical bullets," which are bullets wrapped in a leather patch to insure a tight fit in the barrel.

If the bullet type is shot (a shotgun shell) the number of bullets in the shell must be specified at this time. The number of bullets must be a multiple of 4.

Cartridge Length: The length of the cartridge is a means of defining how much powder is used to propell the bullet, and is the actual length of the barrel cavity in millimeters filled with powder when the weapon is loaded. The longer the cartridge, the more propellant is contained in it and therefore the more powerful the ammunition.

Ammunition is often referred to by two numbers, the caliber followed by the cartridge length, which helps distinguish it from other ammunition of the came caliber. In the case of shotgun shells the length includes the container for the bullets as well, and so 12 gauge shotgun shells (the most common current shotgun round) is also called 18.5x70mm round, even though the powder cartridge is much shorter than 70mm.

Cartridge Type: For our purposes there are two types of black powder cartridges: loose and paper. Loose cartridges are actually separately carried bullets and powder (often in a powder horn). Paper cartridges include both a bullet and a pre-measured amount of powder all wrapped in paper and sealed against moisure using either wax or grease.

Ammunition Evaluation

Once the ammunition round has been designed, determine its length, weight, magazine weight, and average muzzle energy.

Length: The ammunition length is determined using the following formulae:

$$Lab = Lc + d$$
$$Lac = Lc + 2d$$
$$Lasg = Lc$$

Lab: Length (in millimeters) of spherical bullet ("ball").
Lac: Length (in millimeters) of conical bullet.
Lasg: Length (in millimeters) of shotgun ammunition.
Lc: Length (in millimeters) of the cartridge.
d: Diameter (in millimeters) of the bullet.

Weight: The ammunition weight is determined using the following formula:

$$\mathbf{Wa = AwmLc\pi r^2}$$

r: Radius (in millimeters) of the bullet (half the diameter).
π: 3.1416
Wa: Weight (in grams) of a complete round of ammunition.
Lc: Length (in millimeters) of the cartridge.
Awm: Ammunition weight multiplier, which depends on the bullet type, as shown below.

Ammo Type	*Awm*
Shotgun shell	0.003
Spherical ball	0.003
Conical bullet	0.005

Average Muzzle Energy: The average muzzle energy of ammunition is determined using the following formula. (The actual muzzle energy will be affected by the design of the weapon itself.)

$$\mathbf{Ea = TmCmLc\pi r^2}$$

Ea: Average muzzle energy (in joules) of a cartridge.
Lc: Length (in millimeters) of the cartridge.
r: Radius (in millimeters) of the bullet (half the diameter).
π: 3.1416.
Tm: Tech Level Modifier, as shown on the table below.
Cm: Cartridge modifier, as shown on the table below.

CARTRIDGE MODIFIER

Cartridge Type	*Cm*
Shotgun	0.2
Spherical Ball	0.15
Patched Spherical Ball	0.225
Conical Bullet	0.3

TECH LEVEL MODIFIER

TL	*Tm*
2	0.5
3	0.6

Price: The price of the ammunition is determined by the following formula:

$$\mathbf{Cr = WTm}$$

Cr: Price in credits.
W: Weight of the round in grams.
Tm: Type multiplier, as determined below:

Type	*Tm*
Shotgun	0.01
Loose Powder	0.005
Paper cartridge (TL-2)	0.05
Paper cartridge (TL-3)	0.01

PART II: Weapon Design

1. BARREL

The barrel of a firearm carries the bullet after the cartridge is fired. Shotguns and muskets, intended for very short ranges, fire their bullets through a smooth bore. Beginning at tech level 3 the barrel is often rifled to impart a spin on the bullet, giving it stability (and thus accuracy) in flight. In addition, the barrel provides a gas-tight constricted space within which the expanding gas of the exploded propellant can act on the bullet, accelerating it. Once the bullet leaves the muzzle of the barrel, however, it begins decelerating. In general, the longer the barrel the higher the muzzle velocity, up to the point where the bullet reaches its greatest possible velocity.

Average Barrel Length: First, determine the average barrel length for the ammunition being used by the weapon. The following formula is used:

$$\mathbf{Bla = (Ea+d^2)Rm}$$

Bla: Average barrel length (in centimeters) - the length of the barrel which allows the ammunition to achieve its average muzzle energy.
Ea: Average muzzle energy (in joules) of the ammunition.
d: diameter (in millimeters) of the bullet.
Rm: Rifling multiplier, as shown below:

Type	*Rm*
Smoothbore	20
Rifled	5

Note 1: Regardless of the results of the above calculations, average barrel length is never less than 10cm.

Note 2: If using **Fire, Fusion, and Steel,** the normal table for rifling multiplier is used, but an additional multiplier of x5 is added for black powder weapons.

Actual Barrel Length: The actual barrel length can be any length desired down to a minimum of 20% of the average barrel length and up to a maximum of 230% of the average barrel length.

Type of Barrel: Barrels may be either light or heavy. All black



powder weapons use heavy barrels except for shotguns, which use light barrels. Weapons other than shotguns may either be rifled or smoothbore. (All shotguns are smoothbores.) Rifled barrels are not available until tech level 3.

Barrel Weight: The weight of the barrel is determined using the following formulae.

Wbl = .02Lb

Wbh = .03Lb

Wbl: Weight (in kilograms) of a light (shotgun) barrel.

Wbh: Weight (in kilograms) of a heavy barrel.

Lb: Length (in centimeters) of the barrel.

Barrel Price: The price of the barrel is determined using the following formula:

Cr = WbBtm

Cr: Price of the barrel in credits.

Wb: Weight of the barrel in kilograms.

Btm: Barrel type multiplier, as determined by the following table:

Type	*Btm*
Smoothbore	100
Rifled	200

Note: Owners of **Fire Fusion and Steel** will notice that black powder rifles have a barrel that weighs as much as a heavy rifled barrel but costs only as much as a light rifled barrel. This is a new type of barrel called Black Powder Rifled.

Actual Muzzle Energy: Once the barrel length is decided on, the weapon's actual muzzle energy can be determined using the following formula.

E = Ea{1 + (0.5[Blp-1])}

E: Actual muzzle energy (in joules) of the weapon.

Ea: Average muzzle energy (in joules) of the ammunition.

Blp: Actual barrel length (cm) dived by average barel length (cm): Bl/Bla

Bl: Actual length (in centimeters) of the barrel of the weapon.

Bla: Average barrel length (in centimeters) for the ammunition used.

If a multiple bullet (i.e., shot) round is fired from the weapon, divide the actual muzzle energy of the round by the number of bullets in the round to determine the energy of each bullet. This is the value used when calculating damage, penetration, and range for multiple round bullets.

Damage: Once muzzle energy is known, it is possible to calculate damage using the following formula.

D = ($\sqrt{E}$)+15

D: damage value (if D = less than 0.8, damage is 1D6–1, written as "–1.").

E: muzzle energy (in joules).

With a multiple bullet round damage is calculated separately for each bullet. The result is the medium range damage of each bullet. The close range damage *of the entire round* is determined by the following formula:

Dr = .75NDb

Dr: Damage value of the round.

Db: Damage value of a single bullet.

N: number of bullets in the round.

Penetration Rating: It is also possible to determine penetration rating of rifle bullets once muzzle energy is known by consulting the following table.

E	*Pen*
0-2000	Nil
2001-3000	1-Nil
3001-5000	2-Nil
5001-10,000	2-3-Nil
7001-20,000	2-4-6
20001-50,000	2-3-4
50,001+	2-2-3

(*Note*: If using **Fire, Fusion and Steel**, use the penetration table published there but treat all black powder weapons as being one energy category lower, i.e., a black powder weapon of 601-2000 Mj uses the penetration rating for the 0-600 line.)

Smoothbores (shotguns and muskets) are treated diferently, as their bullets tend to be heavy and slow-moving. All smoothbore bullets (both spherical ball and shot) have a penetration of 3-4-5.

(Note that the very high close-range damage of multiple-bullet shotgun shells is caused by multiple bullet hits, each with a lower damage value. In most cases the penetration of multiple bullets from a shotgun will be nil.)

2. LOCK

The lock is the mechanical heart of a black powder firearm. It allows the user to fire the weapon by means of a trigger which activates the mechanism of the lock and in turn ignites the propellant powder charge. Different varieties of locks are available at different tech levels. All locks have a length of 0 (they add nothing to the length of the weapon as they are mounted alongside the barrel) and have a fixed weight, price, and reload time (given in number of actions), as shown on the following chart.

TL	*Type*	*Mass*	*Price*	*Reload*
2	Match Lock	0.3	30	4
2	Wheel Lock	0.6	100	3
2	Snaphanse	0.5	200	2
2M	Flint Lock	0.5	50	2
3M	Percussion	0.3	20	2

3. STOCKS

Stocks refer to rifle stocks and pistol grips. The desired stock for the weapon is selected from the following table. Note that carbine stocks are generally fitted to rifles with short barrels (up to 80% of the average barrel length for the cartridge) or sport versions of rifles. They are not considered sturdy enough for full-length rifles in military use. At tech level 2, "carbines" are often called arquebuses or musketoons.

TL	*Type*	*L (cm)*	*M (kg)*	*Cr*
2	pistol grip	0	0.4	10
2	wooden stock	35	2.5	30
2	carbine stock	25	1.5	25
3	pistol grip	0	0.3	10
3	wooden stock	25	1.5	25
3	carbine stock	25	1.0	20

Range: Once the type of stock is known, the weapon's range can be calculated according to the following formula:

SR = ($\sqrt{E}$) CmBlm

SR: Short range (in meters) of a weapon.

E: Muzzle energy (in joules).

Cm: Configuration modifier, as shown below. If two configuration descriptionss apply to the same weapon, multiply them together to determine the total configuation multiplier.

Configuration	*Cm*
One-handed	0.4
Two-handed*	1.3
Smoothbore single shot**	0.5

*Note: Two-handed refers to weapons specifically designed to be fired with two hands, and thus including a stock instead of simply a pistol grip.

**Note: Shotgun single-slug rounds, but *not* multiple-shot rounds

Blm: Modification to short range for barrel length. The barrel length modifier is determined by the following formula:

Blm = 1 + ([Blp–1] ×C)



Blm: Barrel Length Modifier.

Blp: Actual barrel length (cm) dived by average barel length (cm): Bl/Bla

Bl: Actual length (in centimeters) of the barrel of the weapon.

Bla: Average barrel length (in centimeters) for the ammunition used.

C: Constant. If (Blp–1 is a negative number, the constant is 1.2. If (Blp–1 is a positive number, the constant is 0.75.

Recoil: Now the weapon's recoil when firing a single shot can be calculated.

$R = [(0.15 \sqrt{E})+Ww] + Em$

R: Recoil number

E: Muzzle Energy

Ww: Weight, in kilograms, of weapon (loaded)

Em: Modifier for high muzzle energy. If the weapon has high muzzle energy, add to the final recoil as shown on the chart below.

E	*EM*	*E*	*EM*
1001+	1	10,001+	4
2501+	2	20,001+	5
5001+	3	50,001+	6

Bulk: Once the final length of the weapon has been determined the bulk can be calculated. Bulk is equal to the weapon length (in centimeters) divided by 15, rounding all fractions down.

4. ADDITIONAL CONSIDERATIONS

The following items are either options that can be added to a weapon, or are special circumstances that must be considered.

Bayonet Lugs: Bayonet lugs are simple standardized brackets at the end of the weapon barrel. A bayonet lug costs nothing, has negligible mass, and adds no length to the weapon, but must be specified as part of the design.

A bayonet is less useful than a hand-held knife unless it is mounted on a well-balanced weapon with sufficient length to allow it to be used as a spear point. This is affected by tech level and bulk.

Tech Level: Weapons with fixed bayonets at tech level 2 suffer a +1 Diff Mod for their chances to hit in melee combat, due to the bulky and heavy nature of stocks.

Bulk: Only weapons with a bulk of 4 or more may profitably benefit from a bayonet lug. Shorter weapons may have them, but the mounted bayonet counts as a short range (instead of long range) melee wepon and suffers a +1 Diff Mod for its chance to hit in melee combat. Note that this translates into a +2 Diff Mod if the weapon uses a tech level 2 stock.

Reload Time: The listed reload number is that used by the weapon. However, the reload time may be increased due to extreme bulk, type of ammunition used, and presence of a fixed bayonet.

Extreme Bulk: Very long weapon are difficult for a single soldier to load by means of conventional muzzle loading techniques. Add one to the reload value per bulk number in excess of 9. For example, a flintlock musket with a bulk of 11 would have a reload rating of 4, meaning that it requires four actions to reload.

Ammunition Type: Patched ball and loose powder ammunition talke longer to reload than conventional cartridges. These increases are cumulative, and so a flint lock rifle firing a patched ball and using loose powder (instead of a paper cartridge) would have a reload time of 4. These modifiers should be noted with the ammunition, however, instead of the weapon, since the same weapon firing a paper cartridge spherical bullet would have a reload rating of 2.

Ammunition	*Reload*
Patched Ball	+1 action
Loose cartridge	+1 action

Fixed Bayonet: Add one to the reload time of any muzzle-loaded small arm which has its bayonet fixed on its bayonet lug.

Multiple Ammunition Types: Black powder rifles must fire either a conical bullet or a patched spherical bulet to take advantage of the weapon's rifling. A rifle can fire an unpatched spherical ball, but performs like a musket when it does so. When evaluating a black powder rifle, it is a good idea to also evaluate its performance with unpatched ball ammunition. Most of the differences between a rifle and a smoothbore are included in the performance of the ammunition itself, but when calculating range be sure to include the 0.5 smoothbore multipler.

WAGONS

Wagons may be designed for use on low-tech worlds using the Ground Vehicle Design sequence in **FF&S** with the following additions and exceptions:

Chassis: The chassis is generlaly made of wood, and need only have an equivalent armor value of 0.2. Use the following values for wood construction:

TL	Type	Toughness	Mass	Price (MCr)
1	Wood	0.2	0.8	0.001

Since the wagon is drawn by draft animals, no internal provision need be made for a power plant.

