TRAVELLER™: 2300

REFEREE'S MANUAL

GAME DESIGNERS' WORKSHOP

**"There can be no thought of finishing,
for 'aiming at the stars,'
both literally and figuratively,
is a problem to occupy generations,
so that no matter how much progress one makes,
there is always the thrill of just beginning."**

**—Dr. Robert Goddard
(in a letter to H. G. Wells)**

The Game Designers' Workshop Design Staff

The placement of the apostrophe says volumes about GDW. Its position after the "s" of Designers means that we are an association of many, rather than the handiwork of just one. Our philosophy has served us well— from the very beginning, GDW has produced quality, award-winning, games and simulations. **Traveller: 2300** is one of them. The award-winning design staff which worked on the game includes:

Marc W. Miller. Designer of the best-selling **Traveller** science fiction role-playing game and many historical and science fiction boardgames including **Imperium** and **Triplanetary**. His games have been recognized across the entire spectrum of gaming; they have won the Charles Roberts Award, the H. G. Wells Award, the Strategist's Club Award, and the Game Designers' Guild Award. Marc was elected to the Adventure Gaming Hall of Fame in 1981.

Frank Chadwick. Designer of the best-selling **Twilight: 2000** role-playing game. Frank is one of the great systems designers in modern gaming; he is responsible for the game systems behind more than 50 titles, including the **Third World War** series, the **Assault** series, much of the **Europa** series. He has designed award winners in boardgames, role-playing, and miniatures. He was elected to the Adventure Gaming Hall of Fame in 1985.

Timothy B. Brown. Experienced writer, developer, editor, and designer. He worked his way up through the GDW organization, showing his talents and making himself indispensible. He naturally gravitated to development, where he has made his mark on **Twilight: 2000** and **Traveller** products.

The background history for **Traveller: 2300** was developed over the course of 1985-86 using a grand social-political-economic-military-diplomatic simulation known fondly here as *The Game*. The future course of history depended not on just one person's ideas of what the future would be like, but on the interaction of many people's ideas— the ones that survived were the ones that withstood the conflict and diplomacy of *The Game*. Beginning with the conduct of World War III, players manipulated their nations on five or ten year turns to bring them into the future of 2300. Players in *The Game* were—

John Astell (Mexico, Romania, and India).
Rich Banner (Russia, Zimbabwe, and Canada).
Kevin Brown (Cuba, the Ukraine, and Australia).
Timothy B. Brown (United Kingdom, Algeria, and Manchuria).
Larry Butz (Venezuela, Italy, Iran, and Angola).
John Harshman (France, Argentina, and Israel).
Dr. David MacDonald (Military Government of the United States, Poland, and Canton).
Marc W. Miller (Azania, Japan, Bolivia, and Egypt).
Matt Renner (Civilian Government of the United States, Sweden, and Nigeria).
Wayne Roth (Brazil, Spain, and Turkey).
Loren Wiseman (New America, Germany, and Indonesia).
Frank Chadwick (Referee and kibbitzing player).

Significant Contributions

Additional help in the design, development, and production of **Traveller: 2300** came from many quarters. They included:

Loren Wiseman for basic science fiction conceptualizations and background development. Gary Thomas and Joe Fugate of Digest Group for their task system design and development. John Harshman for some basic science fiction conceptualizations. Matt Renner and Kevin Brown for character generation systems. Steve Venters for the **Traveller: 2300** logo, equipment and weapons conceptualizations, and the box cover painting. Bryan Gibson for vehicle designs.

Artists contributing to this game: D. J. Barr, Tim Bradstreet, Steve Venters, Bryan Gibson, Rob Caswell, Dana Reischauer, Dan Panosian, Liz Danforth, Tom Peters. Barbie Pratt provided art direction and graphic design.

The Game Designers' Workshop production staff includes: Darlene File, Vera Nerby, Barbie Pratt, Elena Santos, and Dana Reischauer.

TRAVELLER™: 2300

REFEREE'S MANUAL

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GAME DESIGNERS' WORKSHOP

Life on the Frontier

No simple description of life in the colony worlds will suffice since there are over thirty worlds with human inhabitants and, to some extent, each one is unique. Tirane, the first colony world, has large technologically advanced cities, and is in many respects a less-crowded and better-designed version of Earth. The early colonies on Tirane have been in existence for 133 years, and there are currently fifth and sixth generation Tiraneans. More recent colonies may often have only second or third generation colonists, and these are always in the minority as immigration tends to be the largest component in colonial population growth. Second and third generation colonists on such worlds often view "tenderfoot" immigrants with very mixed emotions. In the two Incan colonies there are no second generation colonists older than their teens, and very few of these. Effectively, all inhabitants are there because they moved there and are carving new homes from the wilderness.

One aspect of frontier psychology which separates first generation colonial immigrants from native-born human inhabitants of the planet is their views toward the mother country. Native-born colonists tend to think of themselves as citizens of their planet rather than of the home country, while immigrants have stronger emotional ties to the motherland. On many worlds with multiple national colonies the native-born inhabitants feel they have more in common with other natives of the world than with the citizens of their country back on Earth, and this often causes friction. Territorial boundaries between national colonies often mean more to politicians back home than to the actual inhabitants of the area. When international tensions run high and neighboring colonies find themselves on opposite sides of the fence it is generally the immigrants who swell the ranks of newly raised local military forces; the "old-timers" are usually more inclined to leave their neighbors on the other side of the imaginary political line in peace.

On the other hand, neighboring colonies sometimes generate friction of their own over some local issue, such as water or mineral rights in an area. If the owning governments enjoy otherwise friendly relations, the dispute is often viewed as an irritation by the central authorities causing further estrangement between Earth and the colonies.

Despite all of the above, however, a sense of national, linguistic, and cultural identity remains a central element to human self-image. Mankind has not yet become sufficiently cosmopolitan to achieve an end to the nation state.

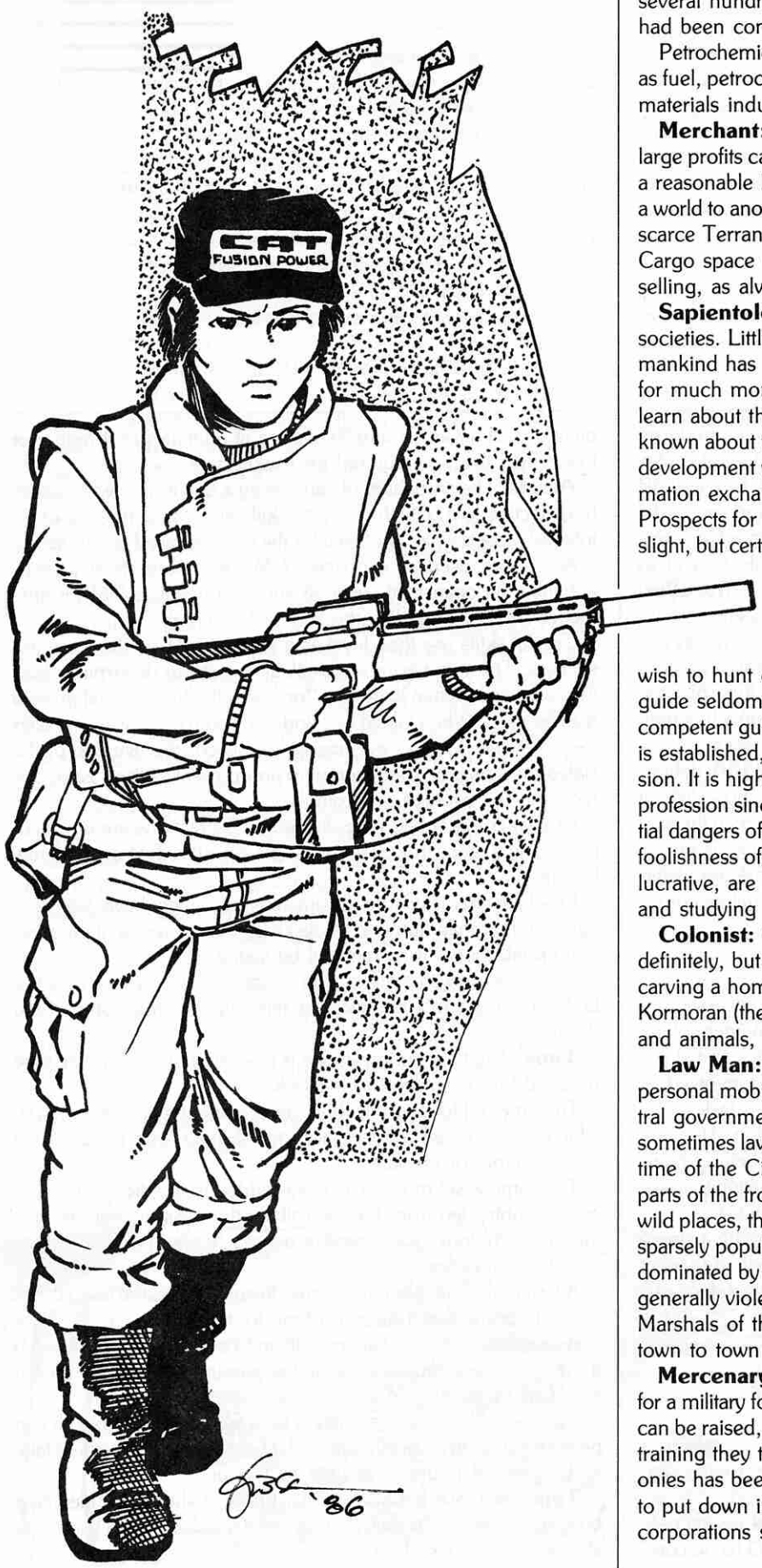
One aspect of frontier life which continues to draw immigrants and holds native colonists to their home is the continuous excitement and challenge of the unknown. Even in the twentieth century there were regions of Terra which had scarcely been mapped, let alone extensively explored, and that was on a world literally teeming with people. The colony worlds all remain almost entirely unexplored except in the most cursory fashion. While all points on the world are theoretically accessible by modern means of transportation, there simply have not been enough people nor time to even begin a complete exploration of any of the worlds. For those who crave isolation and untouched wilderness, there is always another valley over the next mountain range, and many small family ranches or farms can be found scattered around the surface of many worlds.

A variety of occupations are engaged in by frontiersmen, and game players can take any of these as a guide to their adventures. A brief list is presented below and is intended to be a springboard for your imagination rather than a limit to it.

Explorer: The colony worlds remain largely unexplored; in addition, there are virgin worlds not yet even visited by humans which can be explored. Often a scientific organization, foundation, or entertainment company will finance such an exploration. Earth's demand for entertaining and informative documentaries about alien worlds is nearly inexhaustible. Extensively filmed safaris into unexplored territory command good prices, especially if the element of danger and excitement is high. The trick is not only to survive, but to get it all on film!

Governments will often pay for more practical surveys of an area, as a prelude to colonization or out of interest in potentially exploitable minerals. Fully exploring even a 100 kilometer hex can take weeks, depending on what is to be accomplished. One task might be simply to catalog the native life present. Since there is usually more than one animal occupying a singe niche in the food chain, a referee may have a party camp and explore an area and conduct animal encounters until they have encountered the top carnivore, two each of the next tier of animals, four each of the next tier of animals, and ten each of the next tier. This should give a reasonably complete catalog of the carnivores, omnivores, and herbivores in a region. Of course, in areas of scarcer life there would not be as many tiers and a much lower diversity of life.

Prospector: Minerals are still valuable. Bulk ores (such as iron) are useful, but not particularly rare. Radioactives are extremely useful in medicine, research, and some power plants, and thus command high prices. Tantalum, the extremely rare metal used in the central coils of the Jerome Effect star drive, is worth fortunes to the lucky prospector who finds it. (However, by the year 2300 there were only 47 major tantalum deposits discovered on



all of Terra, which should give some indication of the scarcity of the mineral. None of these "major" deposits contained more than several hundred metric tons when discovered, and by 2300 all had been completely mined out.)

Petrochemicals are another valuable find. Although seldom used as fuel, petrochemicals remain extremely valuable to the synthetic materials industry.

Merchant: You don't need a starship to be a merchant. While large profits can be made carrying goods from one star to another, a reasonable living can be made trading goods from one part of a world to another. This is particularly true on enclave worlds where scarce Terran technology can be traded for unique alien goods. Cargo space on bulk carriers can be contracted for; the key to selling, as always, lies with the salesman.

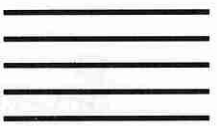
Sapientologist: Sapientologists study alien cultures and societies. Little is known about any of the alien races with which mankind has contact. After all, none of them have been known for much more than fifty years, which is not very much time to learn about the history and culture of an entire species. More is known about the Sung than any other race, as their technological development was so close to ours that rapid and large-scale information exchange could easily take place on a meaningful level. Prospects for learning more about the Kafers are, at the moment, slight, but certainly challenging. The Xiang, Ebers, and Pentapods, however, are both open to contact and are fascinating, unknown races.

Guide: The lure of the wilderness is strong in most humans, and wealthy individuals often wish to hunt or explore in dangerous territory. Those without a guide seldom return, which results in a high demand for those competent guides who are available. Once a reputation as a guide is established, a character can make a good living at the profession. It is high paying and interesting. It is also a fairly dangerous profession since the guide is almost constantly subject to the potential dangers of the wilderness complicated by the inexperience and foolishness of his wealthy safari parties. Less glamorous, but also lucrative, are scientific parties with a genuine reason for visiting and studying an area.

Colonist: Characters may not choose to remain colonists indefinitely, but there is considerable adventure involved in simply carving a home out of the wilderness. This is particularly true on Kormoran (the Eber homeworld), where in addition to the elements and animals, colonists must deal with local natives as well.

Law Man: The combination of low population density, high personal mobility, the lure of riches, and fairly low respect for central government makes much of the frontier a pretty rough and sometimes lawless place. Think of the American West around the time of the Civil War and you have a pretty good feel for many parts of the frontier. While the starport cities themselves are often wild places, the most challenging assignments for lawmen are the sparsely populated ranges where small settlements are sometimes dominated by corrupt politicians, terrorized by local gangs, or just generally violent, anarchic places to live. Much like the Territorial Marshals of the American West, lawmen are often moved from town to town to "clean up" the less savory elements.

Mercenary: When border disputes erupt, there is often a need for a military force to assert or defend a colony's rights. Local militia can be raised, but in the absence of a standing army and universal training they tend to be poor units. The alternative for many colonies has been the hiring of mercenaries. Mercenaries are used to put down insurrections or hunt down frontier bandits. Private corporations sometimes hire them as special security guards.



Tasks

A task is any important activity which characters can perform; any activity can be a task. Characters face tasks as natural consequences of their adventures and ambitions; they may face a single task, or a series of tasks. Proper selection of tasks and successful completion of those tasks is what leads to success in adventures.

Because these game rules define and describe tasks (as well as allowing the referee to also define and describe tasks), **Traveller: 2300** players are given understandable and consistent descriptions of what must be done to accomplish missions. Referees can use tasks to handle recurring situations on a consistent basis, confident that they are being fair in their dealings with their players. Players can, on the basis of task statements, predict which of their number will be most likely to succeed in specific tasks.

Overview: The task concept in **Traveller: 2300** defines specific undertakings by noting what must be done, how difficult it is to do, and what skills and characteristics will influence the success of the task. Specific rules handle tasks which may be uncertain, hasty, hazardous, or unskilled. Attempting the task also determines how long it took. Finally, rules cover the negative consequences of failure in a task attempt.

TASK COMPONENTS

Tasks are written in a specific format to allow all necessary information to be included. Each task consists of a statement of the task, its degree of difficulty, the assets (characteristics and skills) which may modify the outcome, and the time factor involved. A task may be identified by type if it is not a standard task.

Task Statement: A short, but complete, description of the task conveys to the players and the referee the actions being undertaken. The task statement should have enough information to make it distinct, but not be wordy enough to make it unclear.

The basic concept of the task statement is to describe a single action which can reasonably be considered by itself. Repair of damaged items may, for example, be broken down into a diagnosis task and a repair task.

Examples of task statements are:

To sneak past a compound guard.

To repair a broken radio.

To solve a complex mathematical equation.

Difficulty: Difficulty indicates the probability of success in a specific task. There are five levels of difficulty: simple, routine, difficult, formidable, and impossible.

Difficulty indicates the basic 1D10 throw needed for success in completing a task. Routine tasks require 7+ (on 1D10) to complete; the other levels of difficulty are at multiples of 4 higher or lower than the 7+ required for routine tasks.

Assets: The probability of completing a task is affected by assets (a collective term which refers to skills and characteristics or attributes). Assets which are listed for the task are called crucial assets.

Assets are used as a positive DM for success (better DM's enhance the chance of success) and as a negative DM for time (better DM's accomplish the task in less time).