Suspension: Add this line to the Suspension table

Type	*TL*	*Vol.*	*Mass*	*SA*	*Price*
Wagon Wheel	1	3.5	0.1	70	.002

Power Plant: Wagons are pulled by draft animals which become the wagon's power plant. Each draft animal pulls with a force in megawatts equal to its mass in tonnes multiplied by 0.0005. A 2-tonne draft animal, for example, pulls with the equivalent of 0.001 MW.

Horses average 350 kg in mass.

Oxen average 600 kg in mass.

Crew: One wagon driver on a bench seat, which counts as a restricted passenger seat.

Passengers: If desired, additional bench seats may be installed for passengers. Treat these as Restricted Seats.

Road Speed:

Base road speed in kilometers per hour = (MW + LM) x 7000.

MW = pulling power, in megawatts, of the draft animals.

LM = loaded mass in tonnes of the vehicle, excluding the mass of the draft animals.

However, road speed is limited to the maximum speed of the draft animal pulling the vehicle. Light draft animals (massing 500 kilograms or less) have a maximum road speed of 5 kilometers per hour. Heavy draft animals (massing over 500 kilograms) have a maximum road speed of 2.5 kilometers per hour.

Cross-Country Speed: Base cross-country speed in kilometers per hour = (MW + LM)×4000.

However, cross-country speed is limited to the maximum speed of the vehicle being drawn and the maximum speed of the draft animal drawing it (as noted above). Vehicle maximum cross-country speeds are limited by the loaded mass (in tonnes, but not counting the mass of the draft animals) of the vehicle, as shown in the box to the right.

LM	*Max Speed*
0.4	4.5
0.6	4.0
0.8	3.5
1	3.0
>1	2.5

Combat Move: The combat movement of animal-drawn vehicles (in meters per turn) is the vehicle's maximum speed (in kilometers per hour) multiplied by 2.15, rounding the result to the nearest increment of 5.



BOW WEAPON DESIGN

Bow weapons are projectile weapons that use mechanical energy (rather than chemical energy as in firearms) to launch projectiles intended to do damage to a target. As such, they are low-tech alternatives or precursors to firearms, but also remain in limited use at high tech levels in specialized roles or for sporting and recreational purposes.

1. Design

A bow is defined by three characteristics: material, length, and type. As some of these are tech-level dependent, the designer must first determine the tech level of design and then specify its exact characteristics.

Material: There are five materials from which bows are commonly made, as shown on the Bow Material Table below. Select one for the bow.

Length: Bow length is measure in meters from tip to tip. Select any length desired.

Mass: Based on the length and material, calculate the mass of the bow. The mass in kilograms per meter of bow length is given on the Bow Material table. Multiply this value by the bow length in meters to determine its total mass in kilograms.

Shaft Energy: Based on the length and material, calculate the energy of an arrow fired from the bow (called its shaft energy). The shaft energy, in joules per meter of bow length, is given on the Bow Material table. Multiply this value by the bow length in meters to determine its total shaft energy in joules.

Price: Based on the length and material, calculate the price of the bow. The price in credits per meter of bow length is given on the Bow Material table. Multiply this value by the bow length in meters to determine its total price in credits.

Type: There are two types of bows: conventional bows and crossbows. If a conventional bow, the design process is complete.

Any bow at tech level 1 and higher may be a crossbow, and any bow longer than the average height of an adult of the race for which it is designed *must* be a crossbow. (Humans have an average height of 1.8 meters.) Crossbows are not available at tech level 0.

Crossbows require a stock/trigger and a cocking mechanism in addition to the bow itself. A bow with a shaft energy of 500 or more joules requires a windlass, and is called a heavy crossbow. A bow with a shaft energy of less than 500 joules requires only a cocking handle and is called a light crossbow.

Consult the Crossbow Hardware Table for the masses and prices of these items and add them to the mass and price of the bow to determine the total mass and price of the weapon.

BOW MATERIAL

TL	*Material*	*M*	*E*	*Cr*
0	Wood	0.6	50	100
1	Horn	0.5	60	150
1	Composite	0.7	70	200
2	Steel	2	150	200
7	Composite Steel	1	200	300

TL: Tech level of construction.
Material: material used to construct the bow.
M: Mass, in kilograms, per meter of bow length.
E: Shaft energy, in joules, per meter of bow length.
Cr: Price in credits per meter of bow length.

CROSSBOW HARDWARE

Item	*Mass*	*Cr*
Stock/trigger	1.5	50
Cocking handle	0.5	25
Windlass	1	75

Mass: mass in kilograms of noted item.
Cr: price in credits of noted item.

2. Evaluation

Once the bow is designed, the following combat characteristics can be determined.

Reload Rate: Reload rate, in the required number of actions to prepare another arrow for firing (exclusive of the aiming action) is depenent on the type of bow, as shown below.

Weapon	*Reload*
Bow	1
Crossbow	3
Heavy Crossbow	5

Damage Value: The damage value of an arrow is calculated the same as for a bullet. Divide the square root of its shaft energy by 15 and round to the nearest whole number.

$$D = (\sqrt{E})+15$$

Calculated damage value of less than 0.8, however, become recorded damage values of "–1" (meaning 1D6–1).

Penetration: Any bow with a shaft energy of 601 joules or more has a penetration of 1-Nil. All other bows have a pentration of Nil.

Bulk: The bulk of the bow is the length of the bow in meters divided by 0.15, rounding fractions down.

Required Strength: Required strength is equal to the shaft energy of the bow divided by the torsion efficiency of the bow, rounding fractions to the nearest whole number. Torsion efficiencies are listed below.

Type	*TE*
Conventional Bow	15
Composite Steel Bow	30
Light Crossbow	30
Heavy Crossbow	60

Required strength is recorded in the single shot recoil column of the weapon's record form, and is used in exactly the same manner as a recoil number.

Range: The short range in meters of a bow weapon is equal to three times the square root of its shaft energy in joules, rounding to the nearest increment of 10 meters.

$$SR = 3\sqrt{E}$$

3. Ammunition

Ammunition for conventional bows is called arrows; ammunition for crossbows is called bolts or quarrels. In either case, the specifics are the same.

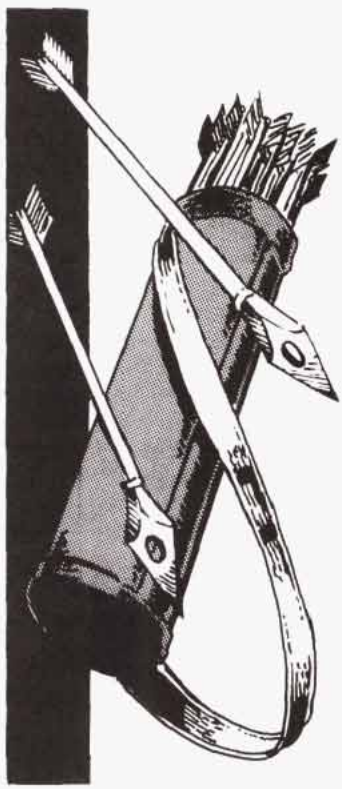
Price: One arrow or bolt/quarrel costs Cr1.

Mass: One arrow or bolt/quarrel masses 40 grams (0.04 kg).

Ammunition is carried in containers called quivers. Quivers may be worn over the shoulder or hanging from the belt. Quivers are designed by specifying the number of arrows/bolts/quarrels they are to carry.

Price: A quiver costs 0.5 credits per arrow/bolt/quarrel that can be carried in it.

Mass: The mass of a quiver is equal to the mass of the ammunition that can be carried in it.





BLACK POWDER CANNON DESIGN SEQUENCE

For owners of **Fire, Fusion, & Steel** this design sequence will be quite familiar, as it is an abbreviated version of the CPR gun design procedure. This sequence covers black powder artillery built at tech levels 2 and 3. A black powder cannon is a specialized (primitive) form of CPR gun relying on a less efficient form of propellant.

Part I: Weapon Design

A. Specifications

The characteristics of black powder cannon are determined by five specifications. In addition, the weapon's muzzle energy is used through the rest of the design sequence and is calculated at this time.

1. Tech Level: Select a tech level appropriate to the world where the gun was built. These weapons are built at tech levels 2 and 3. Some weapon features are described as "mature" tech level 3 innovations, and so are only available at mature tech level 3 worlds (abbreviated tech level 3M). See page 92 for a discussion of mature tech levels.

2. Type: There are five types of black powder cannons: mortars, howitzers, smoothbore guns, rifled muzzle-loading guns, and rifled breach-loading guns. Mortars and smoothbore guns are available at tech level 2 and up. Howitzers are available at tech level 3 and up. Rifled guns (both types) are available at tech level 3M.

3. Bore Size: Bore size, also known as caliber, is the diameter of the gun's bore. The smallest black powder cannon has a bore of 5cm. The cannon table lists bore sizes in increments of centimeters, but intermediate sizes may be selected as well, such as 7.62cm.

4. Barrel Length: Barrel length is expressed as a length in calibers. That is, a 12cm gun with a barrel fifteen calibers long would be (12x15=180) 180 centimeters long. Barrels may be of any length desired up to 80 calibers. Howitzers may not be any more than 12 calibers long while mortars may not be any more than 5 calibers long. Field guns usually range from 15-25 calibers long while longer barrels are usually reserved for heavy siege artillery.

5. Mount: Mortars must be mounted on a mortar carriage, which is a flat stable platform designed to take the stress of high angle fire. Guns and howitzers may be mounted either on field carriages or truck carriages. Field carriages have a single axle and two large wheels, with a trail that rests on the ground during firing. It is designed to provide both a mobile carriage and a stable firing platform. Truck carriages are lower and generally have two axles and four small wheels. They are lighter and handier, but are not suitable for cross-country movement. They are mostly used in fortresses and aboard ships.

6. Muzzle Energy: The cannon table (page 99) lists the muzzle energy, in megajoules (Mj), of each bore size gun assuming a barrel length of 60 calibers. (Note that the information on this table is the same as that printed on page 109 of **Fire, Fusion, & Steel.**) For bore sizes which fall between those listed on the table, use interpolation to find the correct muzzle energy.

For every caliber in length longer than 60, increase the muzzle energy by 1%.

For every caliber less than 60, reduce the muzzle energy by 2%, until the weapon reaches 15 calibers. For every caliber in length less than 15 calibers, reduce the muzzle energy by 1%.

When this calculation is completed, multiply the result by the configuration modifier found on the Cannon Configuration table to the right.

CANNON CONFIGURATION

Configuration	*Multiplier*
Smoothbore Gun	0.3
Rifled Gun	0.6
Howitzer	0.25
Mortar	0.15

B. Mass

The complete cannon weight is equal to the weight of the cannon barrel plus the carriage.

1. Gun Mass: Consult the Cannon table (page 99) and read the weapon mass (in tonnes). The mass on the table assumes a 60-caliber gun. Increase or decrease the mass by 1% for each caliber change in length up or down. A gun 25 calibers long, for example, is 35 calibers less than 60, and so would mass (100–35=65) 65% of the mass shown on the table.

If the bore size falls between two bore sizes on the table, interpolate the correct value.

Once this calculation is done, multiply the result by the configuration multiplier found on the table below.

Configuration	*Multiplier*
Mortar	1.5
TL 2 gun	1.0
TL 3 Gun	0.75
Howitzer	0.6

2. Carriage Mass: The carriage mass of a cannon, in tonnes, is determined by its barrel mass, configuration, and tech level, according to the following formula:

$$CrM = TM \times CM \times BM$$

CrM: Carriage mass in tonnes.
BM: barrel mass in tonnes.
CM: configuration modifier from table below.
TM: tech multiplier from table below.

CONFIGURATION MODIFIER

Configuration	*CM*
Gun, truck carriage	0.6
Gun, field carriage	1
Howitzer, truck carriage	0.9
Howitzer, field carriage	1.5
Mortar	0.8

TECH MULTIPLIER

TL	*TM*
2	2
3	1

C. Gun Crew

The number of crewmen required to man a gun depends on its bore size and carriage. A field gun or howitzer requires crewmen equal to its bore size in centimeters (rounding fractions down) plus 5. A mortar or a cannon on a truck carriage requires crewmen equal to its bore size in centimeters (rounding fractions down).

A 7.6cm field gun, for example, requires a crew of 12, while the same weapon on a truck carriage requires only 7 crewmen.

D. Range

Cannons have four direct fire ranges: short, medium, long, and extreme. Black powder weapons cannot engage in indirect fire in the modern sense, although mortars and howitzers can lob shells over obstructions.

Short range is mostly a function of the muzzle velocity of a weapon, which is largely determined by its barrel length. A secondary consideration is the size of the round, as larger rounds lose velocity from drag more slowly than do smaller rounds.

Short direct fire range in meters for a black powder cannon is equal to the sum of its bore size in centimeters plus its barrel length in calibers plus 20, all multiplied by a configuration multiplier.

$$SR = Cm(B+L+20)$$

Configuration	*Cm*
Howitzer (TL 3 only)	2
TL 2 SB gun	2.5
TL 3 SB gun	3
TL 3M Rifled ML	5
TL 3M Rifle BL	4.5



Mortars calculate range differently. Mortars have only a long range and an extreme range (twice long range). They may not fire at any target at ranges less than their calculated long range nor more than their extreme range, and all shots fired are resolved as extreme range fire.

Long range is calculated using the following formula:

$$LR = B \times BL \times TM$$

LR: long range in meters. Mortars have only a long range and an extreme range. May not fire at anything at less than long or greater than extreme. All shots count as extreme range.

B: bore in cm.

BL: barrel length in calibers.

TM: tech level modifier.

TL	*TM*
2	5
3	12

E. Reloading

The time the weapon requires to reload is a function of the mass of its barrel and whether it is a breachloader or a muzzleloader.

The number of five-second turns required to load a round in a tech level 2 muzzleloader is equal to the the mass of the barrel in tonnes multiplied by 7, rounding all fractions to the nearest whole number (but rounding any result of less than 1 up to 1).

The number of five-second turns required to load a round in a tech level 3 muzzleloader is equal to the the mass of the barrel in tonnes multiplied by 5, rounding all fractions to the nearest whole number (but rounding any result of less than 1 up to 1).

The number of five-second turns required to load a round in a breachloader is equal to the the mass of the barrel in tonnes multiplied by 4, rounding all fractions to the nearest whole number (but rounding any result of less than 1 up to 1).

The minimum reload time for a muzzle-loading black powder cannon is 3 turns. The minimum reload time for a breach-loading black powder cannon is 2 turns.

F. Price

The price of the weapon is equal to the sum of the price of the barrel and the carriage, both of which are determined by the mass of the component. The price of each component in millions of credits is equal to its mass in tonnes times its cost multiplier, shown in the box above.

Component	*Cost Multiplier*
Barrel	0.02
Carriage	0.002

G. Set-Up

All towed field cannon must be set up before they can fire. Ship and fortress guns on truck carriages are assumed to be set up and ready to fire (once they have been loaded).

The time, in five-second combat turns, needed to set up a towed cannon on a field carriage is equal to its bore size in centimeters times 4.

The time, in five-second combat turns, needed to set up a mortar is equal to its bore size in centimeters times 8.

H. Volume

The volume of a cannon in cubic meters, for purposes of transportation or mounting in a fortress or ship, is equal to its mass in tonnes.

Part II: AMMUNITION

A complete round of ammunition for a cannon consists of a projectile and a propelling charge of black powder. At tech level 2 the propelling charge is usually poured into the cannon from a barrel or put in with scoops. Superior textile manufacturing techniques at tech level 3 allow widespread and inexpensive use of linen powder charges, making loading quicker.

A. Specify Projectile Type

There are four different projectile types available for black powder cannon, each with its own special function.

1. Shell: This is a hollow projectile filled with black powder and detonated by a burning fuse. The time to bursting is controlled by cutting the fuse to different lengths. Smoothbore weapons (including black powder mortars and howitzers) fire spherical shell, so-called due to the shape of the projectile, while rifled weapons fire conical shell with a larger bursting charge.

2. Shot: This is the most common projectile fired by early black powder cannons, consisting of a solid iron shot. Smoothbore guns fire spherical shot while rifled guns fire conical shot.

3. Cannister: Canister is a tin cylinder filled with musket balls. When fired, the tin cannister bursts upon leaving the gun and scatters the musket balls, much like a large shotgun.

4. Shrapnel: This round, available only at tech level 3M, is a combination of shell and cannister, the hollow projectile filled with both powder and ball and with a time fuse. Shrapnel is actually available at tech level 3, but the unreliability of the fuses makes it little different than common shell in effect and so it is ignored until tech level 3M.

B. Tech Level

The principal effect of tech level is to limit the availability of certain projectile types, as shown at right.

TL	*Projectile*
2	spherical shot and shell, cannister
3M	conical shot and shell, shrapnel

C. Projectile Diameter

The projectile diameter is the bore of the gun (in centimeters) from which the round is fired.

D. Damage Value

Damage value is a measure of the force generated at the point of impact by the projectile. In the case of shell, this is a measure of the explosive force of the round, and is called concussion. Non-exploding rounds do damage by the energy of impact. Damage is calculated differently for various types of projectiles.

1. Shell: Shells do damage by the concussion of the explosion of their bursting charges. The concussion value of the charge is calculated using the following formula:

$$C = Tm \times D^2$$

C: Concussion value.

D: Projectile diameter in centimeters.

Tm: Tech level modifier, as shown on the chart to the right:

TL	*Tm*
2	0.02
3	0.03
3M*	0.05

* Used only for conical shell

2. Shot: Shot projectiles have a damage value equal to their diameter in centimeters multiplied by 2.2. This is a constant value for use only for direct hits on personnel. It is never used versus vehicles or structures (for which purpose the penetration value, calculated below, is used).

3. Cannister: Each ball from a cannister round does personnel damage equal to fragments by burst area (2D6 within the primary radius, 1D6 in secondary).

4. Shrapnel: Each ball from a shrapnel round does personnel damage equal to fragments by burst area (2D6 within the primary radius, 1D6 in secondary).

E. Burst

Burst radius defines the area covered by the primary effects of a bursting warhead, usually the area covered by potentially lethal fragments or musket balls.

The formulas below give exact burst radii. To convert to the standard **Traveller** burst area figures resolved to the 10-meter grid,



round to the nearest 10-meter increment (as listed on page 284 of the basic rules). For example, 7 meters rounds to 5, 12 rounds to 15, 30 to 35, etc.

1. **Shell:** The burst radius of a shell is the primary burst area covered by fragments. The burst radius in meters is the square root of the warhead's concussion value multiplied by 7 for guns and howitzers and by 10 for mortars.

2. **Shot:** Shot does not explode and so has no burst radius.

3. **Cannister:** Unlike shell, cannister rounds have an elongated burst area, since the musket balls keep moving along the ballistic path of the cannister after it disintegrates.

The primary burst area is the area immediately beyond the muzzle of the firing cannon, while the secondary burst area is the area after that. The primary burst area is defined as half of the short range of the cannon.

4. **Shrapnel:** The burst radius of a shrapnel round is the primary burst area covered by fragments. The burst radius in meters is the square root of the warhead's concussion value multiplied by 15.

F. Penetration

Cannon are usually used against vehicles or structures, and so their penetration is expressed as a penetration value, the total penetrative capability of the round.

1. **Shell:** Penetration of a shell is a function of bore size. Subtract 7 from the bore size (in centimeters) to determine the penetration value of the shell. All shell rounds have a constant penetration value and so the letter "C" is written after the value. Rounds with a penetration value of less than 0 are shown as "Nil." Rounds with a penetration value of 0 have that listed as their penetration value (meaning that the final penetration is the base 2D6 roll without any addition).

2. **Shot:** Shot relies on muzzle energy to pierce hostile armor. Penetration value is a function of range and muzzle energy. The base penetration of solid shot ammunition at medium range is based solely on muzzle energy (in megajoules) of the gun, as shown below.

If Mj = 12+, then PV = Mj×4.
If Mj < 12, then PV = Mj×5 (but never higher than 48).
If Mj < 9, then PV = Mj×6 (but never higher than 45).
If Mj < 7, then PV = Mj×7 (but never higher than 43).
If Mj < 5, then PV = Mj×8 (but never higher than 35).
If Mj < 1.5, then PV = Mj×10 (but never higher than 12).
If Mj < 1, then PV = Mj×12 (but never higher than 10).
If Mj < 0.5, then PV = Mj×16 (but never higher than 6).
If Mj < 0.3, then PV = Mj×22 (but never higher than 5).

For example, a gun has a muzzle energy of 4.6 Mj. Since this is less than 5 but not less than 1.5 Mj, the gun has a penetration value equal to Mj×8, or 36.8, rounded up to 37, but then reduced to 35 (the maximum PV for weapons with a muzzle energy of less than 5 Mj.

The result of the calculations above is the penetration of conical shot. For spherical shot, multiply the result by 0.7.

Once the medium range penetration value is known, penetration values for the other range bands can be calculated.

At short range, add 15% of the penetration value or a flat value of 10, whichever is less.

At long range, subtract 15% of the penetration value, or a flat value of 10, whichever is less.

At extreme range, subtract 45% of the penetration value, or a flat value of 30, whichever is less.

3. **Cannister and Shrapnel:** The bullets contained in cannister and shrapnel rounds have the same penetration value as normal fragments (1 in the primary radius, Nil in the secondary).

G. Mass

All spherical shot and shell and cannister projectiles have a mass calculated according to the following formula:

$$PM = (\pi r^3)+100$$

PM: projectile mass in kilograms.
π: 3.1416
r: radius of the projectile (half the diameter) in centimeters

All conical shot and shell and shrapnel use the same formula but multiply the result by 2.

H. Volume

The volume of a projectile in cubic meters for purposes of storage is equal to the mass of the projectile in tonnes divided by 5.

I. Price

The price for ammunition in credits is equal to its mass multiplied by its ammunition type modifier, as shown below

Type	*Modifier*
Shell	10
Shot	5
Cannister	10
Shrapnel	20

Part III: POWDER CHARGE

The propelling powder charge (carried in a linen cartridge at tech level 3) is defined in terms of mass and price.

A. Mass

The pass of a powder charge is equal to the mass of the projectile being fired multiplied by 0.25.

B. Volume.

The volume of a powder charge in cubic meters for purposes of storage is equal to the mass of the powder charge in tonnes divided by 5.

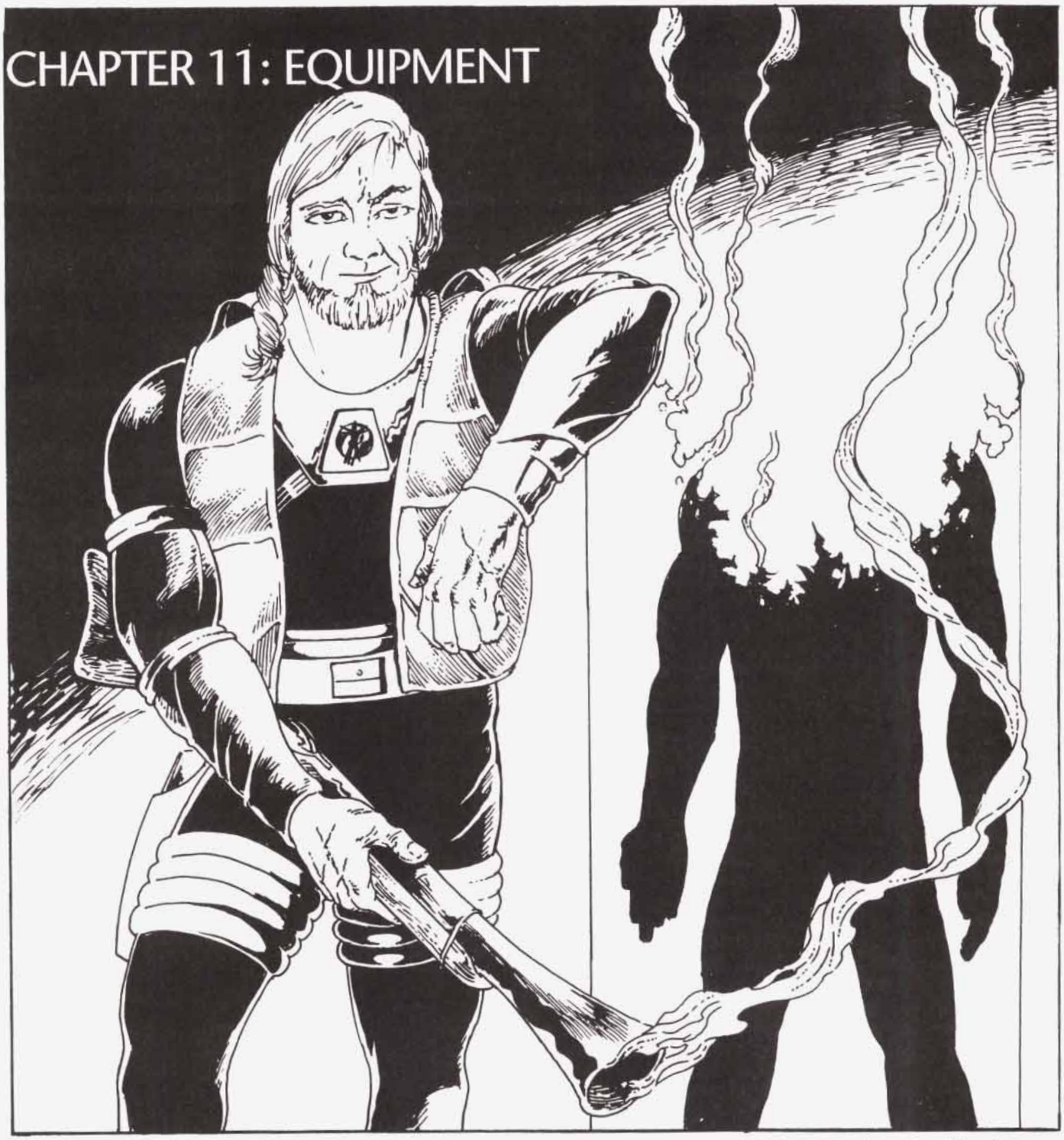
C. Price

The price of a powder charge in credits is equal to its mass in kilograms multiplied by 5.

CANNON TABLE

Bore (cm)	*Gun Mass (tonnes)*	*Gun Muzzle Energy (Mj)*
5	0.30	0.8
6	0.42	1.6
7	0.54	2.4
8	0.60	3.6
9	1.0	4.9
10	1.2	6.0
11	1.5	7.7
12	2.1	9.3
13	2.7	11.7
14	3.3	15.0
15	4.0	18.6
16	4.5	23
17	6.0	29
18	7.5	36
19	9	41
20	11	48
21	13	55
22	15	63
23	17	72
24	19	83
25	21	96
30	30	150
35	40	230
40	50	350
45	60	500

CHAPTER 11: EQUIPMENT



"In comparison to modern firearms, the performance of low-tech black powder weapons such as the blunderbuss is unimpressive, but this is no reason for complacency. At short range, unarmored targets of the blunderbuss will end up just as dead as if they were hit by a plasma pulse."