Crucial skills use their level as a positive DM on the throw for success. The manner in which skills are stated determines how they are used. When joined by "or" only the highest skill present may be used. When joined by "and," the sum of all available skills may be used. When "average of" is stated, the average of the stated skills may be used (counting non-present skills as zero, and reducing the average accordingly).

Crucial characteristics are divided by 5 (fractions are dropped, producing a range from 0 to 4) and are a positive DM on the throw for success.

Labelled characteristics (characteristics which have labels or names rather than numeric values) may be referred to; if they are, appropriate numeric values will be stated.

Assets shown with a minus sign are detriments; they are negative DMs on the die roll, and work against success in accomplishing the task.

Time: The time period shown is *one-tenth* of the average time required for completion of the task.

The time roll for a task is 3D6; an average throw of 3D6 is 10, which produces an average accomplishment time equal to the average time for the task.

The same asset modifier that was added to the die roll for success is subtracted from the die roll for time. Assets help reduce the time required to accomplish a task. Assets may not reduce the time roll below 3.

A task may omit mention of time; in such cases, the task is considered *instant* and it takes no time to accomplish.

A task may state *absolute* in addition to a period of time; in such a case, the task requires the stated amount of time and is not modified by assets.

For example, a task may state a time period of one hour. It can be accomplished in an average of 10 hours, although it could take as long as 18 hours or as little as 1 hour.

Type: If a task is not a standard task, it should be identified by type: *uncertain*, *unskilled*, *hasty*, or *hazardous*. Each such type affects how the task functions.

Uncertain or unskilled tasks should always be identified. Hasty and hazardous tasks are often variants of standard tasks, and may be identified only when they are attempted.

PROCEDURES

When confronted with a task, the characters are aware of the situation and indicate to the referee their intentions. With these intentions in mind, the referee selects an already established task, or generates a new one specifically for the situation. The procedure for resolving the task is then used.

Attempting a Task: The player determines assets which apply to the task, and creates a DM for the task.

If related skills are to be used or can be used in place of the crucial skills, the referee should tell the player.

If the task is to be hasty, the player indicates that to the referee. If the task is hazardous, or uncertain, or both, the referee indicates that fact to the player.

The player then throws 1D10 (die roll results 0 to 9) to determine success. The throw required is determined by the difficulty level of the task. A natural roll of 0 (regardless of DMs) is a fumble, and the task is an automatic failure.

The noted DMs are added to the throw and its result is compared to the required throw for the difficulty level.

If the modified throw equals or exceeds the required throw, then the task is successful. The character continues with his or her actions.

If the modified throw is less than the required throw, then the task is a failure. The character must consult the failure type table.

In all cases, the player determines the time elapsed for the task attempt. The time elapsed is the time required to complete the task attempt, regardless of success or failure. The player throws 3D6 and applies the same DMs that were used for success, but now subtracts them from the 3D6 throw. DMs may not reduce the result below 3. The result is multiplied by the time stated for the task and produces the total elapsed time for the task attempt.

If no time is stated for the task, the attempt takes no time. If an absolute time is stated for the task, then the task takes that amount of time and no time throw is made.

Failure: If a task attempt is unsuccessful, then the player must consult the failure type table. For most tasks, the throw is 2D6; if the task is hazardous, the throw is 3D6.

The failure type table produces five types of results: reroll, retry, check determination, mishap (2D6), and serious mishap (3D6).

Reroll requires the player to reroll on the failure table.

Retry allows the player to retry the task again without penalty, if desired.

Check Determination requires that the player stay determined if he is to retry the task without penalty. To stay determined is itself a task.

Mishap (2D6) requires the player to consult the mishap table using 2D6. After reacting to, absorbing, or correcting the effects of the mishap, the player may check determination and retry the task if successful.

Serious Mishap (3D6) requires the player to consult the mishap table using 3D6. After reacting to, absorbing, or correcting the effects of the mishap, the player may check determination and retry the task if successful.

Mishaps: Negative results from a failure are indicated on the mishap table. Mishaps range from superficial through minor and major to total or destroyed.

The referee must determine the implementation of specific mishaps in relation to a task attempt. Damage produced should relate to equipment, devices, vehicles, or participants in the task.

Superficial mishaps produce superficial damage to equipment and/or a potential light wound. Superficial damage affects appearance but not function or operation. A device may take any number of superficial damages without impairing its operation.

Minor mishaps produce minor damage to equipment and/or a potential light wound.

Major mishaps produce major damage to equipment and/or a potential serious wound.

Total mishaps produce total damage (destruction) to equipment and/or a potential kill.

Unrepaired damage levels above superficial are added together. Two minor damages create major damage; major damage and minor damage on a device creates total damage and destroys it. The referee may, however, rule some larger devices (vehicles, for example) are composed of component devices and record damage levels on component devices separately.

Diagnosis: When a mishap produces damage to a device, it must be repaired before it can again be used. Before it can be repaired, the nature of the damage must be diagnosed.

Diagnosis is an uncertain task whose level of difficulty corresponds to the level of damage to the device. Diagnosing superficial damage is a simple task; diagnosing minor damage is a routine task; diagnosing major damage is a difficult task; diagnosing total damage is a formidable task.

The time interval required for a diagnosis task, and the assets applying to the task, must be established by the referee.

Damage and Repair: Diagnosed damage may be repaired using the damage and repair table. Each level of damage has an associated difficulty level for the task to repair.

The damage and repair table assumes repairs are undertaken in a repair shop (commercial, military, municipal, or private). If repairs are to be made in the field, increase difficulty by one. If repairs are to be performed without spare parts, increase difficulty by one. If repairs are to be performed without tools, increase difficulty by one. All difficulty increases are cumulative.

If a diagnosis has not been made, it is still possible to replace the entire assembly (at an 1D10 times the stated repair cost).

Repairs performed in the field, or without spare parts can be made without cost. The referee may record this fact and impose a greater likelihood of breakdown of such repaired items. Any task using a device/vehicle which has had major damage repaired in the field is automatically hazardous; this lasts until the original major damage is repaired in the shop.

Repeatability: Unless specifically stated, any task is repeatable. Some tasks may be defined as non-repeatable (or only repeatable a specific number of times).

Retrying Tasks: Failed tasks may be retryed if allowed by the failure table.

Determination: When a task attempt has been unsuccessful, and the failure table produces a result of "check determination," the character must successfully complete the task of checking determination before a repeat attempt may be made on the unsuccessful task.

To stay determined after failure of a task. Difficult, determination.

Referee: If this task is successful, the unsuccessful task may be repeated without penalty. If unsuccessful, the character may 1) retry immediately at one increase in difficulty, or 2) retry with no penalty after waiting ten times the actual duration of the failed task.

Total Failure: A formidable task increased in difficulty becomes impossible; failure is permanent and no more retries can be made on this specific task.

SPECIAL TYPES OF TASKS

The basic type of task defined is the standard task. There are four special types of tasks, each a variation on the standard task: hasty tasks, hazardous tasks, unskilled tasks, and uncertain tasks.

Hasty Tasks: If desired, a character may specify a hasty attempt at a task. The difficulty level of the task is increased by one, and DM's are doubled before subtracting them from the time throw (a hasty attempt may take less time, but at a cost in difficulty).

Hazardous Tasks: The referee may declare a task is hazardous, and it has a higher chance of mishap if unsuccessful. If an attempt at a hazardous task is unsuccessful, throw 3D6 (instead of 2D6) on the failure table.

Unskilled Tasks: If the crucial skill is not essential (it is helpful, rather than vital) to the completion of the task (either temporarily, or in general), declare the task to be unskilled. Do not increase the difficulty of the task if the crucial skill is not present.

Most tasks are skilled; the unskilled task is the exception.

Uncertain Tasks: When a task is concerned with information or opinion gathering, immediate feedback about how successful the effort has been may not be possible, and it is considered uncertain. Those performing the task have some idea of their success, but they are not certain of it.

When an uncertain task is attempted, both the player and the referee roll for success (the referee rolls secretly). If both are unsuccessful, the referee provides *no truth*. If one is successful and the other is unsuccessful, the referee provides *some truth*. If both are successful, the referee provides *total truth*. In all cases, the referee does not indicate whether the answer or information provided is no truth, some truth, or total truth. The characters remain uncertain of the outcome of the task (they may have some clue to the outcome by observing their own die roll).

A result of *no truth* means the character is totally misled as to the success of the attempt. Completely false information is given.

A result of *some truth* means the character is given some idea of the success of the attempt. Some valid information is given.

A result of *total truth* means the character is not misled in any way as to the success of the attempt. Totally correct information is given.

Because of the hidden nature of the referee's throw, the character cannot know for certain the nature of the information being obtained. A referee may find character doubting total truth, accepting some of no truth, or accepting all of some truth.

CRUCIAL ASSETS

Assets specified for a task are considered crucial. They are important to the accomplishment of the task.

Characteristics or attributes contribute to the accomplishment of a task, and because all characters have characteristics, the individual will have some value (even zero) which applies to the task.

Skills, however, may not be present in the character attempting a task. If a character does not have the crucial skill, then attempting the task is more difficult; increase the difficulty of the task by two levels (perhaps even to impossible).

If the character has a related skill (in the referee's judgement), then the task may be attempted at one higher level of difficulty.

Occasionally, a character may be allowed to use a combination of Intelligence and Education as a substitute for the lacking skill. This represents all of the character's intellect, knowledge, and experience being brought to bear.

Unskilled tasks indicate assets which are helpful rather than vital; for unskilled tasks, these assets are not essential and the lack of

them does not hurt a task attempt.

SPECIAL CASES

Tasks cannot be so flexible as to cover all situations. Consequently, special cases may be necessary to deal with unusual problems. If a special case is called for, then a paragraph (one or more sentences) should follow the task headed by the word "Referee." The referee paragraph lists any special conditions which apply to the task attempt. For example:

Referee: Non-repeatable; only one attempt is allowed.

Referee: Any mishap causes a security alarm to sound.

Referee: If any character with Education 8- attempts this task, it becomes Difficult.

GENERATING TASK DESCRIPTIONS

Tasks are described in various **Traveller: 2300** situations, but the referee is still called on to generate task descriptions as adventures progress. Generating task descriptions can be relatively easy if the referee understands the task to be described.

Checklist

1. Referee defines task in general terms.
2. Determines crucial assets.
   A. Characteristics.
   B. Skills.
3. Determines type of task.
   A. Standard.
   B. Uncertain.
   C. Unskilled.
   D. Hazardous.
4. Determine average time to complete task, then determine time period. Decide if absolute or instant time is applicable.
5. Determine difficulty level of task.
6. Record task description.

SOME IDEAS FOR USE OF TASKS

Tasks can be as simple or as complex as the referee wants them to be. However, they need to be more than an exercise in die-rolling, and they need to be more than random roadblocks to the progress of an adventure. Instead, tasks force players to use logic and creativity in their role-playing activities.

The Effects of Randomness: The random aspect of task accomplishment is there for a reason; it adds an element of uncertainty to any task and prevents absolute prediction of the outcome, but does allow reasonable prediction of time and success. Players can analyze any task situation, decide ahead of time how much chance they have of success (just as they would in the real world), and perhaps seek out simpler alternatives if the problem they face is too great.

For example, faced with a vehicle which has sustained major damage, a character with mechanical skills might still attempt to repair it, while an outdoorsman would consider the time required and the chances of success and decide to continue his journey on foot.

Research: The process of finding information is easily and accurately handled by the task system. Research in the laboratory or out in the wilds of another planet can be conducted through a series of dependent tasks.

Once a topic for research has been established, the referee can establish a sequence of related and dependent tasks which will lead to the desired result. At the same time, a related series of tasks can be established which are dead ends, false starts, unnecessarily long sequences, and expensive delays. With this small library of tasks, the research project can begin.

Research begins with a literature search. The task allows the character to consult available data in a reference library, in the computer, or even in discussion with colleagues. Such a task is uncertain, and its ideal result is a research plan which involves a series of tasks leading to the desired goal, result, or outcome. Total success in the literature search produces a totally true research plan; less than total success produces a less usable plan.

The tasks of any research plan are themselves uncertain. Progress toward the desired result may be slow and full of delays, but ultimately, every course of action will show itself as valid or invalid.

But achieving the goal of the research once is not enough. The uncertainty of the truth of any task outcome means that results can be depended on only when they are repeatable with accuracy. A researcher must repeat his experiments until he is certain he is getting accurate, repeatable results.

Some tasks in research may be hazardous; the researcher risks injury or equipment damage during his endeavors.

Diagnosis: The uncertain task type can be used to diagnose the extent of damage to mechanisms. It can also be used in the diagnosis of disease or trauma effects, equipment malfunctions, or computer programming bugs.

Logical Prediction and Thought Processes: Even thinking can be a task within this system. Instead of forcing a player to solve a puzzle himself, the task system makes it possible for a player to approach a scientific, mathematical, social, or technical problem as a task. Faced with a fragment of text in a foreign language, a character could perform the task "to translate using a foreign language dictionary," modified by intelligence and foreign language skill (related foreign languages could serve as lower level modifiers). Confronted with a group of related clues, a player could perform the uncertain task "to analyze available data." Role-playing by the player will always help the referee create and administer tasks, but the task system itself allows a player of above average intelligence to play a character at the genius level.

Cooperation and Teamwork: When more than one character is attempting to accomplish a task, their cooperation can be taken into account when determining success.

Teamwork indicates that the participants are working together as a team, in close proximity to each other, and with each depending on the others as they work. The crew of a sailing vessel is a team; several medics working on a patient are a team; the pit crew

servicing a racing car is a team. When a team attempts a task, the referee must specify the number of individuals required, and determine the difficulty of the task based on the number participating. The lowest level of crucial skill held by the group is noted and doubled before creating a DM.

Cooperation indicates that the participants each have their own tasks to complete, but that the overall cooperative task depends on these subordinate tasks being completed. Each individual cooperating is assigned a personal task; these personal tasks are classified as supportive or vital. Successfully completed supportive tasks contribute DMs to the completion of vital tasks; vital tasks must be completed or the overall task will fail.

Whenever a cooperation or a teamwork task fails, the members of the group must each successfully accomplish the task "to cooperate;" those who are not successful may not participate in the next attempt.

EFFECTIVE USE OF TASKS

Tasks provide an excellent way of encouraging consistency within a role-playing situation. They can be used effectively if a few simple rules are followed.

Make Tasks Visible: To prevent a task from becoming buried in text or difficult to locate, all tasks in published materials are indented and each is on a line by itself. A referee should maintain separate lists of tasks as they are defined. Players should be allowed access to lists of tasks so that they can make their own choices about actions they wish to take.

Keep Tasks Understandable: Large complex tasks should be broken down into smaller, more easily understood ones. Repairing a mechanism can be broken down into a diagnosis task and a repair task. Failing one smaller task still allows tackling the overall mission by redoing the single failed task.

Skills and characteristics called for should be related to the accomplishment of a task. When they make sense, they are easier to understand.

Use Common Sense: Be creative in application of the task system when it creates seemingly inappropriate results. When task resolution becomes a random event, a challenging adventure can become a frustrating one. Use the task system as a tool for better role-playing, and it will serve you well.

CREATING TASK LIBRARIES

Since tasks can play such an important part in resolving adventures, it is helpful to have a library of tasks which may be used time and time again. A task library can be kept in any number of ways; the following are just a few suggestions.

Notebook: Keep a notebook with your game rules. Each time you generate a task, record it in the notebook for future reference.

File Cards: Record each task you use on a notecard, and keep them together in a small holder or with a rubber band.

Computer Files: Keep written notes, but transcribe them to a computer data base. Before you run an adventure, print out your current list so it will be available. You might even make print-outs sorted by crucial assets, task statements, or times required.

Whenever a task is used, record the date, or just make a small note that it has been used. Ultimately, you can tell what tasks are being used most.

When a task description seems inappropriate or unusable, modify it. Tasks should always be modified to make them better or more efficient as player feedback tells you how good or how bad a specific approach is.

Remember, a task library is something that will help a referee run adventures more efficiently or more effectively. The work you put into it will pay you and your players back handsomely.

EXAMPLES AND FORMATS

The following are examples of how to express tasks.

Standard: A standard task uses the basic task format without exception.

To force open a door: Routine. Strength. 6 seconds.

Unskilled: An unskilled task is affected by assets which are helpful but not vital.

To find information from a computer data bank: Difficult. Computer. 10 minutes.

Hasty: A hasty task increases difficulty level by one, but doubles the DMs for time.

To find information from a computer data bank (Hasty): Formidable. Computer. 10 minutes.

Hazardous: A hazardous task, if failed, requires use of 3D6 on the failure table.

To disarm an unexploded warhead (Hazardous): Routine. Demolitions. 20 minutes.

Uncertain: An uncertain task provides information which the participants cannot tell for certain is accurate. Internal cues during the procedure, however, help participants to evaluate the quality of the information.

To debug a computer program (Uncertain): Routine. Computer. 15 minutes.

Teamwork: A teamwork task uses more than one character working together to complete the same task, with each depending on the others for a contribution to completion.

To push a vehicle out of a ditch (Teamwork): Formidable. Strength. 1 minute. Referee: Minimum 2 individuals plus a driver. Difficulty decreases by 1 for each additional individual.

ROLE-PLAYING TASK RESOLUTION

The use of tasks to determine success or failure should not be used to replace role-playing by the players involved. Instead, role-playing is an excellent way for the referee to determine the difficulty of tasks the player characters undertake.

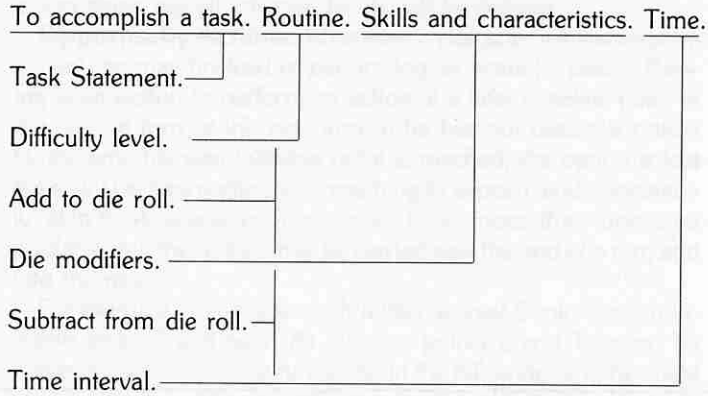
Whenever a non-standard task is called for, the referee should ask the player how he intends to go about performing the task. The player must consider the task at hand, and then describe in role-playing terms the strategy he would use to accomplish the task. The referee listens to this strategy and evaluates it in terms of difficult and probable success; he uses that evaluation to determine a difficulty level for the task. Only then is the task resolved.

For example, a player character might want to convince a clerk to sell him an important piece of equipment at a time when such sales are prohibited. The argument or plea which the player character makes determines the difficulty of the task; the referee can judge the plea on originality, quality, reasonableness, and other factors. A plea which claims the character has to catch a shuttle flight might make the task routine; an argument that threatens violence might make the task formidable, or it might make the task simple, depending on how it is presented.

Tasks are an aid to resolution of the details in **Traveller: 2300**. They can be used with role-playing to make adventures both exciting and realistic.

Task Resolution

TASK FORMAT



TASK DIFFICULTY (1D10)

Difficulty	*Roll Needed*
Simple	3+
Routine	7+
Difficult	11+
Formidable	15+
Impossible	19+

FAILURE (2D6 OR 3D6)

Throw	*Failure Type*
2	Reroll
3+	Retry
7+	Check Determination
11+	Mishap (2D6)
15+	Serious Mishap (3D6)

MISHAPS

Throw	*Consequences*
2	Reroll
3+	Superficial Damage
7+	Minor Mishap
11+	Major Mishap
15+	Total Mishap

DAMAGE AND REPAIR

Damage Level	*Operable?*	*Repair Task (Shop)*	*Repair Cost*
Superficial	Yes	Simple	1D10× 1%
Minor	No	Routine	1D10× 5%
Major	No	Difficult	1D10×10%
Destroyed	No	Formidable	1D10×20%

TASK TYPES

Standard: Any task which states the standard task components: statement, difficulty, assets, and time.

Unskilled: Any task which does not *require* a specific skill for accomplishment. If a skill is stated and the character has it, it may be used, but there is no penalty for lack of the skill.

Hazardous: Any task declared hazardous by the referee or the rules; hazardous tasks use 3D6 on the failure table.

Hasty: Any task declared hasty by the player or referee; difficulty is increased by one level, and time required is reduced by double the asset modifiers.

Uncertain: A task whose results are uncertain to the characters; results may be totally true, partially true, or totally false.

DETERMINATION

Characters must check determination in order to retry some tasks.

To stay determined after failure of a task. Difficult. Determination. Instant.

Referee: If this task is successful, the character may retry immediately without penalty. If unsuccessful, the character may retry immediately at one increase in difficulty, or retry with no penalty after waiting ten times the actual duration of the failed task.

SPECIAL CASES

A task may have special instructions which further detail how the task is to be performed. A note to the referee below the task may state repeatability, consequences, substitute skills or attributes, or other information.

CHECKLIST

1. Referee defines task in general terms.
2. Referee determines crucial assets.
   A. Characteristics.
   B. Skills.
3. Referee determines type of task.
   A. Standard.
   B. Uncertain.
   C. Unskilled.
   D. Hazardous.
4. Referee determines average time to complete task, and establishes time period (it may be absolute or instant).
5. Referee determines difficulty level of task.
6. Referee records task description.

TIME

Time shown is one-tenth the average time required to complete the task.

Standard: The throw for time is 3D6, with asset modifiers subtracted; minimum result is 3.

Instant: If a task shows no time, it is instant and takes no time. Split second decisions and many reactions are instant.

Absolute: If a task is labelled absolute, it takes the time specified. Many combat actions are absolute and use one action within the combat structure.

FUMBLE

A natural roll of 0 when resolving a task automatically produces a fumble and the task fails, regardless of the asset modifiers on the task. The referee may decide that such a fumble is a minor inconvenience or a major roadblock.

UNCERTAIN TASKS

When an uncertain task is attempted, both the referee and the player roll for success (the referee rolls secretly).

If both fail, the result is no truth.

If one succeeds and one fails, the result is some truth.

If both succeed, the result is total truth.

In all cases, the referee does not reveal his die roll. Even when total truth is provided, it is possible for the player to not believe it is total truth.

Uncertain tasks are used for diagnosis, information gathering, and research.

Combat

The universe of **Traveller: 2300** can sometimes be a dangerous place. Often, players will find themselves unable to talk their way out of a difficult situation; a resort to violence may be the only resolution to a problem or the only means of survival.

Combat Overview: The general heading of personal combat includes attacks against living beings and vehicles using weapons such as guns, knives, bare fists, explosives, even rocks. But regardless of the type of attack or the type of target, the results can always be determined by answering two questions:

1. Did you hit the target?
2. If so, how much damage did you do?

To resolve a combat attack, players and referee roll dice to determine the answers to these two questions. The specific rules vary, and there are many complications which handle circumstances, special weapons, and other details, but the two main questions are always there.

ATTACKS

There are two general types of attacks—*fire attacks* and *melee attacks*.

Fire attacks involve attempts to hit a target with a projectile. The projectile may be a thrown rock, an arrow from a bow, a bullet fired from a gun, a beam from a laser, a missile or a rocket, or any other form of projected attack. Fire attacks may be aimed fire or area fire. Aimed fire involves aiming a single fire attack against a single target (much as a hunter or a sniper would). Area fire involves projecting a large volume of fire into an area with one or more targets (machine guns and bombs produce area fire).

Melee attacks involve attempts to hit an enemy within touching range. Melee (which means a hand-to-hand fight) attacks may be armed blows (with a melee weapon such as a club or a knife), or unarmed blows (fist strikes, slaps, punches, kicks, or tackles).

INITIATIVE

Coolness under fire is a splendid asset for any individual to have; it allows rational evaluation of a situation and then capable action toward victory or survival. Characters with coolness under fire have *initiative*; initiative determines when, during a combat turn, the individual can conduct an action.

Characters have an initiative level equal to their coolness under fire; encumbered characters subtract 2 from initiative; body armor may also reduce initiative (as indicated in the body armor lists). However, initiative is never reduced below 1.

Non-player characters acquire an initiative rating assigned by the referee based on their NPC experience category (green: 4, experienced: 6, veteran: 8, elite: 10).

TURN SEQUENCE

Combat is fought in turns which represent thirty seconds of real time. In each turn, a character can perform any two of the following actions:

Remain stationary.
Conduct aimed fire at one target.
Conduct area fire at one area.
Move.
Conduct walking area fire.
Conduct trotting area fire.
Reload a weapon.
Change weapons.
Duck.
Special action.

All actions are carried out during a turn at *initiative points*. Each initiative point corresponds to an initiative level of a character. During the turn, the referee calls out initiative points in descending order (beginning with the highest level—10—and counting down). A character may conduct one action when an initiative point corresponds to his initiative level, and may conduct a second action when the initiative point equals half (round fractions down) his initiative level. Characters with initiative level 1 may only perform one action per turn. For example, the referee begins specifying initiative points at 10, and counts down through 9, 8, 7, 6, etc. A character with initiative level 5 could perform one action when the count reached 5, and another when the count reached 2.

All characters performing an action at the same initiative point do so simultaneously, and actions take place during movement. That is, any character who fires can fire at any one, including a character who is moving. Fire at a moving character may take place at any point during that movement. If several characters attack at the same initiative point, they attack in order of the bulk of their weapons (weapon bulk is listed in the weapon descriptions; unarmed blows are treated as bulk 0). Characters with bulk 0 weapons attack first, followed by characters with bulk 1 weapons, followed by characters with bulk 2 weapons, and so on. If characters have the same bulk weapons, they attack simultaneously.

Characters knocked down or killed by an attack at any time in a turn stop conducting actions (except for a simultaneous action

at the current initiative point) and lose eligibility for actions in the rest of the turn.

If all ten initiative levels were represented by characters on one or both sides in a battle, there would be a maximum of ten initiative points. In practice, there will be fewer initiative points in a turn since not all initiative levels will be present.

Opportunity Actions: Whenever a character's initiative point occurs, he may (instead of performing an action) "pass." Passing is an option to perform an action at a later initiative point in the current turn or the next turn. If he has not used the option by the time his next initiative point is reached, the option is lost (he spent his time waiting for something to happen, and it apparently didn't). A character may never have more than one pass available, but the option may be carried past the end of a turn and into the next.

For example, a character with initiative level 6 might reach initiative point 3 and pass. As initiative points 2 and 1 occur, he makes no action, and the turn ends. In the following turn, he could elect to use the option to perform an action at initiative point 10, 9, 8, or 7. If the option is not used by the time initiative point 6 is reached, it is lost, although he could then perform the normally possible action for initiative point 6.

MOVEMENT

When characters elect to move as an action, they may select a mode of movement and then move up to the distance allowed for that mode.

Four movement modes are possible: *crawling*, *walking*, *trotting*, and *running*.

The movement mode not only affects speed; it also affects the chance of being hit by enemy fire. Crawling makes use of all available cover; walking makes use of local partial cover; trotting and running do not use cover.

DAMAGE

Damage comes in three types: *normal damage*, *blunt trauma*, and *stun*. Normal damage is significant surface and internal tissue damage (as in burns or gunshot wounds). Blunt trauma is impact damage or crushing (as in blows from a club, concussion, or perhaps crushing from a tire rollover). Stun is damage to the central nervous system (as in electric shock, or incapacitating gas). All three types of damage are resolved similarly, but they have slightly differing effects.

The Extent of Damage: After a character has been hit (by a fire attack or a melee attack), find the extent of damage. First find the potential effect and then resolve the actual effect. Throw 1D10 on the target hits diagram and find the type of wound (kill, serious, or light wound) and the hit location. The potential wound effect column of the wound table shows how serious the wound could be. Subtract any armor effects from the weapon's damage point value (DPV or DP value): if the remaining damage point value is zero or less, there is no effect; if the remaining damage point value is greater than zero, find the actual result.

Blunt Trauma: Characters suffer blunt trauma when hit by a nonpenetrating kinetic energy round (any fire weapon except a laser), when hit by an unarmed melee attack or by a blunt weapon, or when they are within the concussion radius of an explosion.

Stun: Characters suffer stuns from sonic stunners, electric shocks, or stun gas.

Potential Kill: If weapon DPV is greater than or equal to 1, the target is killed.

If weapon DPV is less than 1, roll 1D10. If that result is less than or equal to the DPV times 10, the target is killed. Otherwise,

the target suffers one shock point and is knocked down.

Blunt trauma is identical.

Stun inflicts four stun points (or the DP value of the stun weapon, whichever is larger), and the target is knocked down.

Potential Serious Wound: If weapon DPV is greater than or equal to 1, the target suffers one shock point per damage point of the weapon and is knocked down.

If weapon DPV is less than 1, roll 1D10. If that result is less than or equal to the DPV times 10, the target suffers shock point and is knocked down. Otherwise, the target suffers a light wound and is knocked down.

Blunt trauma makes every odd-numbered shock point (1, 3, 5, etc.) a stun point instead, and the target is knocked down.

Stun makes every shock point a stun point instead, and the target is knocked down.

Potential Light Wound: If weapon DPV is greater than or equal to 1, the target is knocked down and suffers a light wound.

If weapon DPV is less than 1, roll 1D10. If that result is less than or equal to the DPV times 10, the target is knocked down and suffers a light wound. Otherwise, there is no effect.

Blunt trauma knocks the target down (with no other effects).

Stun inflicts one stun point. The target is not knocked down.

WOUND EFFECTS

Wounding results have the following effects:

Knocked Down: The character is knocked or blown down by the force of the attack or blow and is dazed.

Dazed: The character cannot move or act. He is assumed prone, motionless, and is under any available cover. Dazed remains in effect for a number of turns equal to the total of shock and stun points the character has received (and this effect is cumulative). If the character has no shock or stun points, dazed applies only until the end of the combat turn.

All eligibility for further actions in the combat turn is lost, regardless of initiative level. Any passed or option actions are lost. Knocked down applies even to individuals who are already down.

Light Wounds: The character is immobilized for the rest of the combat turn. Initiative level is reduced by 1 per light wound.

NPCs may be incapacitated by light wounds. Green NPCs are incapacitated by 1 light wound; Experienced NPCs are incapacitated by 2; Veterans by 3; Elites by 4.

Stun Point: The character is dazed. Initiative is reduced by −3, but never below 1 until the character is unconscious. NPCs are made unconscious after receiving three stun points. The character is unconscious when his total of shock and stun points equals his consciousness level.

Shock Point: The character is dazed. Initiative is reduced by −3, but never below 1 until the character is unconscious. NPCs are made unconscious after receiving one shock point. The character is unconscious when his total of shock and stun points equals his consciousness level.

Kill: The character is dead. Head hit kills are absolute; torso hit kills may be eligible for resuscitation.

ARMOR EFFECTS

Characters may wear personal armor. Armor effects are subtracted from the Damage Point Value of the weapon, and the remainder is used to determine the effects of the wound.

For some characters, body armor will only cover part of the body, or armor ratings will be different for different parts of the body. The potential hit table die roll shows the body part hit; armor on that body part is used.

FIRE COMBAT

Fire combat uses weapons which shoot a projectile, a bullet, or some object at a target. Basically, fire combat is used against targets which are some distance from the shooter.

Weapons are identified in the weapons chart as fire weapons if they can conduct aimed or area fire.

The weapons' descriptions give the available information about specific weapons. When characters select their weapons, this data is transcribed to the weapons chart for use by the referee and the players. The weapons chart makes pertinent information available in one place for ease of play and to limit the time required to look up data.

Information presented in the charts includes the following:

- weapon bulk
- magazine capacity
- aimed fire range
- area fire range
- area fire value
- damage point value
- rate of fire
- rounds per burst
- explosive point value

Human Limits: One character can only fire one weapon at a time. Even a vehicle gunner who has several weapons available can only fire one weapon at a time.

A character without the required skill for a weapon cannot fire it.

Rate of Fire: Weapon rate of fire is the number of aimed shots or area fire bursts that a weapon can fire in a combat round.

Range: Weapon range is the effective range of the weapon. There may be a different effective range for aimed fire and area fire.

Close range is half the effective range; long range is twice the effective range; extreme range is four times the effective range.

HIT PROCEDURE

The hit procedure is used to determine if a shot has hit the target. The procedure is different for aimed and area fire.

Aimed Fire: Hitting a target with aimed fire is a task.

To hit a target with aimed fire at close range. Routine. Weapon skill. Absolute (1 action).

Referee: Difficulty increases one level with each increase in range.