— Gunnery Sergeant Midushuugi "Leaper" Liebman
RCES Primitive Weapons Familiarization Seminar

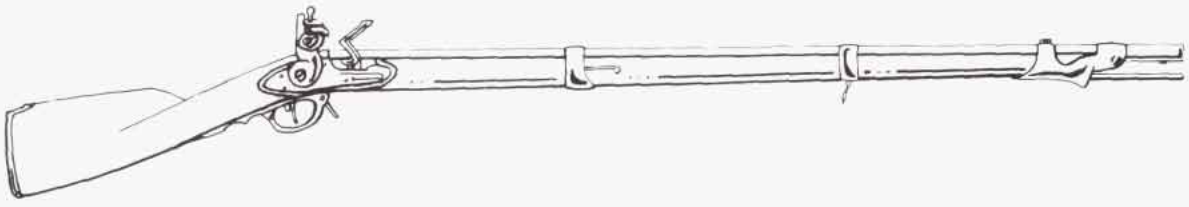
Not all of the equipment in the following section is high tech, but it can be dangerous nonetheless. In the Wilds, a long way from hospitals, spare parts bins, and maintenance bays, it only takes one lucky shot to ruin your whole day, and it doesn't matter if that shot is a plasma bolt, an armor-piercing fin-stabilized discarding-sabot bonded superdense kinetic energy penetrator, or a lousy arrow, or even a rock.

The following pages show the mainstay weapons of worlds of tech levels 2 and 3, from manportable black powder small arms on pages 101-104 up to crew-served cannons on 105-106. These may be encountered carried by "zippers" in the Wilds, or picked up as extemporaneous armament by RC troops, bootstrap team leaders, or undercover agents.

In addition to this low-tech equipment, three new starships suited for colonial transport are presented here, beginning on page 107.

All of the equipment shown here is designed with the **Fire, Fusion, & Steel** Technical Architecture sourcebook, or the design sequence additions found here in this book.

Smoothbore Flintlock Musket
Rifled Musket



Smoothbore Flintlock Musket

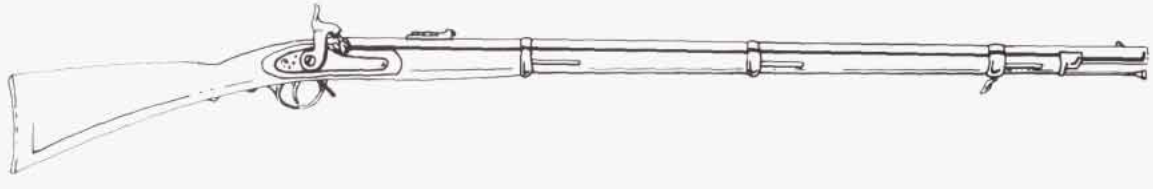
A flintlock uses a spring-loaded flint-and-steel striker to ignite the main powder charge in a gun barrel. The weapon illustrated is typical of numerous archaic designs in use on very low TL worlds, and in the hands of poorly equipped militias and insurgents on worlds with higher technology levels. Because of its short range and poor accuracy, smoothbore muskets are most effective when used by massed bodies of soldiers exchanging volley fire.

This weapon holds one individually loaded round inserted in the muzzle, and requires two actions to reload. If prepared paper cartridges are not available, the weapon may be loaded using loose powder and ball, but this takes one additional action.

TL: 3
Ammo: 18×52mm black powder and ball in paper cartridge
Muzzle Energy: 1446 joules
Weapon Length: 130 cm
Weapon Weight: 5.19 kg loaded, 5.15 kg empty
Weapon Price: Cr390

Magazine: None.
Ammunition Price: Cr0.4 (Ball)
Ammunition Weight: 40 grams per round
Features: Bayonet lug.

						— Recoil —		
Round	*Reload*	*Dam Val*	*Pen Rtg*	*Bulk*	*Magazine*	*SS*	*Burst*	*Short Range*
18mm P&B	2	3	Nil	8	1i	2	—	30



Rifled Musket

Rifled muskets of the type illustrated are more advanced archaic firearms. Using a rifled barrel and a conical bullet, the rifle musket achieves greater range and damage than the smoothbore version, and the percussion cap ignition system results in fewer misfires. Soldiers using these weapons are able to make use of more modern tactics and need not resort to massed volleys (although the weapons are sometimes used in that fashion).

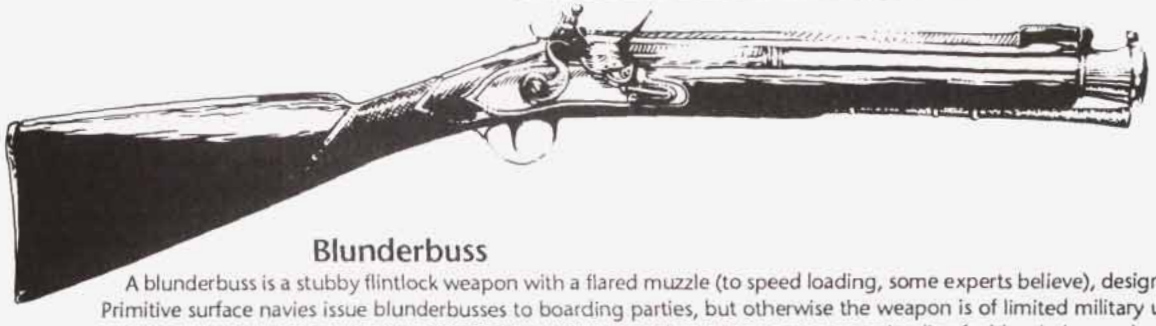
This weapon holds one individually loaded round inserted in the muzzle, and requires two actions to reload. If prepared paper cartridges are not available, the weapon may be loaded using loose powder and bullet, but this takes one additional action.

TL: 3M
Ammo: 12×76mm black powder and conical bullet in paper cartridge
Muzzle Energy: 2010 joules
Weapon Length: 110.8 cm
Weapon Weight: 4.41 kg loaded, 4.37 empty

Weapon Price: Cr560
Magazine: None.
Ammunition Price: Cr0.43 (Conical bullet)
Ammunition Weight: 43 grams per round
Features: Bayonet lug.

						— Recoil —		
Round	*Reload*	*Dam Val*	*Pen Rtg*	*Bulk*	*Magazine*	*SS*	*Burst*	*Short Range*
12mm P&B	2	3	1-Nil	7	1i	3	—	80

Blunderbuss
Double Blunderbuss



Blunderbuss

A blunderbuss is a stubby flintlock weapon with a flared muzzle (to speed loading, some experts believe), designed for close-range use. Primitive surface navies issue blunderbusses to boarding parties, but otherwise the weapon is of limited military utility. In civilian hands, blunderbusses are popular for close-in defensive applications. Shot is the most common loading for blunderbusses, because of the devastating short range damage value (rivaling that of many more modern weapons).

The word "blunderbuss" is believed to descend from a word meaning "thunder-gun" an old Terran language known as Dutch. The name is an obvious reference to the weapon's powerful discharge.

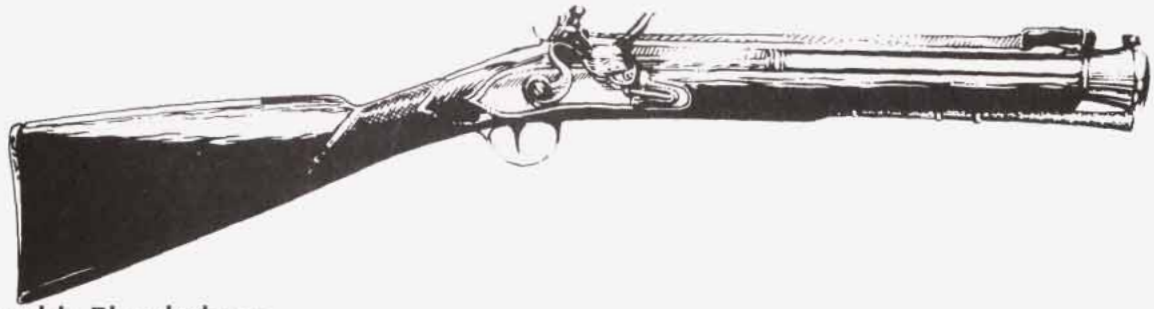
The weapon can be fitted with an optional spring bayonet, which adds 0.2 kg to the weight and Cr20 to the price. This bayonet is kept folded against the side or top of the barrel when not in use, and is released by a thumb-operated latch when the firer desires. When released, the bayonet flips forward into position and locks into place, ready for use. The bayonet does not increase the weapon's mass enough to change recoil.

Weapon Price (with Spring Bayonet): Cr185
Magazine: None.
Ammunition Price: Cr0.94 (slug or shot)
Ammunition Weight: 94 grams per round
Features: Optional spring-loaded bayonet.

TL: 2M
Ammo: 20×100 loose black powder and shot or slug
Muzzle Energy: 2021 joules
Weapon Length: 70 cm
Weapon Weight: 2.994 kg loaded, 2.9 empty
Weapon Weight (with Spring Bayonet): 3.194 kg loaded, 3.1 empty
Weapon Price: Cr165

						— Recoil —		
Round	*RLD*	*Dam Val*	*Pen Rtg*	*Bulk*	*Magazine*	*SS*	*Burst*	*Short Range*
20mm P & B	3	3	Nil	4	1i	3	—	4
20×100 Shot Short	3	18	Nil	4	1i	3	—	3
Medium	3	1	Nil					

Note: A shot round fired at medium range is resolved as a 5-dice burst.



Double Blunderbuss

The double blunderbuss is a standard blunderbuss manufactured with two barrels. As with the normal blunderbuss, shot is the most common load.

This weapon can be fitted with an optional spring bayonet, which adds 0.2 kg to the weight and Cr20 to the price. This bayonet is kept folded against the side or top of the barrel when not in use, and is released by a thumb-operated latch when the firer desires. When released, the bayonet flips forward into position and locks into place, ready for use. With the spring bayonet, the weapon's recoil becomes 2.

The weapon may discharge both barrels in a single 5-second turn, as if the weapon had an ROF rating of SA.

TL: 2M
Ammo: 20×100 loose powder and slug or shot
Muzzle Energy: 2021 joules
Weapon Length: 70 cm
Weapon Weight: 4.394 kg loaded, 4.3 empty
Weapon Weight (with Spring Bayonet): 4.594 kg loaded, 4.5 empty

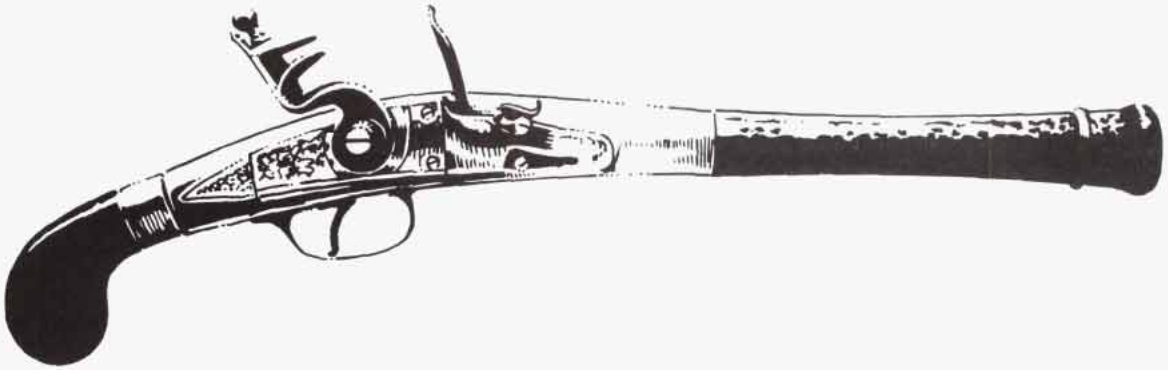
Weapon Price: Cr305
Weapon Price (with Spring Bayonet): Cr325
Magazine: None.
Ammunition Price: Cr0.94 (slug or shot)
Ammunition Weight: 94 grams per round
Features: Optional spring-loaded bayonet.

						— Recoil —		
Round	*RLD*	*Dam Val*	*Pen Rtg*	*Bulk*	*Magazine*	*SS*	*Burst*	*Short Range*
20mm P & B	3*	3	Nil	4	2i	3	—	4
20×100 Shot Short	3*	18	Nil	4	2i	3	—	3
Medium	3*	1	Nil					

*Reload rate is per barrel.

Note: A shot round fired at medium range is resolved as a 5-dice burst.

Blunderbuss Pistol
Horse Pistol



Blunderbuss Pistol

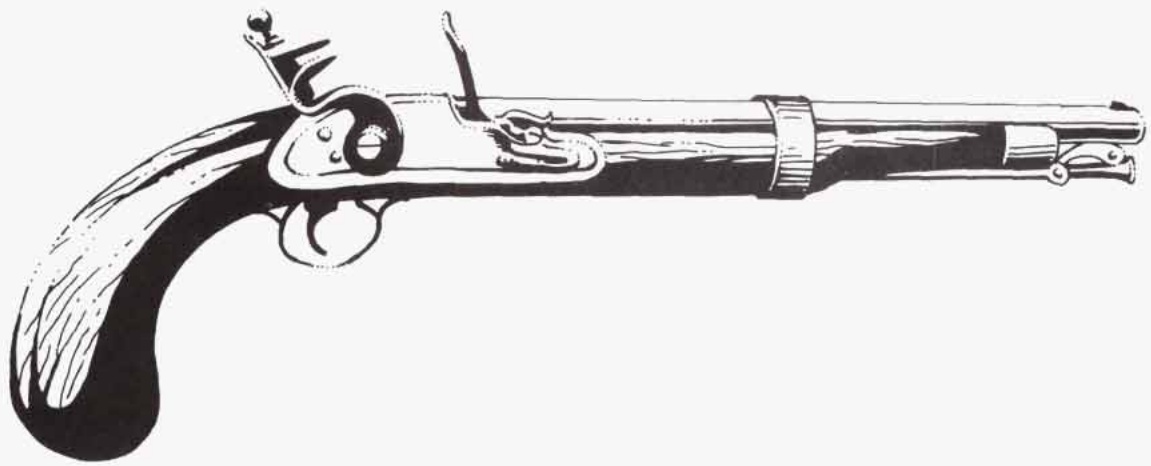
The blunderbuss pistol incorporates the same bell-mouthed barrel of the standard blunderbuss into a pistol, with a resultant reduction in length and range. As a close-range defensive weapon for cavalry and the like, however, the blunderbuss pistol is very effective.