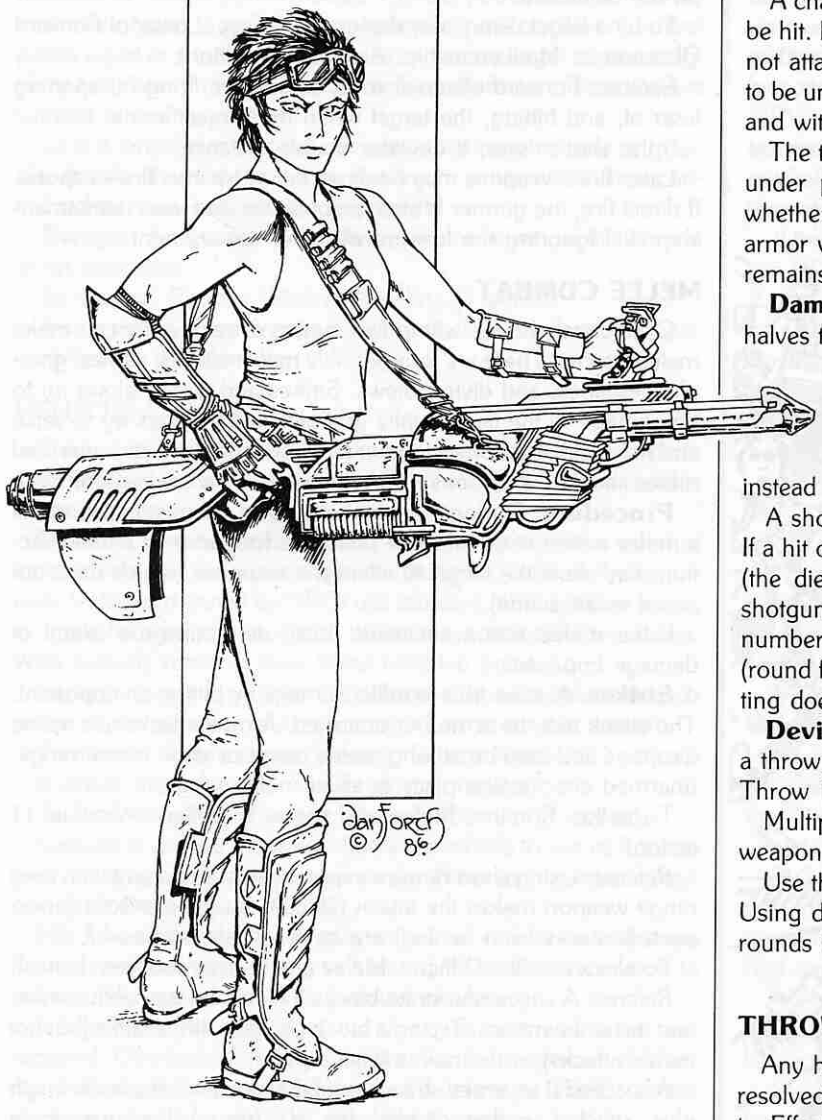
If a range finder is listed for the weapon, its bonus may be used if the target is a vehicle, building, or other large object.

The task is difficult at effective range, formidable at long range, and impossible at extreme range. Flechette grenades may not fire aimed fire. Direct fire weapons' DPV is halved at extreme range; shotguns cannot fire at extreme range.

Area Fire: Area fire depends on weapon characteristics rather than skill. The weapon chart shows rounds per burst and area fire value of the burst at effective range. Area fire value is doubled at close range and halved at long and extreme range. Shotguns and flechette grenades do not halve their area fire value at long range; and they may not fire at extreme range. Flechette grenades do not double their area fire value at close range.

The chance of hitting is determined from the area fire value and the rate of fire. Multiply the area fire value times the number of bursts fired to produce the number to be thrown on 1D10. If the die roll is equal to or less than the hit number, the burst achieves hits. Round all fractions down; some weapons may become totally ineffective at extreme range even at maximum rate of fire.

Area fire is directed at a single area ten meters in diameter. Area fire attacks separately each target in the target area and each target



on a line between the weapon and the target area. Targets in the line of fire beyond the target area are attacked by half the weapon's area fire value if in the same range band as the target area. Targets beyond the range band are not affected.

Characters subjected to area fire may elect to duck for cover. Ducking is an action and counts as the next available action the person may take, even though it happens immediately. If both actions for the current turn have been taken, it counts as the first action of the next turn.

Player characters always have the option of ducking. NPCs may be forced to duck. Throw 1D10 and add the area fire value; if the result is greater than the NPC's coolness, the NPC ducks. The ducking column of the NPC table also shows NPC ducking reactions.

Moving Area Fire: A player may move and conduct moving area fire. The actual action is either walking area fire or trotting area fire. Weapons with ROF 1 may not be used. Movement must be walking or trotting (not crawling or running). Moving area fire cannot be performed at extreme range.

Walking area fire is resolved normally.

Trotting area fire treats each range band as one farther than it is. For example, trotting area fire at an area which is at close range treats it as if at effective range.

Cover: Characters who duck or who are protected by cover benefit from cover effects.

A character who is under full cover cannot be seen and cannot be hit. However, someone under full cover from an attacker may not attack that attacker as a target. It is possible for a character to be under full cover from one attacker, partial cover from another, and without cover from a third.

The target diagram shows what portions of a human target are under partial cover. The wound potential die roll determines whether the shot hit cover rather than target. Determine the cover armor value and subtract it from the weapon DPV. If any DPV remains, it then hits the character.

Damage: Fire attacks produce normal damage. Extreme range halves the DPV of a weapon. If the DPV of a weapon is greater than 1, round fractional results up to the nearest whole number. If the DPV of a weapon is 1 or less, round fractional results to the nearest tenth.

If a shot fails to penetrate body armor after hitting, it instead inflicts blunt trauma damage.

A shotgun halves its DPV at long range (round fractions up). If a hit occurs, throw to determine the number of slugs which hit (the die rolled is shown in parentheses after the DPV of the shotgun). At close and effective range, the number rolled is the number of slugs hitting; at long range, half the number rolled (round fractions up) is the number of slugs hitting. Each slug hitting does damage equal to the DPV of the shotgun.

Deviation: If a weapon which fires an exploding round (from a thrown hand grenade to artillery) misses its target, it deviates. Throw 1D10 for the distance of the deviation.

Multiply the deviation distance by the distance for the type of weapon used to determine the actual deviation distance.

Use the scatter diagram to determine the direction of deviation. Using direction and distance, determine the location where the rounds impact.

THROWN WEAPONS

Any hard object may be thrown at a target. Hitting a target is resolved as aimed fire using the character's thrown weapon ability. Effective range for thrown weapons is equal to the character's

throw range if the object weighs 1 kilogram or less; if the object weighs more than 1 kilogram, effective range is the character's throw range divided by the object's weight in kilograms.

If a thrown object hits the target, it will cause blunt trauma damage; use a damage point value equal to the character's strength divided by 20, rounding fractions down to the nearest tenth.

A throwing knife inflicts normal damage with a DPV of 0.3, regardless of the range and strength of the thrower.

Hand Grenades: Hand grenades are thrown weapons thrown at specific targets. If the throw misses, it deviates (in accordance with the deviation rule). Total deviation, however, may never exceed the range of the throw (a grenade thrown at a target 20 meters away cannot deviate more than 20 meters).

All grenades explode when they hit (if at least 5 meters from the thrower—because of safety devices). Depending on the grenade type, they do contact, concussion, and/or fragmentation damage, as noted in the grenade descriptions.

The actual chance to hit with a grenade is affected by the size of the target and other circumstances. The referee may analyze the situation and reduce the difficulty of a throw (perhaps against a bunker or tank), or increase it (perhaps against a small window or firing slit).

INDIRECT FIRE

Indirect fire is fire at a target that the firing weapon crew cannot see; they follow directions given by a forward observer who can see the target. Only weapons with indirect fire range (shown on the weapons chart) can use indirect fire. Indirect fire weapons are rifle grenades, grenade launchers, howitzers, mortars, rockets, and missiles.

Calling Fire: To perform indirect fire, the weapon crew must be in contact (by radio or telephone) with a character (called the forward observer) who can see the target. The target is a stationary position; it can be a building or a geographic feature or even an open patch of ground. It can't be a moving vehicle (although it can be a place where the forward observer thinks the vehicle will be when the fire hits). Indirect fire attacks are conducted one turn after the forward observer requests them.

Resolving Fire: Indirect fire is a task which is resolved when the weapon is fired.

To hit a target with indirect fire. Difficult. Lower of Forward Observer or Marksmanship. Absolute (1 action).

If the shot misses, it deviates.

Effects: If a shot hits its intended target, it attacks that target with its normal damage point value. If it is an exploding round, it will also conduct an area fire attack on all targets within its burst area.

Self-Observed Fire: The firing character may act as his own observer if he can see the target. This is done if the target is out of the weapon's direct fire range or if the weapon has no direct fire capability. For self-observed fire, only the firing player's indirect fire skill is used.

LASER DESIGNATION

Some weapons can use laser designation. The forward observer directs a spotting laser at the target, and the firing weapon's projectile homes in on the laser's reflection from the target. Electronic coding keeps the projectile from becoming confused by other lasers on the battlefield.

To hit a target using laser designation. Easy. Lower of Forward Observer or Marksmanship. Absolute (1 action).

Referee: Forward observer must actually be firing his spotting laser at, and hitting, the target when the projectile hits.

If the shot misses, it deviates double distance.

Laser fired weapons may be direct fire or indirect fire weapons. If direct fire, the gunner is also the observer and uses marksmanship skill ignoring the forward observer requirement.

MELEE COMBAT

Characters who are within two meters of each other can make melee attacks. There are four possible melee attacks: strikes, grapples, escapes, and diving blows. Strikes and diving blows try to do damage to the target while grapples and escapes try to seize and hold the target or try to counter such a hold. All are unarmed melee attacks except for strikes which may be armed or unarmed.

Procedure: During the combat turn, a character may select a melee action at an initiative point. Performance of a melee action may allow the target to attempt a response (which does not count as an action).

If the melee action succeeds (hits), determine the extent of damage imposed.

Strikes: A strike tries to inflict damage by hitting an opponent. The attack may be armed or unarmed. Armed attacks use melee weapons and may be at long melee range or short melee range; unarmed attacks take place at short melee range.

To strike. Routine. Melee and melee modifiers. Absolute (1 action).

Referee: Using short range weapon against opponent with long range weapon makes the attack difficult. Surprise attacks (unexpected attacks from behind) are automatically successful.

To block a strike. Difficult. Melee and melee modifiers. Instant.

Referee: A successful strike blocks a would be successful strike, and the strike misses. Trying a block prohibits fire attacks (but not melee attacks) at the next initiative point.

A successful unarmed strike has a DPV equal to attacker strength plus attacker melee divided by 30 (round fractions down

to tenths). A successful armed strike uses the DP value of the weapon. Armor is subtracted from the DP value of an attack; however, armor is never breached by a strike attack.

Unarmed strikes inflict stun damage; characters with melee 4 or higher may choose to inflict blunt trauma instead. Armed strikes using weapons labelled "blunt" cause blunt trauma.

Diving Blows: Diving blows attempt to knock down an opponent and inflict stun damage. A diving blow is automatic unless the target avoids it (avoiding is possible; blocking is not). If the target is not surprised, he may attempt to avoid it.

To avoid a diving blow. Routine. Agility. Instant.

If a diving blow is avoided, the attacker is knocked down.

If the diving blow is not avoided, compare the attacker's size times 2 + 1D6 to the defender's strength plus size. The lower value receives the damage (if equal, both receive the damage).

The recipient of the damage receives 1 stun hit (DP value = 0.5).

Armor has no effect on diving blows.

Grapples: A grapple is an attempt to place an opponent under control.

To grapple. Routine. Melee. Absolute (1 action).

Blocking a grapple is not possible; armor and range have no effect.

The target of a grapple receives one hit of stun damage; DPV equals attacker's (strength + melee)/30. Treat any stun points received as control points instead. Control points are a temporary indicator of who is winning in a grappling melee. When control points equal or exceed the target's strength, the target ceases struggling and may not move; the controlling character may not move without releasing control.

Until a target is controlled, he may attempt to escape or grapple. If both characters grapple, the first to achieve sufficient control points then controls the opponent.

Escape: An escape is an attempt to move out of the control of an opponent.

To escape. Routine. Melee. Absolute (1 action).

A successful escape removes all control points that the opponent has on the character.

VEHICLE COMBAT

The involvement of vehicles in combat is an important consideration. Vehicles are under the control of their drivers and are capable of movement and taking hits.

Vehicle Movement: Vehicles move at the initiative point of their drivers and fire weapons at the initiative point of their gunners. Vehicles manned by NPCs use standard NPC initiative levels. Animals being ridden move at the initiative point of their riders. Wild animals move at their listed initiative point.

Vehicles may move their listed combat movement rates each action. If the driver wishes, he may move at double speed.

To drive at double speed. Routine. Driver. Absolute (1 action).

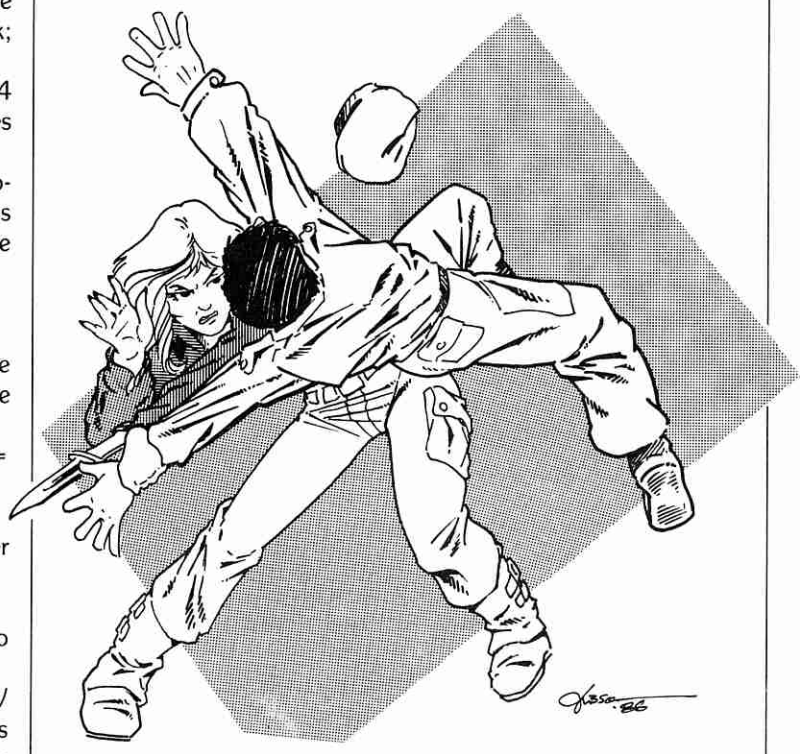
A driver may also use evasive driving tactics.

To drive evasively. Routine. Driver. Absolute (1 action).

Success in driving evasively allows the vehicle to use its full evasion rating against an incoming missile. Nonevading vehicles use one-tenth their evasion rating.

Hit Location: A vehicle may be hit on one of several faces (front, overhead, flank, rear, or bottom), or in the suspension (a hovercraft's suspension is its plenum chamber).

A face hit is determined by the direction from which fire was received. Overhead missiles always strike the overhead. If front, rear, bottom, or flank was hit, a result of 3 or less (on 1D10) creates a suspension hit; a result of 4 or more creates a hull hit.



Damage: If the vehicle hull was hit, compare the DPV of the weapon to the armor value of the face of the vehicle hit. If the DPV is equal to or less than the armor value, the hit does not penetrate and does no damage. If the DPV is greater than the armor value, throw 1D10 and add 1 for each 5 DPV in excess of the vehicle armor and consult the vehicle damage chart.

If the fire attack hits the suspension instead of the hull, compare the DPV of the fire attack to the armor value of the suspension. If the DPV is equal to or less than the suspension armor value, the hit does not penetrate and does no damage. If the DPV is greater than the armor value of the suspension, it damages the suspension. Divide the DPV of the weapon by the armor value and round all fractions down. The result is the number of damage points inflicted on the suspension.

All vehicles are reduced to half speed after five damage points to the suspension, and are immobilized after ten damage points.

For example, a hovertank with a plenum chamber armor of 5 receives a hit in the suspension from an 18 DP laser. Dividing 18 by 5 equals 3.6 which rounds to 3. The plenum takes 3 damage points. Taking another two will reduce the hovertank to half speed.

Vehicle Damage Effects: Damage on the vehicle damage table ranges from no effect to catastrophe.

No Effect: The vehicle is unaffected.

Crew Hit: One crewmember is hit. If a player character, roll for the wound potential normally using the DPV which penetrated the vehicle. The crewmember receives normal damage.

2 Crew Hits: Two crewmembers are hit. If player characters, roll for the wound potential normally using the DPV which penetrated the vehicle for each. The crewmembers receive normal damage.

Armament: One weapon, determined by the referee (at random if necessary) is destroyed. The crew (one crewmember) for the weapon (if not a remote mount) receives one crew hit.

Mobility: The vehicle is stopped and suffers one crew hit. If airborne, the vehicle crashes. If moving at double speed, the driver

must succeed in avoiding a crash.

To avoid a crash. Difficult. Driver. Instant.

Catastrophe: The vehicle is destroyed and the crew is killed.

MISSILES

Missiles are used to attack vehicle-sized targets. All missiles available are homing missiles; once fired, the missile will seek its target until it hits, crashes, or is shot down.

Missiles are provided by the equipment list. They have the following characteristics:

Launcher Weight: The mass (in kilograms) of the launcher.

Missile Weight: The mass (in kilograms) of the missile.

Range: The maximum distance (in meters) the missile can travel to a target. If the missile misses, or it does not hit, it crashes.

Guidance: The type of guidance system used for the missile.

Fully automatic guidance allows a missile to be fired into the general vicinity of enemy vehicles and it will seek out and attack a target.

Automatic after Lock On guidance requires that a gunner observe and indicate a specific target vehicle. Observe includes visual acquisition in the missile launcher sights, or acquisition by vehicle sensors. The missile then seeks out that specific target vehicle.

Homing Value: The chance that the missile will hit its intended target. Subtract target vehicle evasion rating (if any) from missile homing value and throw (on 1D10) that number or less to hit; otherwise, the missile missed and crashed.

Regardless of the homing value of the missile, it always misses on a throw of 10.

Attack Angle: The angle or approach that a missile makes against its target. Overhead missiles always attack by flying overhead and diving on the target. Direct missiles attack directly along their line of flight. Selectable missiles may be set to overhead or direct by the gunner before launch.

Damage: The explosive points the missile warhead produces. All missiles cause damage as tamped explosions.

EXPLOSIONS

Some weapons fire rounds which explode when they hit, and at other times characters may be subjected to the effects of explosions due to accidents or sabotage. Explosions may produce damage due to concussion, fragmentation, or explosive contact.

Concussion: All explosions have a concussion value which affects every character within five meters and may affect characters further away as well. For each additional five meters from the explosion, halve the concussion value (round fractions down). For example, an explosion with a concussion value of 8 at five meters produces a concussion value of 4 at ten meters, 2 at 15 meters, and 1 at twenty meters.

The chance of being hit by concussion equals the concussion value of the explosive at range. Throw that number or less on 1D10. If hit, the explosion produces blunt trauma damage with a DP value equal to the concussion value at range.

Fragmentation: Most explosions produce fragmentation. All explosions which do so have a burst radius. All characters within the burst radius have a 60 percent chance of being hit by fragments with a DP value of 0.4. All characters within twice the burst radius have a 20 percent chance of being hit by fragments with a DP value of 0.2. Throw 1D6 to determine the number of fragments which hit the character, each one producing a separate wound.

Contact: Direct hits by an exploding round, or touching a mine or explosive when it detonates. Contact damage is resolved as normal damage using the DP value for the explosive.

EXPLOSIVES

Explosives have many uses other than combat (indeed, most of their uses are not combat related), but they are dealt with here because their effects are not covered by other rules.

Types of Explosives: Many types of explosives are available. All are listed in terms of their Explosive Points (EP). Fixed charges have a specific EP value while bulk explosives are rated by EP per kilogram.

Setting Charges: An explosive charge is one or more blocks of explosive (or a container of bulk explosive) connected together and with a total mass of ten kilograms or less.

To emplace an explosive charge (uncertain). Easy. Demolitions. one minute.

Referee: Treat total falsehood as detonation of the charge. Treat partial truth as failure of the charge when triggered.

Explosive Effects: Explosives can produce concussion, fragmentation, and contact damage.

Concussion value for an explosive equals twice its EP value. Tamped explosive concussion value equals its EP value.

Fragmentation is produced when the explosive is in contact with a hard material that will produce fragments (rock, brick, steel). An explosion with an EP value of 1 has a fragmentation radius of 5 meters. Doubling EP value adds 5 meters to the fragmentation radius. Thus, EP 4 has a fragmentation radius of 15 meters; EP 8 has a fragmentation radius of 20 meters.

Lower energy fragments are thrown to twice the fragmentation radius.

Contact Damage: An explosion does normal contact damage with a DP value equal to its EP value.

Tamping: Once a charge is set, it may be tamped. Tamping a charge with additional heavy material contains the force of the explosion and directs it toward the intended surface. A tamped charge has half the normal concussion value (1 per EP instead of 2), always produces fragmentation at the explosion's normal fragmentation radius, and does four times normal contact damage (DP value = 4 times EP value).

Breaching Barriers: Barriers are breached by blowing holes in them. Demolition charges can be used to breach walls, armor plates, starship hulls, embankments, or other barriers.

To determine the size of breach a charge will make, find its maximum penetration, in centimeters, in the material. Divide the contact damage DP value of the charge by the armor multiplier of the barrier material. The result is the maximum penetration, in centimeters, of the charge in the material.

The diameter of the breach is the maximum penetration of the demolition charge minus the thickness of the barrier.

For example, faced with a 50 cm reinforced concrete wall, a character decides to breach it with ten 1 kg blocks of Plastique-9 (a total of 100 EP). The charge is not tamped. It has a total contact damage DP value of 100. Reinforced concrete has an armor value of 0.5; 100 divided by 0.5 equals a penetration of 200 cm (2 meters). Since the wall is only 50 cm thick, the charge will blow a 150 cm (1.5 meters) diameter hole in the wall.

Characters would be well advised to take cover before the explosion. A 100 EP blast has a concussion value of 200, which can injure characters up to 40 meters away, and fragments of concrete will be thrown up to 80 meters.

WIDE AREA SATURATION PROJECTILES

Wasp rounds scatter a large number of grenades or bomblets over a wide area. While the listed burst radius is very large, there is a high concentration of fragments in this area and very little

fragmentation beyond it. Only characters within the burst radius of a wasp round are subject to fragmentation hits. All characters within the burst radius receive a contact hit on a throw of 1 (1D10); vehicles receive a contact hit on a throw of 3 or less (1D10).

WOUNDS AND RECOVERY

A wounded character may be treated and the severity or consequences of a wound reduced.

Resuscitation: Head wound kills cannot be reversed. Torso wound kills or death through shock points may be resuscitated.

Resuscitation must take place within 60 minutes of death or irreversible brain damage makes it impossible.

To resuscitate a dead person. Difficult. Medical and Automed. 30 seconds.

Referee: Requires surgical hospital and surgeon, or Automed and operator.

Stabilizing Serious Wounds: Shock points (which represent serious wounds) require immediate medical care, or a deterioration in condition adds more shock points and eventually brings on death.

To stabilize a serious wound. Routine. Medical and Automed. 90 seconds.

Referee: Requires surgical hospital and surgeon, or Automed and operator.

There are five critical times for wound stabilization; at each point, if the wound is not yet stabilized, there is a chance the condition will deteriorate.

The critical points are as follows:

30 minutes after wounding.
1 hour after wounding.
3 hours after wounding.
6 hours after wounding.
12 hours after wounding.

At each point, throw 1D10. If the result is less than or equal to the number of shock points suffered so far, the character receives one additional shock point.

If a character is moved by hand or vehicle, apply a DM -1 on the throw at the next crisis point.

It is not impossible for a wounded individual to stabilize himself (by effort or naturally). If he has not died from shock points within 12 hours of the wound, he has stabilized naturally. Of course, deterioration of a serious wound at the crisis points can also produce enough shock points to bring on death.

Regaining Consciousness: If a character became unconscious, throw 1D10 every hour. If the result is less than the number of hours unconscious, the character regains consciousness.

Healing: A character naturally recovers from one light wound and one shock point per week. Additional healing is possible as a result of medical care, expressed by the following task:

To heal one light wound and/or one shock point. Routine. Medical and Automed. One Day.

Referee: Requires at least one hour of attention per light wound or shock point per day. Patient requires bedrest and proper meals.

SENSOR DETECTION

All vehicles have a sensor range. In addition, a number of ground-mounted sensors are available. These represent an integrated array of passive and active electromagnetic sensing devices. The listed range for sensors is the maximum range at which they can detect targets. Doing so at maximum range is a difficult task. At half range it is a routine task.

The die roll for success of the task is modified by the "signature" of the target. All man-sized targets have a signature of 0, although certain types of personal armor and equipment may modify this. All vehicles have a listed signature. Positive numbers are added to the die roll (increasing the chance of detection) while negative numbers are subtracted from it (decreasing the chance of detection).

Some sensors are particularly effective and have their own positive modifier for success. For example, a 20-kilometer +2 sensor would roll for a 7 or better at normal range and a 5 or better at half range when trying to detect a target with a signature of 0.

Cover: Targets completely blocked from view or line of sight by intervening terrain may not be detected by sensors. Targets partially obscured from view or line of site (in heavy foliage, in a built-up or urban area, etc.) subtract 3 from their signature.

Targets which move or fire lose the benefit of cover.

Combat Resolution

ARMOR VALUES

Cover	*Armor Value*
Wood	.025
Loose Dirt	.03
Packed Dirt, Stone	.15
Brick, Cement	.25
Reinforced Concrete	.5
Construction Steel	.8
Hardened Steel	1.0
Aligned Crystal Steel	1.5
Construction Composites	2.0
Composite Matrix Armor	3.0

NON-PLAYER CHARACTERS

Experience	*Initiative Level*	*Incapacitation*	*Duck*
Green	4	1	4
Experienced	6	2	6
Veteran	8	3	8
Elite	10	4	10

Incapacitation: shows the number of light wounds required to incapacitate an NPC.

Duck: Throw 1D10 plus AFV for the number shown to force an NPC to duck.

WOUNDING

Potential Wound	*Damage Type*	*DPV=1+*	*1D10≤DPV×10*	*1D10>DPV×10*
Kill	Normal	Kill	Kill	Shock, KD
	Blunt	Kill	Kill	Shock, KD
	Stun	4 Stun (or DPV×times Stun, if more), KD		
Serious	Normal	DPV×Shock, KD	Shock, KD	Light Wound, KD
	Blunt	DPV×Shock, KD	Shock, KD	Light Wound, KD
		(Every odd numbered (1,3,5...) Shock is a Stun instead)		
	Stun	DPV×Stun, KD	Stun, KD	Stun
Light Wound	Normal	Light Wound, KD	Light Wound, KD	No Effect
	Blunt	KD	KD	No Effect
	Stun	Stun	Stun	No Effect

Normal damage is significant surface and internal tissue damage (as in burns or gunshot wounds). **Blunt trauma** is impact damage or crushing (as in blows from a club, concussion, or perhaps crushing from a tire rollover). **Stun** is damage to the central nervous system (as in electric shock, or incapacitating gas).

Wound Effects:

KD (Knocked Down): The character is knocked down by the attack and is dazed.

Dazed: The character cannot move or act, and is assumed prone, motionless, and under any available cover. Dazed remains in effect for a number of turns equal to the total of shock and stun points the character has received (and this effect is cumulative). If no shock or stun points, dazed applies only until the end of the combat turn. All eligibility for further actions in the combat turn is lost, regardless of initiative level. Any passed or option actions are lost.

Light Wound: The character is immobilized for the rest of the combat turn. Initiative level is reduced by 1.

Stun Point: The character is dazed. Initiative is reduced by −3, but never below 1 until the character is unconscious. NPCs become unconscious after receiving three stun points. A character is unconscious when his total of shock and stun points equals his consciousness level.

Shock Point: The character is dazed. Initiative is reduced by −3, but never below 1 until the character is unconscious. NPCs are made unconscious after receiving one shock point. A character is unconscious when his total of shock and stun points equals his consciousness level.

Kill: The character is dead. Head hit kills are absolute; torso hit kills may be eligible for resuscitation.

BASIC QUESTIONS

1. Did you hit the target?
2. If so, how much damage did you do?

ATTACKS

Fire attacks involve attempts to hit a target with a projectile.

Aimed fire involves aiming a single fire attack against a single target (much as a hunter or a sniper would).

Area fire involves projecting a large volume of fire into an area with one or more targets (machine guns and bombs produce area fire).

Melee attacks involve attempts to hit an enemy within touching range with armed or unarmed blows

ALLOWED ACTIONS

Remain stationary.
Conduct aimed fire at one target.
Conduct area fire at one area.
Move.
Conduct walking area fire.
Conduct trotting area fire.
Reload a weapon.
Change weapons.
Duck.
Special action.

Responses do not count as actions:
Block a strike.
Avoid a diving blow.

MOVEMENT

Type	*Meters per turn*
Crawling (uses all available cover)	5
Walking (uses available partial cover)	20
Trotting (no cover)	40
Running (no cover)	80

ARMOR EFFECTS

Armor effects are subtracted from the Damage Point Value (DPV)of the weapon, and the remainder is used to determine the effects of the wound.

RANGES

Effective range is stated for each weapon.
Close range is half effective range.
Long range is 2× effective range.
Extreme range is 4× effective range.

Combat Resolution

COMBAT TASKS

To hit a target with aimed fire at close range. Routine. Weapon skill. Absolute (1 action).

Referee: Difficulty increases one level with each increase in range (difficult at effective range, formidable at long range, and impossible at extreme range). Shotguns may not fire at extreme range. Flechette grenades may not fire aimed fire.

To hit a target with indirect fire. Difficult. Lower of Forward Observer or Marksmanship. Absolute (1 action).

To hit a target using laser designation. Easy. Lower of Forward Observer or Marksmanship. Absolute (1 action).

Referee: Forward observer must actually be firing his spotting laser at, and hitting, the target when the projectile hits.

To strike. Routine. Melee and melee modifiers. Absolute (1 action).

Referee: Using short range weapon against opponent with long range weapon makes the attack difficult. Surprise attacks (unexpected attacks from behind) are automatically successful.

To block a strike. Difficult. Melee and melee modifiers. Instant.

Referee: A successful strike blocks a would be successful strike, and the strike misses. Trying a block prohibits fire attacks (but not melee attacks) at the next initiative point.

To avoid a diving blow. Routine. Agility. Instant.

Referee: A diving blow is automatic unless the target avoids it.

To grapple. Routine. Melee. Absolute (1 action).

To escape. Routine. Melee. Absolute (1 action).

To drive at double speed. Routine. Driver. Absolute (1 action).

To drive evasively. Routine. Driver. Absolute (1 action).

To emplace an explosive charge (uncertain). Easy. Demolitions. one minute.

Referee: Treat total falsehood as detonation of the charge. Treat partial truth as failure of the charge when triggered.

VEHICLE DAMAGE

1D10	*Result*
1	No Effect
2	No Effect
3	Crew
4	2 Crew
5	Armament
6	Mobility
7	Armament
8	Mobility
9	Catastrophic
10	Mobility
11	Catastrophic
12	Armament
13	Catastrophic
14	Mobility
15+	Catastrophic

Effects: Crew Hit= one crewmember receives 1 hit by DPV of weapon. 2 Crew= two crewmembers hit. Armament= one weapon destroyed. Mobility= vehicle stopped and one crew hit. Catastrophe= vehicle destroyed and crew killed.

DEVIATION

If a weapon which fires an exploding round (from a thrown hand grenade to artillery) misses its target, it deviates. Throw 1D10 for the distance of the deviation.

Multiply the deviation distance by the distance for the type of weapon used to determine the actual deviation distance.

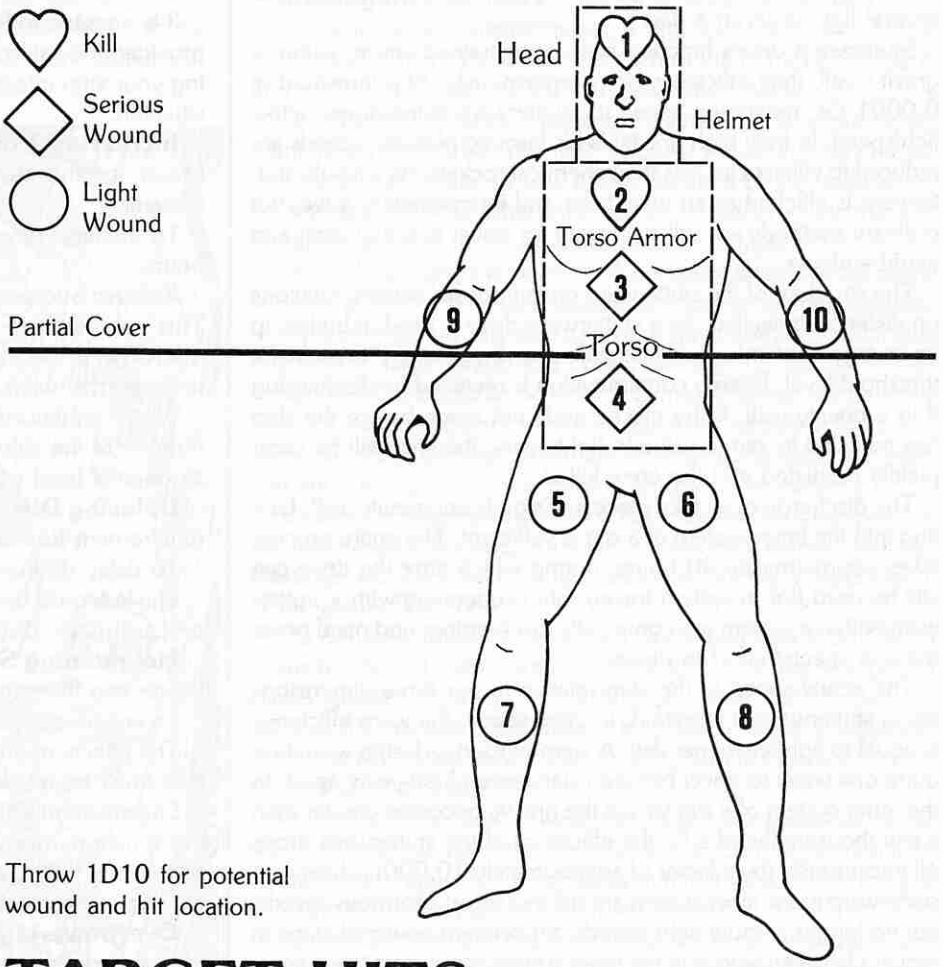
Scatter Diagram

7	8,9	4
6	★	3
5	0,1	2

Use the scatter diagram to determine the direction of deviation. Using direction and distance, determine the location where the rounds impact after deviation.