TL: 2M
Ammo: 20×100 loose powder and slug or shot
Muzzle Energy: 2021 joules
Weapon Length: 45 cm
Weapon Weight: 1.894 kg loaded, 1.8 empty

Weapon Price: Cr150
Magazine: None.
Ammunition Price: Cr0.94 (slug or shot)
Ammunition Weight: 94 grams per round
Features: None.

						— Recoil —		
Round	*RLD*	*Dam Val*	*Pen Rtg*	*Bulk*	*Magazine*	*SS*	*Burst*	*Short Range*
20mm P & B	3	3	Nil	3	1i	5	—	1
20×100 Shot Short	3	18	Nil	3	1i	5	—	1
Medium	3	1	Nil					

Note: A shot round fired at medium range is resolved as a 5-dice burst.



Horse Pistol

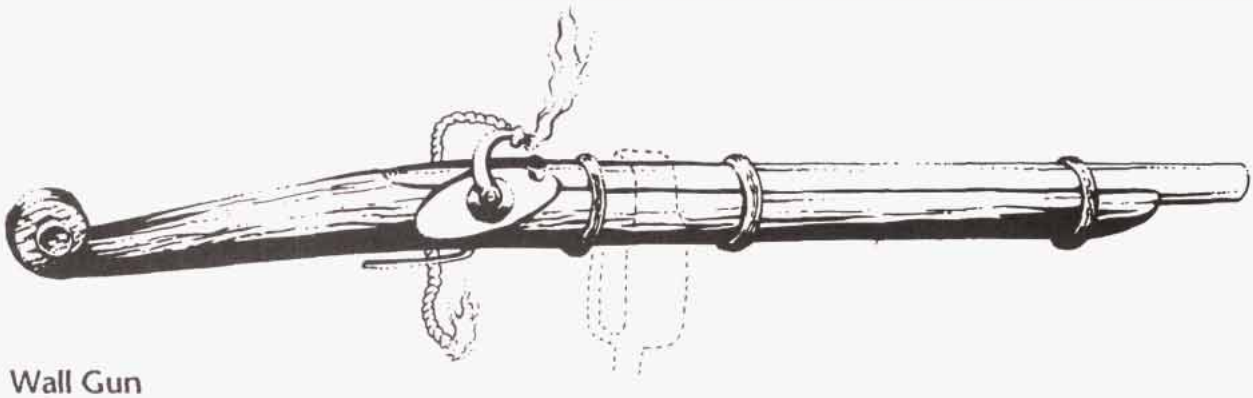
Horse pistols are so-named because they were designed to be used by cavalry mounted on horseback, each soldier carrying two pistols in a pair of holsters attacked to the saddle. These weapons were designed for close-in combat in a swirling cavalry melee, and the range reflects this fact.

TL: 3
Ammo: 15×100mm loose black powder and ball
Muzzle Energy: 1132.09 joules
Weapon Length: 59.9 cm
Weapon Weight: 2.65 kg loaded, 2.6 empty

Weapon Price: Cr239.7
Magazine: None.
Ammunition Price: Cr0.2651 (ball)
Ammunition Weight: 53.0145 grams per round
Features: None.

						— Recoil —		
Round	*RLD*	*Dam Val*	*Pen Rtg*	*Bulk*	*Magazine*	*SS*	*Burst*	*Short Range*
15mm P & B	3	2	Nil	3	1i	3	—	2

Wall Gun
Flintlock Rifle-Musket



Wall Gun

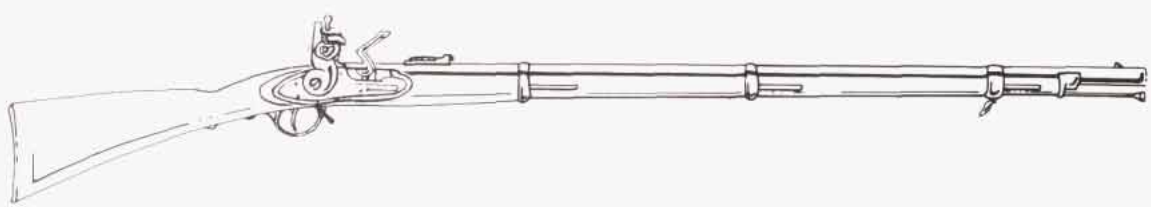
This monster weapon is too clumsy to be used by individuals in the field, it is normally found on a swivel (pintle mount) on fortifications or boats in order to deter attackers. The long reload time is a distinct disadvantage, but the extremely high short range damage means that the weapon must nevertheless be taken seriously, even by armored opponents.

TL: 2
Ammo: 20×120 loose powder and slug or shot
Muzzle Energy: 3564.9 joules
Weapon Length: 203 cm
Weapon Weight: 6.2731 kg loaded, 6.16 empty

Weapon Price: Cr396
Magazine: None.
Ammunition Price: Cr1.13 (slug or shot)
Ammunition Weight: 113.1 grams per round
Features: None.

						— Recoil —		
Round	*RLD*	*Dam Val*	*Pen Rtg*	*Bulk*	*Magazine*	*SS*	*Burst*	*Short Range*
20mm P & B	9	4	3-Nil	13	1i	3	—	30
20×120 Shot close	9	72	Nil	13	1i	3	—	14
medium	9	1	Nil					

Note: A shot round fired at medium range is resolved as two 10-dice bursts.
Fired from a wall (pintle) mount, this weapon has negligible recoil and twice the listed range.



Flintlock Rifle-Musket

This weapon is a slightly less advanced version of the percussion rifle-musket described on page 101. It is rifled, fires a conical bullet, and is loaded using a prepared paper cartridge.

TL: 3
Ammo: 12×76mm black powder and conical bullet in paper cartridge
Average Muzzle Energy: 2010 joules
Weapon Length: 110.8 cm

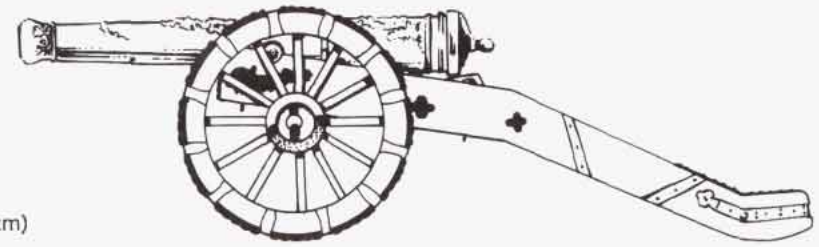
Weapon Weight: 4.61 kg loaded, 4.57 empty
Weapon Price: Cr590
Magazine: None.
Ammunition Price: Cr0.43 (conical bullet)
Ammunition Weight: 43 grams per round
Features: Bayonet lug

						— Recoil —		
Round	*RLD*	*Dam Val*	*Pen Rtg*	*Bulk*	*Magazine*	*SS*	*Burst*	*Short Range*
12mm P & B	2	3	1-Nil	7	1i	3	—	80

13.5cm Heavy Field Gun
9.5cm Light Field Gun

13.5cm Heavy Field Gun

The weapon described here is one of the heaviest field guns in use at tech level 2, heavier guns being reserved for the siege train. Even so, this was an awkward, if powerful, field piece. Guns similar to this used on Earth during the Renaissance, Thirty Years War, and English Civil War were called "culverins."



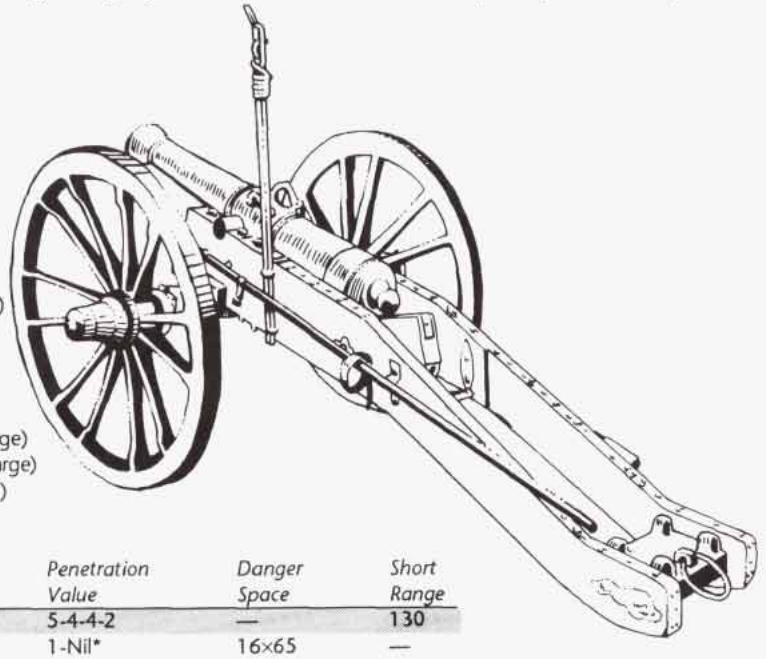
TL: 2
Type: Smoothbore gun
Bore Diameter: 13.5 cm
Barrel Length: 24 calibers (324 cm)
Mount: Field Carriage
Muzzle Energy: 1.1214 Megajoules
Weapon Weight: 5.8 tonnes (Barrel: 1.9 tonnes, carriage: 3.9 tonnes)
Weapon Price: Cr46,080 (Barrel: Cr38,400, carriage: Cr7,680)
Crew: 18
Weapon Volume: $5m^3$
Set-Up Time: 13 turns
Ammunition Price: Cr48.5 (shot), Cr97 (Cannister), Cr12 (powder charge)
Ammunition Weight: 9.7 kg (shot), 9.7 kg (Cannister), 2.4 kg (powder charge)
Ammunition Volume: 1.9 liters (projectile), 0.5 liters (powder charge)
Features: None.

Round	*RLD*	*Conc-Burst*	*Damage Value*	*Penetration Value*	*Danger Space*	*Short Range*
13.5cm Shot	**13**	**—**	**30**	**9-8-7-4**	**—**	**140**
13.5cm Cannister	13	—	2D6/1D6*	1-Nil*	18×70	—

*primary radius/secondary radius

9.5cm Light Field Gun

This weapon is representative of the lightest field guns and heaviest regimental guns in use. Similar guns when used on Earth were commonly called *six-pounders*, after the weight of the roundshot projectile they fired. These light weight guns were the most-often used weapons by horse artillery.



TL: 3
Type: Smoothbore gun
Bore Diameter: 9.5
Barrel Length: 16 calibers (152 cm)
Mount: Field carriage.
Muzzle Energy: 0.1962 Megajoules
Weapon Weight: 1.6 tonnes (Barrel: 0.8 tonnes, carriage: 0.8 tonnes)
Weapon Price: Cr18,150 (Barrel: Cr16,500, carriage: Cr1,650)
Crew: 14
Weapon Volume: $2m^3$
Set-Up Time: 38 turns
Ammunition Price: Cr16.85 (shot), Cr33.7 (Cannister), Cr4 (powder charge)
Ammunition Weight: 3.4 kg (shot), 3.4 kg (Cannister), 0.8 kg (powder charge)
Ammunition Volume: 0.7 liters (projectile), 0.2 liters (powder charge)
Features: None.

Round	*RLD*	*Conc-Burst*	*Damage Value*	*Penetration Value*	*Danger Space*	*Short Range*
9.5cm shot	**4**	**—**	**21**	**5-4-4-2**	**—**	**130**
9.5cm cannister	4	—	2D6/1D6*	1-Nil*	16×65	—

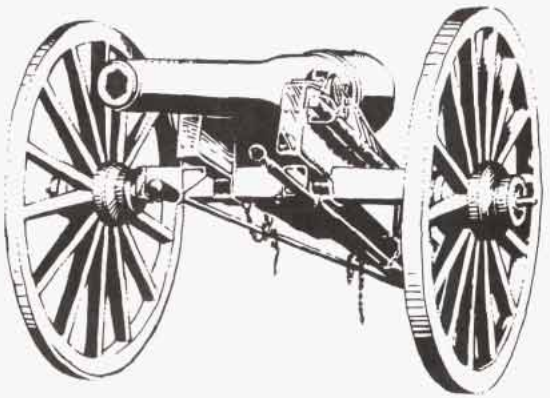
*primary radius/secondary radius

7.5cm Rifled Muzzle-Loading Field Gun
12cm Howitzer

7.5cm Rifled Muzzle-Loading Field Gun

This weapon is one of the earliest rifled field guns. Because early muzzle loaders could fire slightly more powerful charges than could breechloaders, muzzle loaders were retained for some time due to their longer range. Guns similar to this one were used throughout the American Civil War, of which the 3-inch Ordnance Rifle, 3-inch Rodman, and 10-pounder Parrot Gun were the most common examples.