Weapon Type	*Deviation Multiplier*
Direct Fire	1 meter
Indirect Fire Grenades	5 meters
Indirect Fire Mortars	10 meters
Indirect Fire Howitzers	10 meters
Indirect Fire Missiles	10 meters
Indirect Fire Rockets	20 meters

If an indirect fire weapon is shooting at more than half its indirect fire range, double the multiplier.



Throw 1D10 for potential wound and hit location.

TARGET HITS

Star Travel

Starships travel between the stars using the stutterwarp, the star-drive that makes faster-than-light travel possible. Stutterwarp is an implementation on the macro scale of the tunnelling phenomenon common to electrons. The proper introduction of energy in a field around a starship allows it to move instantaneously from one location to another without passing through the intervening space.

The distances that the stutterwarp can travel, however, are very small. One cycle of the drive moves a ship less than a few hundred meters. By cycling the drive very rapidly, however, the ship can travel vast distances in very short times. The speeds commonly achieved depend on the output of the powerplant, but approach several light-years in a day.

Stutterwarp drives function best in unstrained space; within a gravity well, their efficiency drops enormously. At a threshold of 0.0001 Gs, maximum speed for stutterwarp ships drops below lightspeed. In truly high gravity fields (around planets), speeds are reduced to efficiencies less than chemical rockets. As a result, stutterwarp is efficient as an interstellar and interplanetary drive, but ordinary methods are still necessary for travel between orbit and world surfaces.

The structure of the stutterwarp drive imposes some limitations on distances travelled. As a stutterwarp drive is used, it builds up an energy contamination that stalls the drives when it reaches a threshold level. Energy contamination is reversed by discharging it in a gravity well. If the discharge is not made before the ship has travelled its range value in light years, the ship will be completely irradiated and the crew killed.

The discharge must take place in a significant gravity well. Getting into the inner system of a star is sufficient. The entire process takes approximately 40 hours, during which time the drive can still be used (for in-system travel). Ships operating with a stutterwarp within a system are continually discharging, and need never make a special effort to do so.

The actual speed of the ship relative to our three dimensions using stutterwarp is threefold. In deep space, the warp efficiency is equal to light-years per day. A warp efficiency-1 ship would require one week to travel between stars seven light-years apart. In the inner system of a star where the gravity becomes greater than a few thousandths of a G, the efficiency of the stutterwarp drops off enormously (by a factor of approximately 10,000). Ships with stutterwarp in the inner system are still moving at enormous speeds, but no longer at multi-light speeds. Stutterwarp powered ships in moving between worlds in the inner system can expect travel times ranging from hours to at most a couple of days. Finally, when gravitation reaches some tenths of a G, the efficiency of the stutterwarp drops off once again, down to a point where the stutterwarp cannot overcome that gravitation and some other means of propulsion will be required.

Stutterwarps are capable of keeping a ship in an orbit around a planet, but, due to gravitational problems, they cannot be used to land a ship on a planet. Another form of drive will be necessary, or, if the ship is a streamlined airfoil design, it might be able to glide in under little or no added propulsion.

TINKERING WITH YOUR SHIP

It is possible to fine-tune various aspects of ship performance, provided the skilled individuals are available to do the job. Turning your ship into a hot-rod might make the difference in a tight situation.

Increasing Power Output: This translates into increased power for the stutterwarp drives, which means greater warp efficiency.

To increase power output. Difficult. Drive Engineering. Four hours.

Referee: Success increases stutterwarp efficiency 1D6 percent. This task needs to be re-performed each time the ship makes a discharge, or once per month minimum. If failed, the ship reverts to its normal warp efficiency.

When enhanced in this manner, the general maintenance number of the ship is automatically raised by three. It reverts to its original level when enhancement fails or is removed.

Delaying Discharge: Certain steps can be taken to delay the requirement for the energy discharge.

To delay discharge. Difficult. Drive Engineering. One hour.

The task must be attempted before a journey is undertaken. Success will delay discharge by one day.

Heightening Sensors: Each type of sensor (military, navigational, and investigative) can be enhanced.

To enhance sensor values. Formidable. Electronics. One hour.

The effects of enhancement are lost after one month, and the task must be repeated.

Enhanced military sensors add three to both the passive and active sensor number. Enhanced navigational and investigative sensors act as if they are one degree better than they are (minimal act like standard; advanced remain advanced).

Overpowering Lasers: Lasers and particle weapons can be overpowered to allow greater delivery of energy.

To enhance weapons station. Difficult. Electronics.

The effects of enhancement are lost after one month, and the task must be repeated.

Each enhanced laser delivers double hits (twice as much damage per roll on the hit location table). However, each time it is fired, an enhanced laser will burn out on a roll of 10 on 1D10. On a subsequent roll of 10 on 1D10 the laser explodes, probably killing any non-remote gunner, and doing one point of battle damage to the ship. Burnt out lasers cannot be repaired; they must be replaced.

Detonation lasers cannot be enhanced.

REMODELLING YOUR SHIP

Moving walls and rearranging the interior of a ship is relatively easy. Provided all installations remain within the confines of the hull, virtually anything can be done to the interior.

Minor changes such as new partitions, new rooms, rearrangement of cargo space, and so forth, are very easy to accomplish. Materials are easily available as are tools and instructions necessary. The total cost runs about Lv50 per cubic meter involved.

Major changes like changing the computer system or drives, putting in a new power plant, relocating the bridge, etc., are considerably more difficult. These require putting in at a space facility and generally cost some percentage of the purchase price of the ship.

Details of major changes must be determined by the referee.

ARMING YOUR SHIP

The end of the starship listings gives several examples of laser and particle weapons. Any of these can be placed on a ship and are readily available at any space facility on the frontier.

The maximum number of point laser weapons which can be placed on a ship is one per megawatt of power plant output. Attaching one to a hull is the sum of three tasks.

To install point laser. Routine. Drive Engineering. One hour.

To install point laser. Routine. Electronics. One hour.

To install point laser. Routine. Mechanical. Two hours.

Once all three tasks have been completed, the weapon is ready for use.

Any number of missiles can be carried by a ship up to the cargo capacity. However, they can only be launched one per remote station on the ship per space combat player turn.

SENSORS

There are several types of sensors which can be installed on a ship. These are military, navigational, and investigative.

Military sensors are described in space combat.

Navigational Sensors: The following are varieties of navigational sensors which may or may not be included in a ship's sensor package.

Deep System Scan: Generally employed by starships entering a new system, a deep system scan uses various telescopic devices to evaluate the stellar and planetary population of the system. A deep system scan relays the location, size, and type of all stellar bodies; location and physical characteristics of all planetary bodies; and the existence of rings or belts in the system. The deep system scan can be used from any point within a stellar system.

Many ships forego the use of a deep system scan if entering a familiar system.

Gravitational Scan: Not as detailed as a deep system scan, a gravitational scan gives only the size of all planetary and stellar bodies within a star system. It can also be used from anywhere within the system.

Investigative Sensors: Various sensors can be used to investigate unexplored environments. A ship need have none of these to function. The characteristics of each of the minimal, standard, and advanced models of each are described below.

Cartographic Sensors: Mapping a planet's surface can be accomplished from orbit. The time involved is twenty hours for the entire planetary body, or less if only portions of the body are to be mapped. Exactly what information is gathered by the cartographic sensors depends on its level of complexity.

Minimal Cartographic Sensors: A complete sweep of the planet will map all land and liquid masses and major geographic features. In terms of mapping, this scan will reveal the presence of mountainous terrain, large rivers, and coastlines only.

Standard Cartographic Sensors: A complete sweep will generate maps of the entire planet; all terrain types will be determined. The scan also picks up large urban areas, large scale land manipulation such as agriculture or mining, and weather patterns.

Advanced Cartographic Sensors: Advanced sensors can perform just like standard sensors, but down to individual beings, animals, buildings, etc. They also can be used to explore the mineral wealth of the planet from orbit.

Life Sensors: Sensors have been developed which can detect characteristics of living animals. Fine-tuning of the equipment allows greater accuracy and distinction. Note that life sensors measure the raw size of the creature in question, not its intelligence. A dinosaur registers larger than a rabbit; a herd of cows register larger than a dinosaur.

Minimal Life Sensors: These can detect the existence of life within a single kilometer radius of the device. Each registering item cannot be distinguished further using minimal sensors, but its location can be determined to within ten meters.

Standard Life Sensors: Range is increased to ten kilometers, and not only the existence but also the size of everything in that radius is scanned. Location can be pinpointed to within a meter.

Advanced Life Sensors: Range is up to one hundred kilometers. The size of each organism is determined. Advanced sensors allow the operator to scan for a specific type of creature; a scan for humans, for instance, will pinpoint all things with human characteristics within the hundred kilometer range. However, this is not an exact science, and mistakes will occur, especially at long-range.

STARSHIP POWER

Starships need fuel to generate electricity in their power plants and to provide reaction mass for their thrusters. The type of fuel varies with the type of power plant used.

Power plants are rated in megawatts per week. Fuel tankage for ships is generally allocated in terms of what will supply the power plant for a week.

Direct Energy Conversion: Two types of power plants utilize the technique called direct energy conversion: Fuel Cells and MHD Turbines. Both combine hydrogen and oxygen and in the process produce electricity; the difference is only in their efficiency and their handling of the waste gases.

Fuel for both types consists of liquid oxygen and liquid hydrogen (stored in compartmentalized, separate tanks).

Fuel Cells require 100 tons (165 cubic meters) per megawatt per week.

MHD Turbines are more efficient and require 75 tons (125 cubic meters) per megawatt per week.

Fission Power Plants: Fission power plants use decaying radioactive elements to produce heat which then drives electrical generating equipment. The fuel is carried within the reactor vessel and provides continuous energy for two years.

Refuelling a fission power plant is a major operation requiring the attention of skilled operators and heavy tool sets. It is usually performed at a world with an industrial base (and a fission fuel processing plant); it is possible to refuel anywhere if the fuel package is available.

A fission fuel package masses 750 kilograms (2 cubic meters) and will last for two years. Fission fuel packages are dated for freshness and must be installed within two years of manufacture or they provide unreliable service. Used fission fuel packages may be returned to a recycler for reprocessing; they are so dangerous that most are dropped into a star if a reprocessor is not immediately available to handle them.

Fusion: Fusion power plants are constructed with their supply of fuel already in them; they never need refuelling. By the time the fuel supply is exhausted, the plant has worn out and must itself be replaced.

Refuelling: Fuel Cell and MHD Turbines need hydrogen and oxygen for fuel. These gases are obtained by breaking down water.

Terminals: Any colony world and many other star systems have orbital terminals which provide liquid oxygen and liquid hydrogen as fuel for ships. The terminal has performed the work of locating water or ice, transporting it to orbit, and then cracking it using solar power. In exchange, the terminal fuel station charges Lv100 per ton.

Self-Fuelling: Many ships carry the necessary equipment to process water or ice into fuel. In some systems, self-fuelling is necessary because there is no terminal present. In other systems, self-fuelling saves money, but at a cost of time and effort.

Self-fuelling requires that the ship visit a location where ice or water is available, obtain it, and transport it to the ship. Ice or water equal to twice the cubic meters required is necessary (to allow for wastage). The ships's solar arrays are then used to melt the ice and crack the water into fuel. One solar array will process 23 tons (40 cubic meters) in a week. Ships often carry more than one solar array.

Closed-Cycle Fuel Cells: Fuel cells can be operated on closed-cycle; their exhaust gas (water vapor) can be condensed and saved in the fuel tanks. Upon arrival in a system, the ship's solar array can be opened up and the electricity used to crack the water back into fuel.

A closed cycle system eliminates the need to find a local source of water or ice, but still requires one week to process 23 tons (40 cubic meters).

Solar Arrays: MHD Turbines and Fuel Cells are often shut down to conserve fuel when a ship is in orbit and does not have to maneuver. Auxiliary power is provided by solar arrays that provide electrical energy direct from sunlight.

Solar arrays are produced in a standard size and configuration; they are easily procured and replaced when damaged. One standard solar array expands to produce a flat screen 10 m by 10 m and massing about 100 kilograms.

The standard array produces 2 megawatts. One solar panel can substitute for 2 megawatts of power plant.

STUTTERWARP EFFICIENCY

Stutterwarp efficiency is equal to the cube root of (megawattage of the ship power plant/mass of ship in tons) multiplied by a constant. In most cases, this constant is 14.25, but varies slightly with the technology used to build the stutter drive.

CREWING YOUR STARSHIP

Starships are largely automated pieces of equipment, but they nevertheless require a minimum number of people to crew them. In general, humans serve in roles that automation cannot fill. Many times, these different roles overlap.

Workstations: A workstation is a physical location which provides the basic materials, tools, equipment, and facilities that allow a job to be performed. Each workstation requires at least one individual to crew it.

Workstation Types: Workstations may be either constant duty or individual positions. Constant duty workstations require one person at the workstation at all times; the ship must have two persons to fill the position, and they work in alternating twelve-hour shifts. Individual work stations require only one individual, and that

person performs his duties at that workstation only when required by circumstances.

Bridge and Engineering workstations are constant duty. All other (medical, steward, weapons, remote, and other) workstations are individual unless specifically noted.

Workstation implies a computer terminal, acceleration couch, and other specific equipment, but some workstations may be less specific: the medical compartment for the paramedic or ship's doctor, the drive sector for the engineers, or the corridors for security crew.

Crew Positions: Each starship description specifies the workstations aboard, the type and location of the workstation, and the skills required. Any individual with a skill level of one or more can fill such a crew position.

For a ship to operate efficiently it must have each crew position filled by a qualified, skilled individual with at least level-1 in the required skills for the position.

It is possible for a ship to operate with constant duty workstations crewed by only one person and with individual workstations unfilled. Under such circumstances, the level of difficulty of nearly all tasks associated with operating the ship are increased by one level, and many of the tasks become hazardous.

The ship's captain may create additional crew positions (additional pilots, gunners, or cargo handlers, for example), but the total number of crew may not exceed the total life support for the ship.

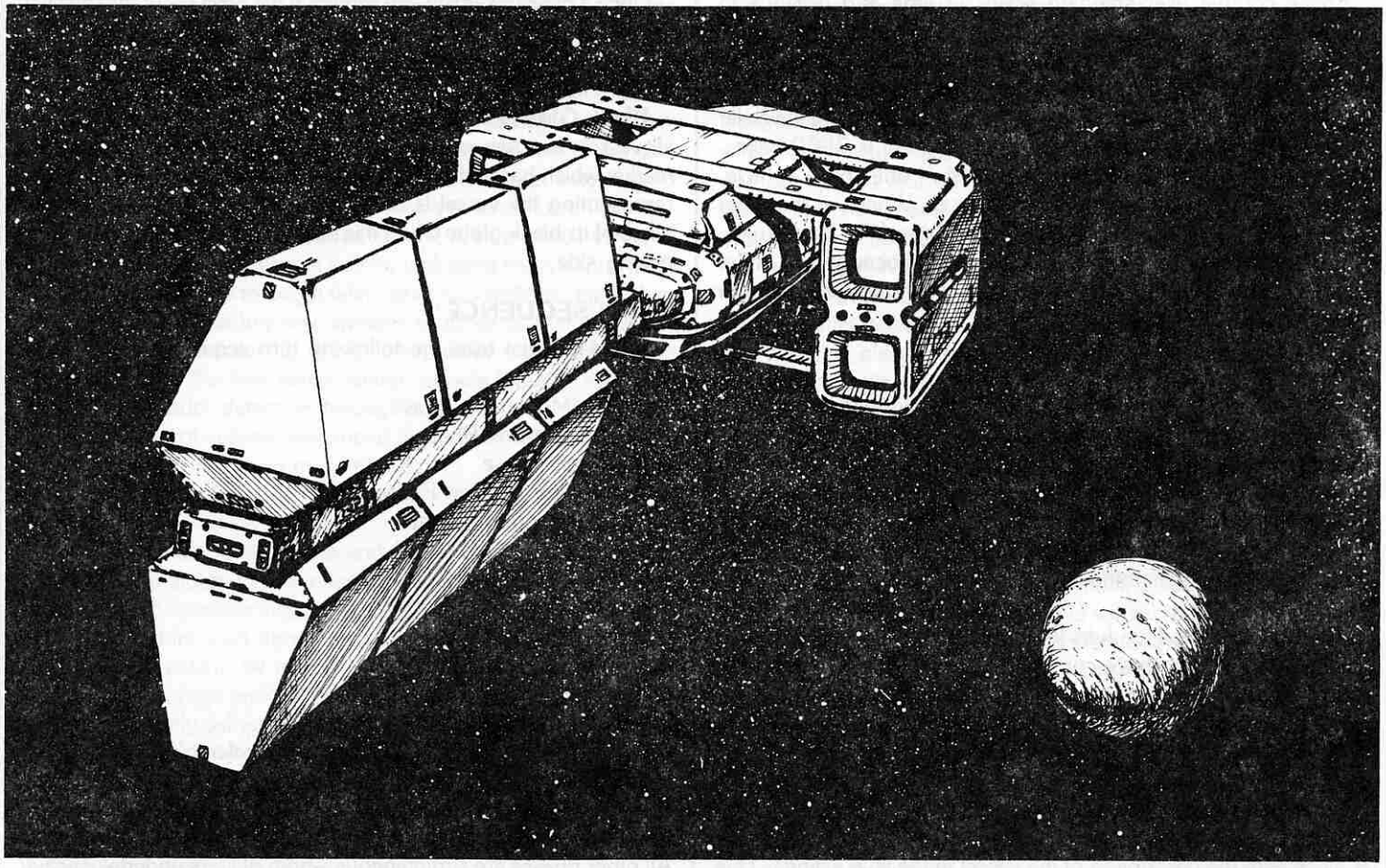
Crew Pay Levels: Crew members are paid in a variety of ways. Members of the military and navy are paid according to their service's pay scales. Civilian crew members are generally hired at standard pay rates established by the marketplace. Some ships hire crew and pay them life support plus a share of the profits.

Standard Pay Rates

Skill	*Pay Level*
Communications	Lv3,000
Engineering	Lv4,000
Medical	Lv4,000
Navigation	Lv3,000
Remote	Lv3,000
Steward	Lv2,000
Weapons	Lv2,000

Pay rates shown are monthly salaries.

In Lieu of Pay: Most commercial ships reduce their salary costs by providing cargo space *in lieu of* some portion of payroll. The cargo space is then usable by the crew member for whatever purpose he wants: recreation, personal storage, non ship-threatening research, or (most commonly) free-lance cargo transport. In lieu of pay is commonly provided at one cubic meter of space (or one ton of mass, whichever is less) per each Lv500 in salary foregone. The cargo space provided must be pressurized (if requested by the crew member), accessible during starflight, and secure. It cannot make additional demands on life support systems (beyond the crew member's own demands) and is not insured by the ship.



Space Combat

Adventures often call for some sort of space combat. Even if no shots are fired, encounters with other vessels help the players and referee to visualize the situation as it unfolds. These rules rely heavily on the information given in the ship descriptions and on the ship status sheets which will be filled out for each vessel involved.

SCALE

Space combat uses standard scales of time and distance to regularize play.

Time: Each turn represents one minute.

Distance: Each hex on the playing surface represents approximately 600,000 kilometers. At this scale, the diameter of the Solar system (30 au, the diameter of Neptune's orbit) is 7500 hexes.

Units: Markers or ship models represent one space vehicle, whether it is a missile, drone, or space craft. Whatever the exact nature of the craft, they are referred to as vessels in these rules.

For purposes of space combat, planets may occupy any of the hexes on the map. However, they do not interfere with play in any way.

PREPARATION FOR PLAY

In the course of any adventure, situations might arise which require resolution using space combat. When such a situation comes to pass, the referee is called upon to perform certain functions in preparation for the ensuing battle.

Playing Surface: Space combat requires a playing surface with a hex grid. The grid size should be tied to the type of units being used, keeping in mind that each hex should be large enough to contain one unit.

Units: Any type of markers to represent the forces of both sides will be sufficient for space combat. Actual models of space craft and missiles are the most aesthetically pleasing, but are not strictly necessary. Counters, coins, or virtually anything else will suffice.

Ship Data Sheets: Each ship likely to be engaged in fighting must have a ship status sheet. A blank data sheet is provided with the game, but be certain to only use photocopies. Save the original as a master. All of the information necessary for the status sheet is given with the description of the vessel in the ship listings. This information is given as follows:

Ship name, movement (in hexes), screens, passive signature, masked passive signature, active signature, passive sensors, active sensors, hull hit capacity, power plant hit capacity, total crew complement, weaponry installations, and remote stations.

Each of these are fully described in the associated sections below.

Other information may be necessary or useful when filling out the ship status sheet. The skill level of the sensor operator is helpful to know, as is the notation of each appropriately skilled individual assigned to damage control. Also, if backup systems for sensors, computers, remote stations, or targetting computers are available, they should be noted under hit capacity. Finally, the skill levels of any gunners or remote pilots should be noted.

Once a playing surface and models have been secured, and ship status sheets have been filled out for each of the participating vessels, play may begin. Initial contact range is approximately thirty hexes, but this depends on the situation and is up to the referee.

Black Globes: Until detected, as described in detection below, all vessels are represented by black globes. A black globe is a marker which has nothing but a facing. The actual marker or model representing the vessel is only placed on the playing surface in place of its black globe when it is successfully detected by the opposing side.

TURN SEQUENCE

Space combat uses the following turn sequence.

Side A Movement Phase
Sensor Commit Phase
Detection Phase
Detonation Commit Phase
Damage Control Phase

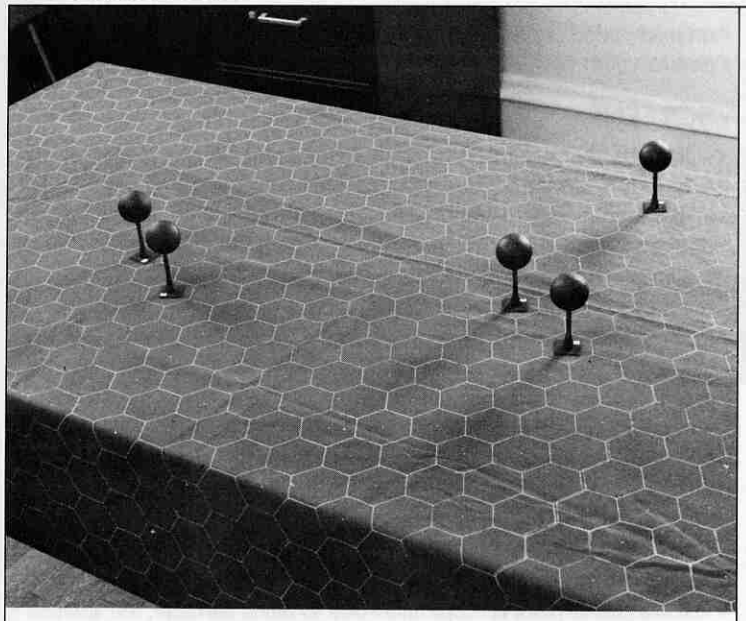
Side B Movement Phase
Sensor Commit Phase
Detection Phase
Detonation Commit Phase
Damage Control Phase

Which side is A and which is B is the referee's decision prior to play. Combat progresses using this sequence until the logical conclusion of the battle.

Only the designated player moves during the movement phases. All other phases are simultaneous—both players undertake activity in those phases. One sequence from movement to damage control is called a player turn. There are two player turns per game turn.

MOVEMENT

Each ship is given a movement rating in the equipment list,



which is also on the ship status sheet. This is the number of movement points which may be expended by the ship in a movement phase.

Note that only stutterwarp driven ships have a movement rating greater than zero. Any ship without a stutterwarp, regardless of its other drive system, has a movement rating of zero.

Facing: Each ship model on the map must be situated so that it faces one of the six possible hexsides. The facing of the ship dictates the direction of movement and can only be changed by expending movement points.

Expending Movement Points: One movement point allows a vessel to move one hex in the direction it is facing. One movement point will turn the vessel one hexside; the vessel remains in its original hex when changing facing. Each vessel may expend up to its total number of movement points each turn.

Expending No Movement Points: A ship which elects to expend none of its movement points, including ships which have no movement points to begin with, have two options. First, they may change their facing any number of times in their hex. Second, they may voluntarily bring their passive signature ratings down to one for the next two detection phases (passive signature is explained under detection below).

Any number of vessels may move through or occupy a hex at any time during the movement phases.

DETECTION

Each vessel has two signatures and two possible means of detecting those signatures in other vessels. Signatures may be active or passive. The passive signature of a ship represents its neutrino emissions and infrared signature created by its power plant; both can, to some extent, be masked by the hull of the ship. Active signature is the high energy radar emissions of the vessel created when it is actively using its radar. Particularly advanced materials and ship designs have greater stealth characteristics which reduce a ships vulnerability to detection by active radars.

Ships usually carry sensors capable of detecting passive signatures; they also may have high energy radars that can actively search for enemy vessels.

Signatures: The numbers given for each ship in its description are its passive signature, its masked passive signature, and its active signature. The masked passive signature follows the passive signature in parentheses. When determining the passive signature of a ship, use the masked value until such time as there has been battle damage to cause a breach or serious breach (both are explained under damage below). The minimum signature in each area is one; the maximum is ten.

Sensors: The numbers given for each ship in its description are its passive sensors and its active sensors. The numbers express the ship's perfect detection range in hexes; perfect dectection range is the range at which the sensors can detect a target with a signature of one or greater. Active sensors can only detect active signatures; passive sensors can only detect passive signatures. Each hex beyond perfect detection range raises the minimum signature detected by one.

Example: A ship with a passive sensor rating of five would be able to detect any ship up to five hexes distant. At six hexes, it could only detect a ship with a passive signature of two or greater. At seven hexes, it could only detect ships with passive signatures of three or greater. Since the maximum possible passive signature is ten, the maximum passive detection range for this ship is fourteen (and at that range, it could only detect a ship with the maximum passive signature of ten).

Committing Active Sensors: During the commit sensors phase, both players decide whether or not they will be using their active sensors. During the phase, both sides place either "commit sensors" or blank chits next to their vessels. Markers are revealed simultaneously for all vessels on the playing area.

Committing active sensors allows the ship to use its active sensor rating in an attempt to detect all targets it can for the next two detection phases: the one immediately following the commit phase, and the detection phase following that.

Committing active sensors also has some consequences. Since the radar is basically a burst of energy, the passive signature of the vessel which committed goes up enormously. In fact, the ship is automatically detected by the opposing side when using active sensors. This automatic spotting takes place for the rest of the current player turn and all of the next player turn. After those two player turns have passed, the detection must be maintained by the opposing side (as described in maintaining detections below), or it is lost and the black globe returns to the map.

Initial Detection: In order to detect a black globe, a ship must attempt initial detection. This is done in the following sequence. The detecting player counts the range to the black globe he wishes to detect and determines the minimum signature which he can detect at that range. The detecting player then asks the target player "Is the passive/active signature of this black globe x or greater?" The target player then answers either yes or no—yes results in the black globe being replaced with a marker or model; no indicates that the initial detection attempt has failed and the black globe remains on the map.

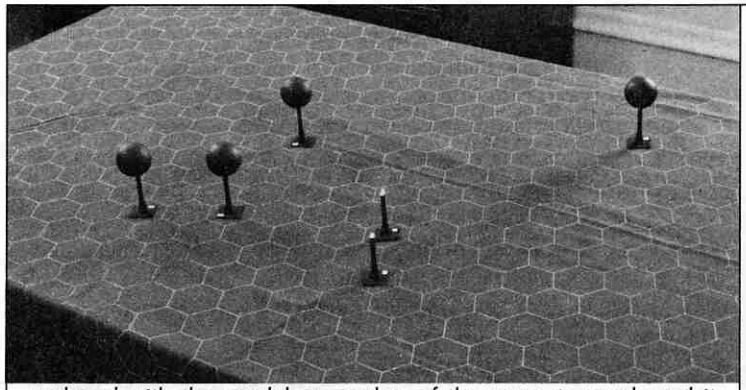
Maintaining Detection: Once initial detection has been successful, maintaining that detection is somewhat easier. Maintaining a detection is a task for the sensor operator.

To maintain detection. Routine. Sensor Operation. Instant.

Referee: Apply DM−1 for each detection he is attempting to maintain in a given detection phase beyond one (if he is trying to maintain three detections, the modifier is −2 on each attempt). Detections can only be maintained to the maximum range of the detecting player's radar for a signature 10 target.

Any number of initial detections may be attempted per detection phase. Any number of detections may be maintained, though this results in a negative modifier for each attempt beyond one maintenance.

Effects of Detection: Until detected and the model or marker is placed on the playing area, a black globe may not be fired at.once detected by either active or passive sensors, the black globe is



replaced with the model or marker of the correct vessel, and it is eligible for all types of weapons fire.

Also, if the vessel detected is of a fairly familiar variety, the exact nature of the vessel becomes readily apparent to the detecting side. (The computer calls up the appropriate information, including displacement, drives, crew complement, etc.) If the item detected is foreign to them, then only the general nature of the vessel is given—this includes displacement in cubic meters and its exact signatures (active and passive). Other information cannot be determined in the context of the space combat rules (the vessel will have to be closely investigated, if that is possible, after the battle).

FIRING

Weapons may be fired at any time during the movement of a turn. Items which are detected are eligible targets, provided they are in range. Firing is in the form of laser or particle weapons, all hereinafter referred to as lasers.

Weapon Descriptions: Each type of laser has several descriptive elements which affect how its hits are determined and/or how its damage is inflicted.

Particularly high tech, well-manufactured lasers often have built-in targetting mechanisms which supplement those of the vessel they are attached to. Any laser with a +1 or +2 Targetting designation may use this as a die modifier to the task to hit.

Double mount lasers roll only once for hit determination with a +1 modifier. If they hit their target, they roll once on the hit location table. High energy weapons may have the designation AxB. A is the number of times rolled on the hit location table and B is the number of hits achieved per location. For example, a 10x2 laser rolls ten hits (each can be affected by screens) on the hit location table, and each hit does two points of damage. Note, however, that the 10x2 laser above only needs one hit determination roll (either they all hit or they all miss). A weapon designated as being x2 does double damage.

Dividing Fire: A multiple shot laser (that is, one with more than one roll on the hit location table) may divide those hits among more than one vessel prior to firing. Each vessel fired upon must have a hit determination roll made in order to receive damage.

Detonation Lasers: During the commit detonation phase, any detonation type lasers must either commit or remain intact. This is done in the same manner as active sensor committment, described in detection above. Once committed, the laser must fire immediately. Once fired, the detonation laser is destroyed and removed from play.

Hit Determination: Hit determination is a task for the gunner. To hit a target. Routine. Gunnery. Instant.

Referee: also apply these DMs. If the ship's targeting computer has a modifier, apply it. If the weapon itself has a targeting modifier, apply it as well. Last, if the range is one hex, there is an automatic −2. Lasers may not fire at more than one hex range.

Hit Determination for Remote Piloted Lasers: Roll 7+ on a ten-sided die with the same modifiers possible as listed directly above.

SCREENS

If there are screens on the ship, they will be given a value of 1 to 10 in the ship's description. This value is the screen value at the beginning of each player turn in which the screens are operative—their effective value may change as they absorb hits.

Once a hit has been achieved on a ship with screens, the hit must be confirmed against the screens. For each hit, roll one ten-sided die. If the number rolled is less than or equal to the screen value, the screens absorb the energy. If the roll is greater than the screen value, the hit is achieved on the ship itself.

Each hit (in a player turn) on the screens reduces its effectiveness by one. For instance, once screens rated at three have taken a hit, they only rate two against subsequent hits that player turn. The most hits that that ship can hope to absorb into the sensors is three per player turn. At the beginning of the next player turn, the screens reset to their original value.

If the power plant is inoperative due to battle damage, the screens will also be out. They will be operative again at the start of the player turn following successful power plant repairs. The use of screens increases the passive signature of the screened ship by the value of the screens with a maximum of ten. Screens may be tuned to any value less than or equal to their given value at the start of each player turn.

DAMAGE

For each hit achieved on a vessel, rolls are made on the hit location table, and appropriate number of points are marked off of the target vessel's hit capacity. All hits are tallied in the appropriate section on the target's ship status sheet.

Hit Locations

Hull: The hull hit capacity of each vessel is given in its description. It is a three number sequence. The first is the total number of hit points which the hull can absorb before the ship is completely destroyed. The second is 20% of that number, and the third is 50% of the same number.

Once hits totalling 20% of the hull hit capacity have been taken, the hull is breached. Until repaired below this 20% level, the masked passive signature of the vessel is increased by one. If there is no masked signature for the vessel, this has no effect.

Once hits totalling 50% have been taken, the hull is seriously breached. The masked passive signature is ignored in favor of the normal passive signature until sufficient repairs have been made to reduce the hit total below 50%.