TL: 3
Type: Rifled field gun
Bore Diameter: 7.5 cm
Barrel Length: 25 calibers (187.5 cm)
Mount: Field carriage
Muzzle Energy: 0.54 Megajoules
Weapon Weight: 0.6 tonnes (Barrel: 0.3 tonnes, carriage: 0.3 tonnes)
Weapon Price: Cr6,113 (Barrel: Cr5,558, carriage: Cr556)
Crew: 12
Weapon Volume: $1m^3$
Set-Up Time: 30 turns
Ammunition Price: Cr16.5 (conical shot), Cr33 (conical shell), Cr33 (Cannister), Cr66 (Shrapnel), Cr2 (powder charge—cannister), Cr4 (powder charge—all other rounds)
Ammunition Weight: 3.3 kg (conical shot), 3.3 kg (conical shell), 1.7 kg (Cannister), 3.3 kg (Shrapnel), 0.4 kg (powder charge—cannister), 0.8 kg (powder charge—all other rounds)
Ammunition Volume: 0.7 liters (projectile), 0.1 liters (powder charge—cannister), 0.2 liters (powder charge—all other rounds)
Features: None



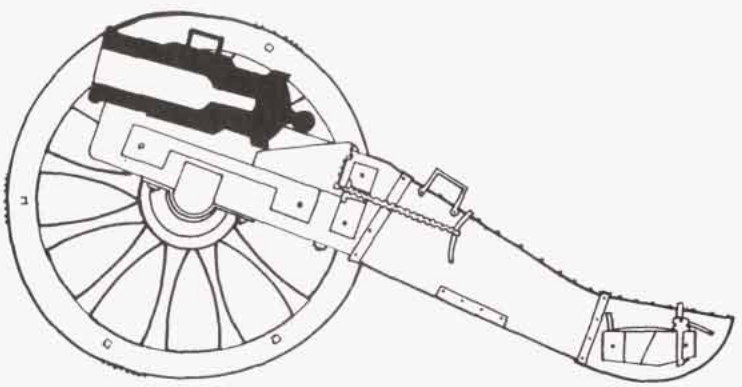
Round	*RLD*	*Conc-Burst*	*Damage Value*	*Penetration Value*	*Danger Space*	*Short Range*
7.5cm Con. Shot	**3**	**—**	**17**	**7-6-6-4**	**—**	**260**
7.5cm Con. Shell	3	C:3, B:15	—	1C	—	260
7.5cm Cannister	**3**	**—**	**2D6/1D6***	**1-Nil***	**33×130**	**—**
7.5cm Shrapnel	3	C:3, B:25	2D6/1D6*	1-Nil*	—	260

*primary radius/secondary radius

12cm Howitzer

This is a fairly typical howitzer of medium caliber. Weapons similar to this were used during the American Civil War and were called 12-pounder howitzers, so-called for the weight of the solid roundshot which they could (but rarely did) fire.

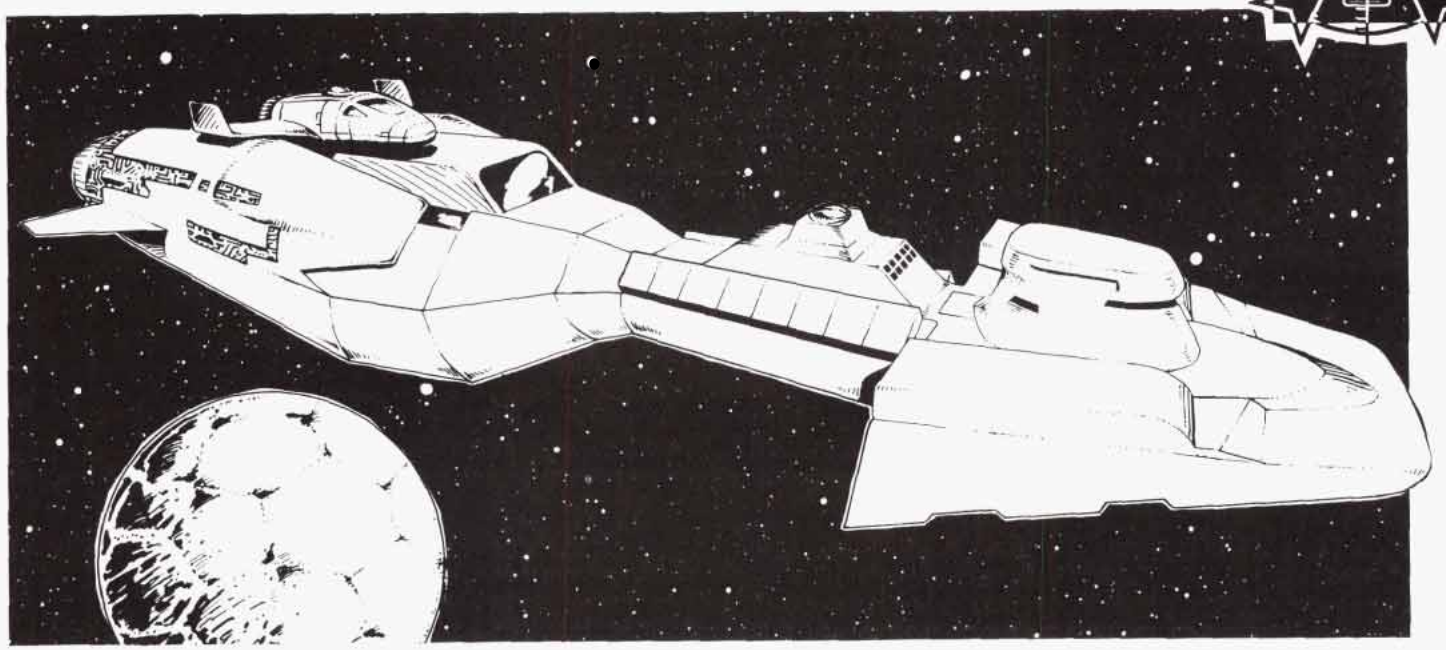
TL: 3
Type: Howitzer
Bore Diameter: 12cm
Barrel Length: 11 calibers (132 cm)
Mount: Field Carriage
Muzzle Energy: 0.1395 Megajoules
Weapon Weight: 1.6 tonnes (Barrel: 0.6 tonnes, carriage: 1 tonne)
Weapon Price: Cr14,780 (Barrel: Cr12,852, carriage: Cr1,928)
Crew: 17
Weapon Volume: $1.6m^3$
Set-Up Time: 48 turns
Ammunition Price: Cr33.9 (shot), Cr67.9 (Shell), Cr67.9 (Cannister), Cr9 (powder charge)
Ammunition Weight: 6.8 kg (shot, Shell, Cannister), 1.7 kg (powder charge)
Ammunition Volume: 1.4 liters (projectile), 0.3 liters (powder charge)
Features: None.



Round	*RLD*	*Conc-Burst*	*Damage Value*	*Penetration Value*	*Danger Space*	*Short Range*
12cm Shot	**3**	**—**	**26**	**3-3-3-2**	**—**	**80**
12cm shell	3	C:4, B:15	—	5C	—	80
12cm cannister	**3**	**—**	**2D6/1D6***	**1-Nil***	**10×40**	**—**

*primary radius/secondary radius

Tukera Freighter



General Data

Displacement: 2905/3000 tons
Length: 124.29 meters
Price: MCr754.61
Configuration: Needle USL
Hull Armor: 28
Volume: 40,670/42,000 m³
Target Size: M
Tech Level: 14
Mass (Loaded/Empty): 27,364.10/9837.99 tonnes

Engineering Data

Power Plant: 1770 MW Fusion Power Plant (98 MW/hit), 1 year duration (9.802 MW excess power)

Jump Performance: 4 (10,500 m³ fuel for jump 4, 7875 m³ for jump 3, 5250 m³ for jump 2, 2625 m³ for jump 1)

G-Rating: 1G (1500 MW/G), no Contra-Grav

G-Turns: 48 (104 using jump fuel), 187.5 m³ of fuel each

Fuel Tankage: 12,600 m³ (900 tons), plus 177 m³ (12.6 tons) reserved for power plant

Maint: 1055

Electronics

Computer: 2×TL-14 Model St (0.5 MW ea.), 1×TL-14 Model Fb (1 MW)

Commo: 2×1000 AU Radio (only one powered; 10 hexes; 20 MW)

Avionics: TL-10+ Flight Avionics

Sensors: Passive EMS fixed array 150,000km (5 hexes; 0.15 MW), Active EMS 240,000km (8 hexes; 13 MW)

ECM/ECCM: None

Controls: Bridge with 7×Bridge workstations, plus 14 other workstations

Weapons

Offensive: 2×TL-14 150 Mj Laser Turrets (Loc: 10, 11; Arcs: All; 4.2 MW ea.; 1 Crew ea.)

	Short	*Medium*	*Long*	*Extreme*
TL-14 150-Mj Laser Turret	2:1/10-31	4:1/10-31	8:1/10:31	16:1/10:31

Accommodations

Life Support: Extended (8.134 MW), Gravitic Compensators (5G; 203.35 MW)

Crew: 32 (14×Engineering, 1×Electronics, 2×Maneuver, 2×Gunnery, 4×Maintenance Crew, 3×Flight Crew, 4×Command, 1×Steward, 1×Medical)

Crew Accommodations: 14×Large Staterooms (double occupancy; 0.001 MW ea.), 4×Small Staterooms (single occupancy; 0.0005 MW ea.)

Passenger Accommodations: 8×Large Staterooms (0.001 MW ea), 2×Small Staterooms (0.0005 MW ea), 5×Emergency Low Berths (0.002 MW ea.)

Cargo: 15,208 m³ (1086.3 displacement tons)

Small Craft and Launch Facilities: 95-ton Shuttle in External Grapple (Unstreamlined)

Air Locks: 29

Notes

The Tukera Freighter is a relic Imperial-era design built for the Tukera Lines, an imperial megacorporation. These freighters were intended for use on civilized trade routes, and were built without a fuel purification plant, as they purchased their fuel at their destinations. For service in the New Era, recovered relic Tukeras are usually fitted with new-build fuel purification plants (1050 m³, 2100 tonnes, 0.42 MCr, and 15.75 MW to purify 10,500 m³ of fuel in 24 hours at TL-12) at the expense of cargo space. This requires the carried shuttle to be used as a fuel skimmer, a time-consuming process as the cutter carries only a maximum 482 m³ of fuel cargo at a time.

They are also built without other features common to ships used in undeveloped areas, such as master fire directors, an extensive defensive armament, and ECM. The ship's excess power allows it to be fitted with additional turret sockets and turrets, but these come at the expense of cargo capacity.

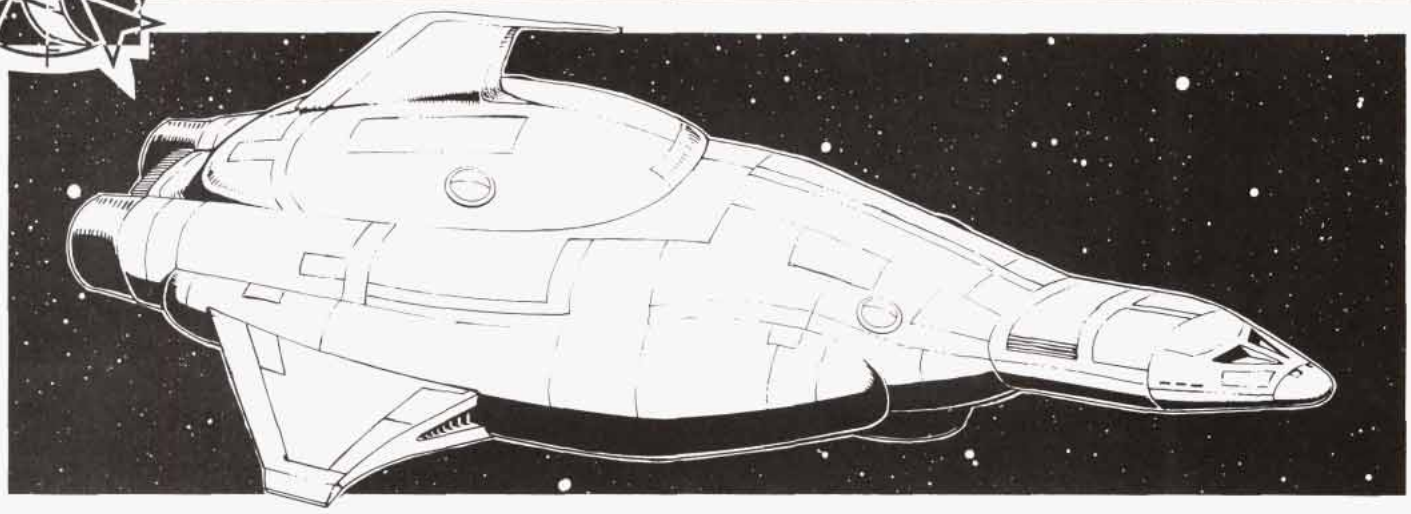
The freighter's drives are scaled to provide full jump and maneuver performance with the 95-ton shuttle attached to the external grapple. However, the shuttle must be powered up to provide its own life support, as the freighter has no excess capacity for this purpose.

On the damage tables below, if the shuttle is not attached, surface shuttle hits are taken by the grapple.

DAMAGE TABLES

Area (1D20)	*Surface Hits*	*Internal Explosion*	*Systems*
1	Ant	1-3: Elec, 4-20: Hold	SSR-(2h)
2	1-2: Ant, 5-7: AL	1-12: Qtrs, 13-20: Hold	LSR-1H
3	1-2: Ant	1-12: Qtrs, 13-20: Hold	Grapple-2H
4-8, 12-14		Hold	LS-10H
9, 15	CH	Hold	ELS-5H
10	1-2: 95-ton shuttle	1: LT, 2-20: Hold	AG-8H
11		1: LT, 2-20: Hold	JD-53H
16-17	95-ton shuttle	Hold	PP-18H

Hercules-class Bulk Carrier



General Data

Displacement: 5000 tons
Length: 127.5 meters
Price: MCr841.92
Configuration: Wedge USL
Mass (Loaded/Empty): 52,876.32/13,827.62 tonnes
Hull Armor: 28
Volume: 70,000 m³
Target Size: M
Tech Level: 14

Engineering Data

Power Plant: 3432 MW Fusion Power Plant (98 MW/hit), 1 year duration (0.3975 MW excess power)
Jump Performance: 1 (7000 m³ fuel)
G-Rating: 1G (2500 MW/G), Contra-Grav Lifters (500 MW)
G-Turns: 48 (70.4 using jump fuel), 312.5 m³ of fuel each
Fuel Tankage: 22,000 m³ (1571.4 tons), plus 343.2 m³ (24.5 tons) reserved for power plant, plus, optionally, additional 7000 m³ (500 tons) in auxiliary fuel bladder at the expense of cargo
Maint: 2098

Electronics

Computer: 2×TL-14 Model St (0.5 MW ea.), 1×TL-14 Model Fb (1 MW)
Commo: 2×1000 AU Radio (only one powered; 10 hexes; 20 MW)
Avionics: TL-10+ Flight Avionics
Sensors: Passive EMS fixed array 150,000km (5 hexes; 0.15 MW), Active EMS 240,000km (8 hexes; 13 MW)
ECM/ECCM: None
Controls: Bridge with 12×Bridge workstations, plus 28 other workstations

Weapons

Offensive: 4×TL-14 150-Mj Laser Turrets (Loc: 2, 3—Arcs: 1, 2, 3; Loc: 16, 17—Arcs: All; 4.2 MW ea.; 0-1 Crew ea.)
Master Fire Directors: 2×TL-14 Beam/Msl MFD (5 Diff Mods; 10 hexes Msl; 2 hexes; 0.874 MW ea.; 1 Crew ea.)

	Short	*Medium*	*Long*	*Extreme*
TL-14 150-Mj Laser Turret	2:1/10-31	4:1/10-31	8:1/10:31	16:1/10:31

Accommodations

Life Support: Extended, (14 MW), Gravitic Compensators (5G; 350 MW)
Crew: 47-51 (28×Engineering, 1×Electronics, 2×Maneuver, 2-6×Gunnery, 4×Maintenance Crew, 3×Flight Crew, 7×Command)
Crew Accommodations: 22×Small Staterooms (double occupancy; 0.0005 MW ea.), 7×Small Staterooms (single occupancy; 0.0005 MW ea.)
Passenger Accommodations: None
Cargo: 36,781.25 m³ (2627.23 displacement tons); reduced to 30,131.25 m³ (2152.23 tons) when auxiliary fuel bladder is filled, can be increased to 37,131.25 m³ (2652.23 tons) by removing auxiliary fuel bladder altogether
Small Craft and Launch Facilities: 50-ton modular cutter with fuel module in Internal Hangar (Spacious) with one launch port
Air Locks: 50

Notes

The *Hercules*-class bulk carrier is the epitome of the lumbering pig of a ship which results from an attempt to maximize cargo capacity within a starfaring hull: fully 52.5% of the ship's displacement is given over to cargo carriage. The *Hercules* was a proprietary design built for Tukera Lines and Akerut Lines (a wholly owned subsidiary of Tukera Lines) during the Last Imperium.

The *Hercules* is a relic pre-Collapse design, optimized for use on the "mains" of the Last Imperium. Mains are astrographic features which are simply a string or clump of star systems grouped so that all of the systems in the group can be reached without having to exceed jump-1. Many ships, notably the standard free traders, remain "trapped" in a single main for all of their service lives, as their jump-1 drives render them incapable of making the 2+ parsec jump to a single world or other main not contiguous with the main they are in. The *Hercules* class is designed to surmount this difficulty with the use of an auxiliary fuel bladder with sufficient capacity to allow two consecutive jump-1s for a total of two parsecs. This allows the *Hercules* to move from one main to another (provided they are not separated by more than a parsec) and enhances its flexibility.

The procedure calls for the *Hercules* to refuel its permanent tanks as well as its collapsible fuel bladder (the bladder displaces 7000 m³ when full and 350 m³ when empty) and make the one parsec jump to deep space (an empty hex on a star map). Here it transfers the fuel from its bladder into its permanent tankage (fuel in a bladder cannot be burned directly, but must be transferred to permanent tankage) for the second jump. Thus the 2-parsec journey takes a nominal two weeks (not counting time to transfer fuel and recalibrate the drives, etc.) rather than the nominal one week of a single 2-parsec jump.

Note that the figures above include a single auxiliary bladder permanently fitted to the vessel. Additional such bladders may be added at a cost of MCr0.7 each. Each bladder displaces 7000 m³ (500 tons) loaded and 350 m³ (25 tons) empty.

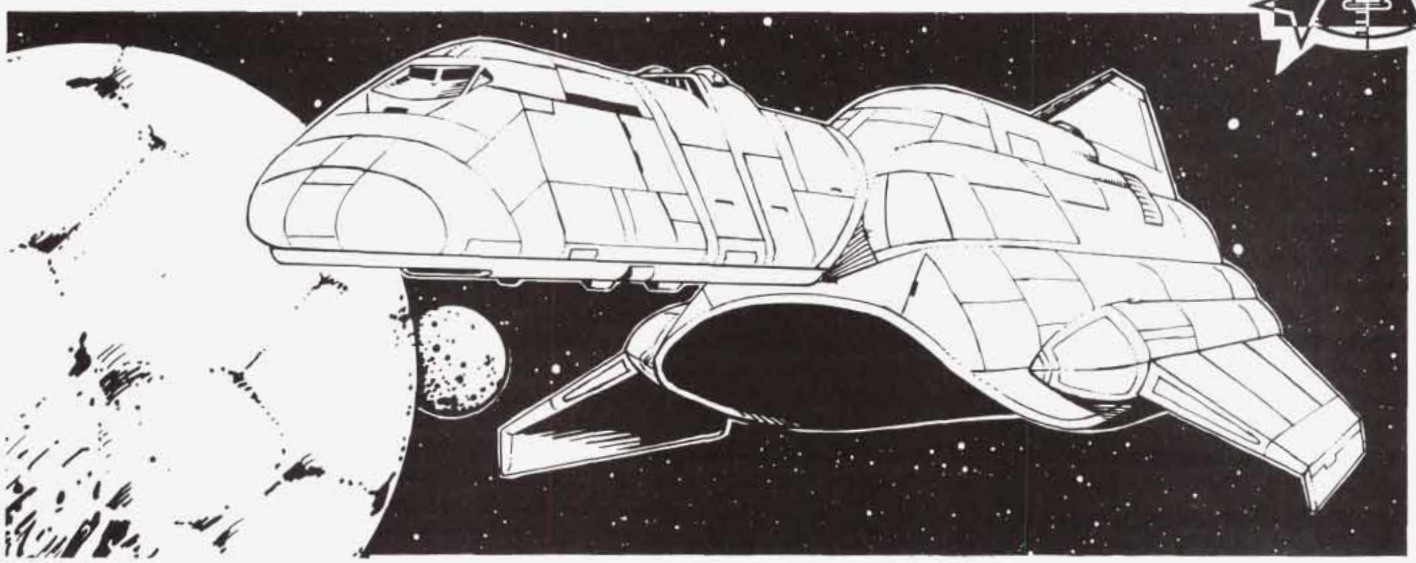
Because its two master fire directors can control the ship's four turrets without requiring them to be manned, the *Hercules* crew can be reduced by four members by leaving the turrets unmanned. This naturally prevents the turrets from being fired under local control should the MFDs be taken out of action.

TL-14 fuel purification machinery (8.75 MW) refines 7000 m³ of fuel (full load of jump fuel) in 24 hours. Standard practice is to skim a full load of fuel (jump fuel and reaction mass), refine sufficient fuel to jump, execute the jump, and refine the remainder while in jumpspace. 5% fuel scoops allow the vessel to scoop 14,000 m³ of fuel per hour.

DAMAGE TABLES

Area (1D20)	*Surface Hits*	*Internal Explosion*	*Systems*
1	1-8: Ant	1-3: Elec, 4-20: Hold	Hangar-28H
2	1-3: AL	1: LT, 2-8: Qtrs, 9-20: Hold	SSR-(2h)
3	CH	1: LT, 2-7: Qtrs, 8-20: Hold	LS-16H
4-6		Hold	ELS-8H
7	1-4: LP, 5-14: CH	Hold	AG-14H
8-12		Hold	JD-35H
13	CH	Hold	PP-35H
14-15		Hold	MD-3H
16		1: LT, 2-20: Hold	CG-10H
17	1-19: CH	1: LT, 2-20: Hold	FPP-9H
18		1-4: Eng, 5-20: Hold	LT-1H
19		1-3: Eng, 4-20: Hold	All Others-(1h)
20		Eng	

Frontier Transport



General Data

Displacement: 2000 tons
Length: 90 meters
Price: MCr520.24
Configuration: Wedge SL
Mass (Loaded/Empty): *20,412.72/8776.66 tonnes*
Hull Armor: 28
Volume: 28,000 m³
Target Size: M
Tech Level: 14

Engineering Data

Power Plant: 2439 MW Fusion Power Plant (98 MW/hit), 6 months duration (7.0585 MW excess power)

Jump Performance: 2 (4200 m³ fuel for Jump 2, 2100 m³ fuel for Jump 1))

G-Rating: 2G (1000 MW/G), Contra-Grav Lifters (200 MW)

G-Turns: 48 (81.6 using jump fuel), 250 m³ of fuel each

Fuel Tankage: 10,200 m³ *(728.6 tons)*, *plus* 121.95 m³ *(8.7 tons)* reserved for power plant

Maint: 771

Electronics

Computer: 2×TL-14 Model St (0.5 MW ea.), 1×TL-14 Model Fb (1 MW)

Commo: 2×1000 AU Radio (only one powered; 10 hexes; 20 MW)

Avionics: TL-10+ Flight Avionics

Sensors: Passive EMS folding array 180,000km (6 hexes; 0.2 MW), Active EMS 240,000km (8 hexes; 13 MW)

ECM/ECCM: None

Controls: Bridge with 11×Bridge workstations, plus 20 other workstations

Weapons

Offensive: 10×TL-14 150-Mj Laser Turrets (Loc: 2, 3, 4, 5, 10, 10—Arcs: 1, 2, 3; Loc: 16, 17, 18, 19—Arcs: All; 4.2 MW ea., 0-1 Crew ea.)

Master Fire Directors: 2×TL-14 Beam/Msl MFD (5 Diff Mods; 10 hexes Msl; 2 hexes; 0.874 MW ea.; 1 Crew ea.)

	Short	*Medium*	*Long*	*Extreme*
TL-14 150-Mj Laser Turret	2:1/10-31	4:1/10-31	8:1/10:31	16:1/10:31

Accommodations

Life Support: Extended (5.6 MW), Gravitic Compensators (5G; 140 MW)

Crew: 36-47 (20×Engineering, 1×Electronics, 2×Maneuver, 2-12×Gunnery, 3×Maintenance, 3×Flight, 5-6×Command), *see Notes below*

Crew Accommodations: 21×Large Staterooms (double occupancy; 0.0005 MW ea.), 6×Small Staterooms (single occupancy; 0.0005 MW ea.)

Passenger Accommodations: None

Cargo: 9968.95 m³ (712 displacement tons)

Small Craft and Launch Facilities: 95-ton Shuttle in Internal Hanger (Minimal) with one launch port

Air Locks: 20

Notes

The Frontier Transport in a relic Imperial-era design, and was a multi-purpose cargo vessel used for trade in undeveloped areas. The design was a proprietary design belonging to the Imperiallines shipping line, which primarily served worlds situated off of the main trade routes.

Some ships dispense with some or all of the 10 gunners, as the turrets can be controlled from the two MFDs, which also allows one of the command crew to be dispensed with. This allows the required complement to be reduced to as low as 36, although without crew, the turrets cannot be fired under local control if something happens to the MFDs. The MFDs are also capable of controlling missile turrets, if these are fitted.

TL-14 fuel purification machinery (5.25 MW) refines 4200 m³ of fuel (full load of jump fuel) in 24 hours or 2100 m³ of jump fuel (sufficient for jump-1) in 12 hours. Standard practice is to skim a full load of fuel (jump fuel and reaction mass), refine sufficient fuel to jump, execute the jump, and refine the remainder while in jumpspace. 5% fuel scoops allow the vessel to scoop 5600 m³ of fuel per hour.

An externally identical variant of this vessel was also built for the Last Imperium, but is equipped with jump-6 drives and fuel tankage at the expense of cargo.

DAMAGE TABLES

Area (1D20)	*Surface Hits*	*Internal Explosion*	*Systems*
1	Ant	1-6: Elec, 7-20: Hold	PEMS Ant-(4h)
2	1-13: Ant	1: LT, 2-12: Qtrs, 13-20: Hold	Hangar-27H
3	1-3: AL	1: LT, 2-12: Qtrs, 13-20: Hold	SSR-(2h)
4-5	1-2: Ant	1: LT, 2-20: Hold	LS-9H
6-7	1-10: CH	Hold	ELS-4H
8-9		Hold	AG-6H
10		1: LT, 2: LT, 3-20: Hold	JD-21H
11-15		Hold	PP-25H
16	1-12: LP, 13-14: CH	1: LT, 2-20: Hold	MD-2H
17	1-14: CH	1: LT, 2-20: Hold	CG-4H
18		1: LT, 2-11: Eng, 12-20: Hold	FPP-6H
19		1: LT, 2-10: Eng, 11-20: Hold	LT-1H
20		Eng	All Others-(1h)

INDEX

20-km Mapping Hexes .. 19-20, 27, 31-33, 72
Acclimatization 13-15, 36, 41
Action ("A") Teams 55, 61-62
Agricultural Capital 27-28
Agricultural Laborer 27
Agricultural Production of Raw Materials .. 30
Agricultural Sector 27
Agricultural Richness 20-21, 28
Agricultural Usable Area 20-21, 28
Agronomists 61, 62
Aircraft 15, 16, 17
Animal Encounters 24, 66-67, 80-81
Armed Forces 33, 49-50, 63
Armed Forces Laborer 33
Armed Forces Sector 33
Atmospheres 11, 90-91
Atmospheric Contaminants 15-16, 90-91
Atmospheric Physiological Effects 11-15
Aurora-Class Clippers 49, 52
Axial Tilt 85
Baldur 6, 69-70, 75-76
Base ("B") Teams 55, 61-62
Base Battalion Combat Value (BCV) 43
Biological Compatibility 18
Black Powder Small Arms ... 92-95, 101-104
Black Powder Cannons 97-99, 105-106
Blocking 45
Blunderbuss 100, 102-103
Bootstrap Operations 6, 48-65
Capital 27-30, 34
Civil Engineers 61, 62
Colonists 70-72
Colony Operations 5, 26-41, 68-79
Combat 45
Continents & Oceans 88-89
Crimes 37, 65, 76
Criminals 72, 73
Day/Night Temperature Variation 85
Dense Atmospheres 11
Density & Gravity 17, 87
Design Sequences
  Black Powder Cannons 97-99
  Black Powder Small Arms 92-95
  Bow Weapons 96
  Wagons 95
Detection 44
Disease 24-25, 37, 64, 75
Economic Model 23, 27-41, 47, 64
Exports 35, 69, 76
Extractable Hydro Power 21-22
Extractable Wind Power 22
Farmers 71, 72, 73
Fatigue 13-14, 24-25
Fatigue, Mass Combat 14, 44, 46
First Contact Reactions Table 54
Fossil Fuels 18, 31
Free Market 41
Geologists 61, 62
Gravity 17, 87
Ground Tactics 63
Growing Season 20, 72
High-Level Roleplaying ... 5, 39, 49, 70, 72
Hivers 49-57
Holmgren 53-56, 64-65
Housing 33
Hydro Power 21-22, 31
Immanuel Kant 49, 52-53
Industrial Capital 29
Industrial Laborer 28
Industrial Output 29
Industrial Sector 28
Infrastructure 31,34
  Armed Forces 34
Instruction 61-62, 63
Interviewing 51
Laborer 27
  Agricultural 27
  Industrial 28
  Materials 30
Land 27, 28, 29
Leadership 41, 63, 74
Livestock 28, 36, 72, 74
Local Inhabitants 53-54, 75
Local Transport Net 32
Low-Level Roleplaying 5, 39, 47, 70, 72
Maintenance 35
Mapping 23, 36, 63, 72, 88-90
Mapping Hexes .. See 20-km Mapping Hexes
Maps, Planetary 57-58, 78-79
Mass Combat System 42-47
Materials Capital 30
Materials Laborer 30
Materials Output 30
Materials Richness 21, 30
Materials Sector 30
Materials Usable Area 21, 30
Metallurgists 61, 62
Military Advisors 51, 61, 62
Mineral Testing 17-18
Month, definition of 36
Monthly Turn Outline 38
Morale 45
Musket 101-104
NPCs 48, 55, 65
NPC Personalities 51-52, 70-71
NPC Templates 73
Oceans & Continents 88-89
Orbital Period (Year) 83
Oriflamme 24, 48, 71-72
Output 28, 29, 30, 34, 41
Output Roll 38, 41, 56, 61, 62
Persuasion Tasks 41, 54, 56
Physiological Difficulties 12
Pistol 103
Planetary Hexes 19, 20, 88
Planetary Maps 57-58, 78-79
Planets 82-91
Player Handouts 57-60, 77-79
Political Roll 40, 61, 62, 64-65
Political Table 40, 55-56
Political Track 41, 56
Population Growth 36
Power 27, 28, 29, 30-31
Poyzen 69-70, 77-79
Prior Exploitation 18, 21
Radioactives 18, 31
Random Events 36-37, 64, 76
  Scenario-specific 37, 64, 74
Rations 28, 33, 47
Raw Materials 27, 28, 29, 33, 34
  Agricultural Production of 30
  Armed Forces use of 34
Readiness 34
Recruiting 51
Resource Transport Lines 32
Richness 20-22, 27, 28, 30
Richness, Materials 21, 30
Roads 32, 36
Rotational Period (Day) ... 58, 77, 83, 85, 87
Satellites 87
Seasons 20, 85
Security Specialists 5, 51, 62, 74
Sensors 9-10
Set-up Procedures 36
So Skire 49-50, 53, 57-60
Soil Contaminants 18
Solar Power 31
Standard of Living 40
Standard of Nutrition 37
Standard of Shelter 39
Stars 82
Starships 8, 37, 70, 74-75, 107-109
Supply 34, 46-47, 63
  and Fatigue 44
Survey 7-25
  As Adventure 23
  General 10
  Goal Oriented 18, 20
Survey Data 50, 57-58, 77, 69
Tainted Atmosphere 15-16
Tech Level, Determining 28
Tectonic Plates 88-89
Temperature 17, 58, 77, 84-86
Temperature Worksheets 58, 77, 86
Tents 36
Terrain 19, 44, 47, 89-90
Thin Atmospheres 11
Tidally Locked Worlds 83, 86, 90
Trade 35
Transportation 31-33
Troop Quality 34
Uncertain Tasks 11
Undesirables 72, 73
Useable Area 20-22
Vehicles 33
Veterinarians 73
Veterinary Medicine 36, 64, 71-75
Weather 17, 23, 35, 36
  Effects on Maintenance 35
Weather Factors 23, 35, 50, 69
Weather Track 23
Wind Power 22, 31
Year 36, 76, 83

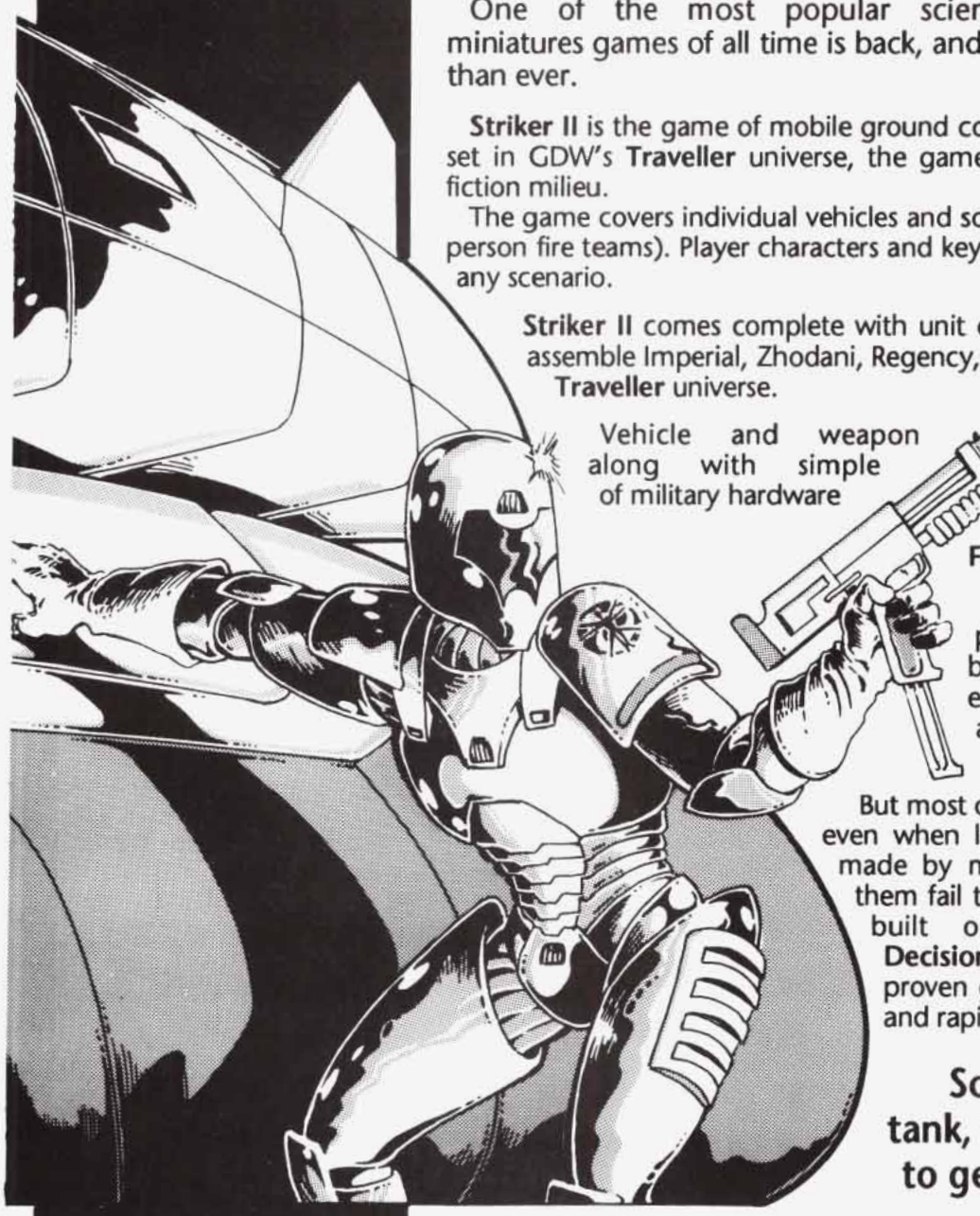
STRIKER II

One of the most popular science-fiction miniatures games of all time is back, and it's better than ever.

Striker II is the game of mobile ground combat in the far future. Although it is set in GDW's **Traveller** universe, the game system is suitable for any science-fiction milieu.

The game covers individual vehicles and soldiers (sometimes grouped into four-person fire teams). Player characters and key NPCs are easily inserted directly into any scenario.

Striker II comes complete with unit organization charts to enable you to assemble Imperial, Zhodani, Regency, Coalition, and other armies from the **Traveller** universe.



Vehicle and weapon ratings are included as well, along with simple guidelines for rating any item of military hardware in the **Traveller** universe (including those designed using **Fire, Fusion, & Steel**™) for the game.

Special rules cover meteoric planetary assault, orbital bombardment, hostile planetary environments, electronic warfare, and all of the other key issues of future military conflict.

But most of all, **Striker II** is fun and fast-playing even when large units are used. That's a claim made by most miniatures rules, and most of them fail to deliver the goods. But **Striker II** is built on GDW's popular **Command Decision**™ World War II and modern rules, a proven game system known for its fast play and rapid movement.

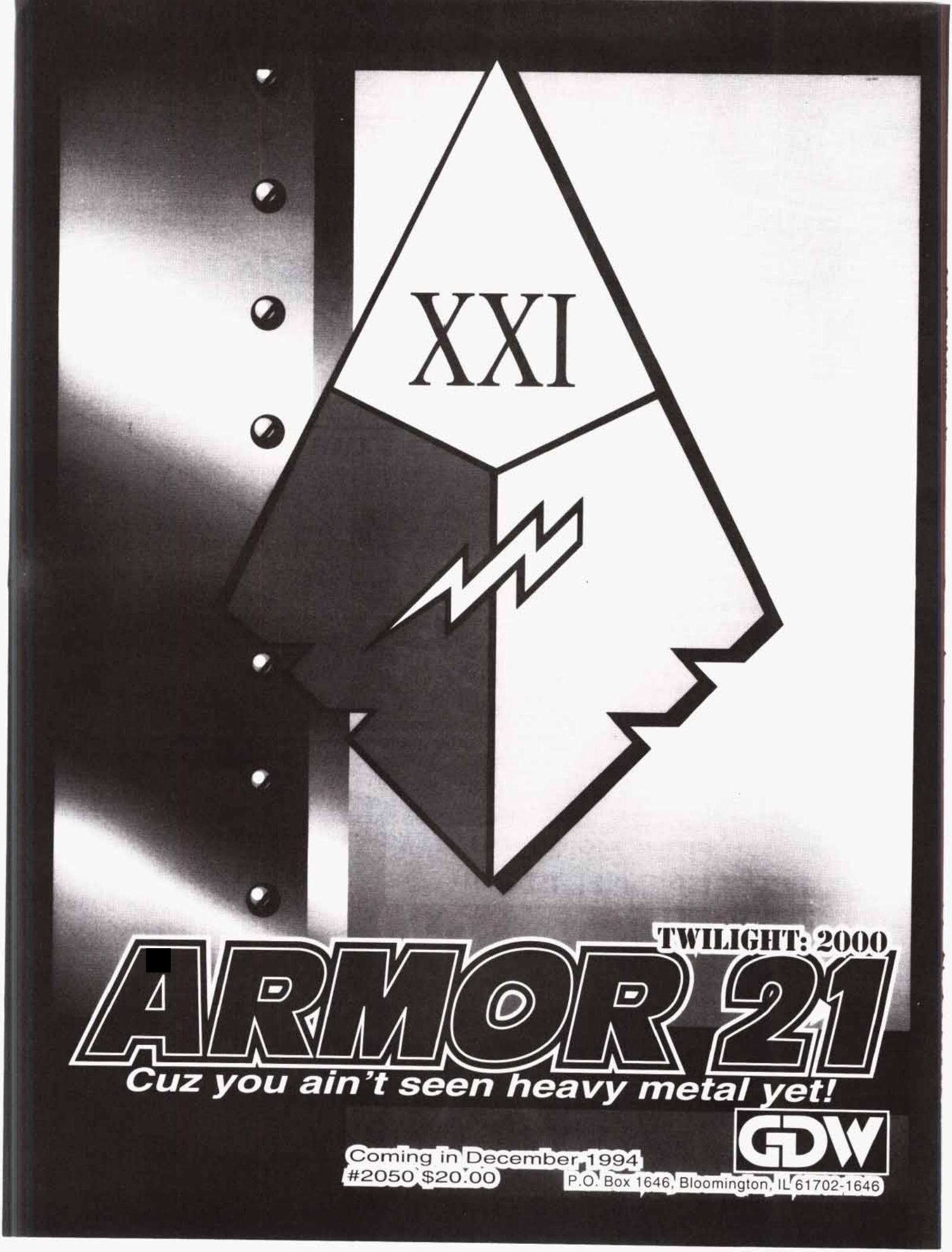
So mount up in your grav tank, trooper. Things are about to get a lot more interesting.

Science Fiction Roleplaying Game

TRAVELLER®
The New Era

GDW
GAME DESIGNERS' WORKSHOP

P.O. Box 1646, Bloomington, IL 61702-1646


XXI
TWILIGHT: 2000
ARMOR 21
Cuz you ain't seen heavy metal yet!
GDW
Coming in December 1994
#2050 $20.00
P.O. Box 1646, Bloomington, IL 61702-1646