Power Plant: The power plant hit capacity is given as two numbers. The first is the total hits that can be absorbed before the power plant is completely destroyed. The second is 20% of this number.

Once hits totalling 20% of the power plant hit capacity have been taken, the power plant is inoperative. The ship may not move or fire weapons until repaired.

Crew: One crew member, determined at random, is killed. If this is a remote pilot or gunner, those devices cannot function until the position is replaced. Once all pilots and navigators on board have been killed, the ship may not move.

Sensors: A sensor hit indicates that all ship's sensors, passive and active, have been rendered inoperable. No detection may be undertaken until they are repaired.

Computer: The ship's computers have been damaged. No firing or moving until they are repaired.

Remote Station: One remote station is destroyed, determined at random. That remote object may not move, fire, or detect until the station is repaired.

Targeting: The ship's targetting computers have been damaged. There is an automatic −2 modifier to the hit determination task of all weapons fired from that vessel until repaired.

Continuing Damage: This indicates that some sort of continuing damage is underway (electrical damage, fires in atmosphere necessary areas, etc.). Continuous damage is marked on the ship, and they are cumulative. For each continuous damage marker on a ship during the damage control phase, roll once on the hit location chart and apply one damage point to that area.

REPAIRING DAMAGE

Hits can be repaired during the damage control segment. Each available engineer can put his talents to use on one specific task per segment, attempting to repair damage which has been done up to that time.

To repair hull hits. Difficult. Drive engineering.

To repair power plant hits. Routine. Drive engineering.

Referee: For repair of both hull hits and power plant hits apply DMs for exceptional electrical (electrical 5+) or mechanical (mechanical 5+) skill.

To repair computer, targetting, continuing, remote, and sensor hits. Difficult. Electroncs.

Referee: For repair of computer, targetting, continuing, remote, and sensor hits, apply DMs for exceptional (5+) drive engineering and/or mechanical skills.

If repairs would make a difference to some ship condition, that effect takes place immediately. For instance, repairing sufficient hull hits to close a serious breach brings the problem to only that of a breach.

REMOTE OBJECTS

Remote objects are all those unmanned vessels which are controlled from a mother ship. Missiles and sensor drones are typical remote objects. Note that fighters and other manned items are not remote objects, though both can be launched from the mother ship at the very beginning of the mother ship's movement.

Controlling the remote object is the job of the remote operator on the mother ship. While controlled, the remote object can do anything that any other ship can do—it can detect other ships, commit sensors or detonation lasers, fire its weapons, and move.

Remote Detonation Missiles: Remote detonation missiles are quite common in modern space combat. They are a means of delivering a high burst of energy at the target without endangering the mother vessel.

First Fire: Once a detonation missile has committed, the target has a chance to fire at it before it goes off. This is a task for each gunner making the attempt.

To detonate a missile before it fires. Difficult. Gunnery.

If successful, the gunner may then fire his weapons at the detonation missile in an attempt to knock it out of action before it goes off. If failed, the gunner's weapons must still fire at the detonation missile, but will only hit it if it doesn't go off.

If sufficient hull hits are achieved to destroy the missile, then the missile detonates but does no harm. If not, each hit achieved on the missile is counted as a negative modifier to each hit determination roll.

HINTS ON TACTICS

Remote objects are very important. Use them as much as possible to detect and fire upon enemy vessels. Ships are too costly to be risked on the front lines, so let your fighters and missiles do that fighting for you whenever possible. Fly around with your remote objects deployed if possible. This puts plenty of black globes on the map at the start of the battle, confusing your opponent as much as possible.

Also, only use your active sensors when you are either, a) reasonably certain of achieving a valuable detection or, b) ready to detonate or about to be destroyed. Otherwise you become visible to everyone in the battle, and that could be the last thing you do.

Don't use your screens until later in the battle. Otherwise you will be very easy to detect. It's better to remain a black globe in the enemy's eyes for as long as possible.

MODELLING SUGGESTIONS

Traveller: 2300 space combat is designed for use with miniatures, though any system of markers and a hex grid will suffice. However, miniatures will lend a bit of added realism and color to your game, and should not be ruled out.

The models and globes shown in the accompanying photographs were all constructed in about an hour only with materials easily obtained for less than $10. The black globes are ping-pong balls mounted on golf tees and wooden bases, held together with wood modeling glue and spray-painted flat black. The ships are pieces of white golf tee mounted the same way. Missiles and sensor drones are also pieces of golf tee, cut to smaller sizes and mounted differently for distinction.

The hex grid is also easy to come by. Several companies create iron-on hex grids to be put on sheets. They range in size from one to several inches per hex (we recommend two inch hexes). At this size, a reasonable battle can be played out on a typical tabletop. Grids can be obtained from

Rafm Company, Incorporated,
19 Concession Street,
Cambridge, Ontario, Canada, N1R 2G6.

Starship Hit Location

Roll	*Result*
1-4	Hull
5-6	Power Plant
7-8	Crew
9-10	Special

Special Hit Location

Roll	*Result*
1-2	Sensors
3-4	Computer
5-6	Continuing
7-8	Remote Station
9-10	Targeting

Ship Listings

Ship listings give all the information needed to operate a ship and to use it in space combat. The format is given in the following order.

First, there is a descriptive passage, giving general details about the ship, its design, its history, and other items of interest.

Streamlining: Either none, or "as space plane" or "as shuttle." These refer to the launch and reentry characteristics of the ship, in terms of its closest equivalents. See the Interface section for details.

Sensor Package: The sensors built into the ship are listed as described in Starship Use.

Work Stations: All the work stations, both on and off the bridge, are listed by their function.

Additional Crew Recommendations: Other crew positions may be called for; they are listed here.

General Information: *Warp Efficiency:* In light years per day. *Plant:* Megawatts output and type of power plant. *Fuel:* Mass of fuel. Type of fuel follows from plant type given above. *Range:* In light years before discharge of stutter drive must take place. *Mass:* Total mass of ship in tons. *Cargo Capacity:* Given in cubic meters. Cargo mass must be considered in warp efficiency. *Comfort:* A modifier to such tasks as hiring new personnel, taking on passengers, and so forth. *Emergency Power:* If there is an emergency power system, its type and duration in hours is given here. *Total Life Support:* This is the total number of human beings which can be accommodated by the atmospheric and food generating life support. Passengers beyond this number can only be taken on in emergency situations. *Solar Array:* The total area in square meters of any solar array are given, plus the total time required to breakdown the total fuel supply in days.

Ship Status Sheet Information: *Movement:* In hexes, unloaded. *Screens:* The value of screens, if any. *Passive Signature, Active Signature, Passive Sensors,* and *Active Sensors:* All single numbers, the meaning of which is given in Space Combat. *Hull Hit Capacity* and *Power Plant Hit Capacity:* Sequences of numbers also explained under Space Combat. *Crew Complement:* The total number of crew actually operating the ship. This is not necessarily the number of people on board. *Weapons:* Any weapons carried will be named and described here. *Remote Stations:* The number of remote stations on the ship will be given here.

Anjou Class Cargo Vessel

The Anjou class was the mainstay of the Sol-Serurier run during the 2270's and 80's. Designed originally by L'Tage, Ltd of Paris, the Anjou class is the result of two predecessors, the ExC-1 and ExC-2. The original contract called for a design which would be capable of hauling an internal 25,000 cubic meters of material at nominal speeds between the worlds of the Serurier cluster. The Anjou class did just that, and the original order of thirty-four vessels has grown over time into a family of nearly six hundred ships.

The contract for the power plant went to Hyde Dynamics of the United States, as a part of the Shared Technology package of the Jones-Bouvier summit of 2267. The American firm provided a powerful, compact 3 MW plant turbine, easily maintained from only a few access points (vital to the design of the engineering section of the rest of the ship). The stutter warp unit itself was an off-the-shelf French design, typical of all French craft of that era.

The hull is a basic cylinder 100 meters long and approximately 20 meters in diameter. Virtually all of the interior space is formed into cargo holds, though a large portion of the ship is set aside as a spin habitat for the possible 24 personnel on board. The ship does not benefit from streamlining, and is not manufactured with any ship's vehicle or bays for such, but many models still in use today have a shuttle or cutter dock attached.

There were no weapons installed on the Anjou class when they were being produced (the last came off the line approximately 20 years ago). However, the government of New Melbourne is known to employ several as revenue cutters, and have been mounted with shields, several lasers, and an escape pod.

As a cargo ship in the present world of trade and commerce, the Anjou class is definitely outclassed by newer, more sophisticated models. However, due to the large numbers produced and the ready serviceability of the design, Anjou class ships are often purchased and refitted for a variety of purposes. They are a cheap, abundant resource to draw upon when constructing new starships is either physically or economically impossible.

Streamlining: None.

Sensor Package: Navigational radar, Deep system scan.

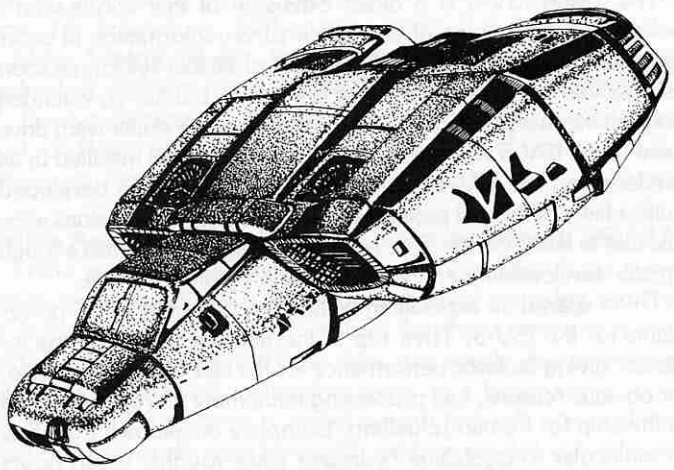
Work Stations:

Off-Bridge: 2 Engineering.

Bridge: 1 Command, 1 Navigation, 1 Communication, 2 Engineering, 1 Computer.

Additional Crew Recommendations: None.

General Information: *Warp Efficiency:* 2.386 (unloaded), *Plant:* 3 MW MHD Turbine, *Fuel:* 300 tons, *Range:* 7.7, *Mass:* 639 tons (unloaded), *Cargo Capacity:* 25066 cubic meters, *Comfort:* +1, *Emergency Power:* Battery, 150 hours, *Total Life Sup-*



port: 25, *Solar Array:* None.

Ship Status Sheet Information: *Movement:* 5 hexes (unloaded), *Screens:* None, *Passive Signature:* 5, *Active Signature:* 7, *Passive Sensors:* 0, *Active Sensors:* 5, *Hull Hit Capacity:* 30/6/15, *Power Plant Hit Capacity:* 10/2, *Crew Complement:* 10, *Weapons:* None, *Remote Stations:* None.

Desarge 8680

Introduced in 2275, the Desarge class have virtually taken over the luxury passenger market along the Sol-Alpha Centauri-Beta Canum Venaticorum route. The original specifications for the 8680 were drawn up by the eccentric founder of General Service Transport, author and architect Julius Bourge. GST originally purchased six of the vessels (the fleet has since been expanded to twenty-three) which run regular passenger service to all colony worlds along the frontier. These ships are the famed Tall Ship Fleet of GST; their flagships are an institution in their own right.

The Tall Ships are designed around a relatively small but powerful fusion reactor, designed by TerraFuse, a subsidiary of Hyde Dynamics (though not at the time of the original contracts). Considering the ambitious design and luxurious accommodations, a fusion plant was seen as the only acceptable option. Anything less would have required an enormous fuel load, which might interrupt regular service without warning.

The actual staterooms of the Tall Ship class are designed to handle the entire complement and passengers totalling 534 persons. The ship's crew, including stewards, runs at about 100, and many of the other suites are taken up by entertainers or company officials, so the ship can hope to take on in the neighborhood of 400 passengers per flight. Each stateroom or suite provides a generous amount of room, classic furnishings (some Tall Ships boast that no two staterooms are furnished alike), and superb cuisine, which alone would draw the upper crust of passenger service.

However, the Tall Ships are much more than simple comfort and luxury.

Each Tall Ship is built with a casino deck, designed and furnished in a unique style for each vessel. One is made up to resemble an American casino of the twentieth century, one like an ancient Egyptian palace, one like Tangiers in the 1920s. Live entertainment of a variety of sorts can be found here or in one of the two night clubs featured on each vessel.

For the passengers there are also two gymnasiums for their enjoyment. Social events are planned and generally adhered to (costume parties, official dinners in honor of distinguished passengers, and dances), plus an in-the-round holographic theatre. Tall Ship passages are highly sought after by those wanting more than just to travel the distance. There are faster ships, but none more entertaining than the Tall Ships.

In the 2280's and 90's, the Tall Ships gained another reputation as being a neutral meeting ground for diplomats and intelligence agents of all nations. This lent itself well to the overall feel of each vessel, as rumored intrigue added to the mystique of each ship. These ships are, in fact, the chosen method of travel for both the corporate and government elite. Many rich patrons spend months, if not years, living on the Tall Ships, moving from one vessel to another on an extended vacation of debauchery and conspicuous consumption.

Desarge is rumored to be constructing what it is calling the Tall Ship II class. The prototype is under construction in orbit around Titan in the Sol system under extremely tight security. However, industry gossip reveals that this ship is at least three times the size of the Tall Ship 8680 class, and that the prototype is within months of completion.

Streamlining: None.

Sensor Package: Navigational Radar, Gravitational Scan.

Work Stations:

Off-Bridge: 26 Engineering, 18 Steward, 11 Medical.

Bridge: 1 Command, 2 Navigational, 2 Communications, 4 Computer, 4 Engineering.

Additional Crew Recommendations: None.

General Information: *Warp Efficiency:* 2.412 (unloaded), *Plant:* 180 MW Fusion, *Fuel:* NA, *Range:* 7.7, *Mass:* 37,103 tons (unloaded), *Cargo Capacity:* 20,000 cubic meters, *Comfort:* +3, *Emergency Power:* Battery, 150 hours. *Total Life Support:* 750, *Solar Array:* None.

Ship Status Sheet Information: *Movement:* 5 hexes (unloaded), *Screens:* None, *Passive Signature:* 9, *Active Signature:* 7, *Passive Sensors:* 0, *Active Sensors:* 5, *Hull Hit Capacity:* 400/80/200, *Power Plant Hit Capacity:* 120/24, *Crew Complement:* 94, *Weapons:* None, *Remote Stations:* None.

York Class Colonization Vessel

The York class was designed and built by the government of Great Britain in the period from 2220-2240 as part of the national colonization effort of that era. Now, most of a century later, the York class has fallen out of the British scheme of things, and they are being sold at bargain prices to countries beginning their own large scale colonization programs, such as Brazil and Argentina.

At the time of construction, fusion power plants were available, but they were enormous and quite costly. Additionally, Great Britain was far from the cutting edge of fusion power plant technology; since this was a national effort, power would have to be derived from more readily available, very British fission reactors. The original vessel, the *York*, was laid down in far orbit around Wellington Orbit Station in 2221; it was completed four years later.

The government plan was to provide the country with a vessel which could be used by the British public and British industry to get to their colony-suitable worlds at Henry's Star and 61 Ursae Majoris. (61 Ursae Majoris has since become an international planet, though there is still a large percentage of the population which can trace its immediate family to a berth on a York class vessel.)

At first sluggish, the British effort of the mid-century was a great success. The York class, with its ability to transport approximately 200 pioneering families with all their possessions at once, was

the king pin of the operation. In fact, Prime Minister Edgewood said of the York class that it was "one of the central pieces of equipment which has led us to our present extraterrestrial society." (Great Britain was the first nation to have half of its loyal population base living away from Terra proper; this event took place in 2298.)

Modern times have done little to change the design characteristics of the York class. Those purchased by Argentina for their colonization program on Montana have been virtually unchanged from the original specifications. There are berths for 900 persons beyond the crew, plus 80 cubic meters for each in personal storage. There are thirteen vessels still in existence; five are owned by the Argentinians, three by the Brazilians, one is on lease to Trilon Corporation, one serves as a power plant and warehouse at Vega Far Station 5, and three are in far orbit around Mars awaiting final orders to be scrapped.

Streamlining: None.

Sensor Package: Gravitational Scan.

Work Stations:

Off-bridge: 54 Engineering, 20 Medical, 20 Steward.

Bridge: 1 Command, 1 Navigational, 1 Communication, 2 Computer, 2 Engineering.

Additional Crew Recommendations: 33 Security.

General Information: *Warp Efficiency:* 2.416 (unloaded; 1.601 with common load), *Plant:* 75 MW Fission, *Fuel:* NA, *Range:* 7.7, *Mass:* 15392 tons (unloaded; 52892 with common load), *Cargo Capacity:* 75,000 cubic meters, *Comfort:* −1, *Emergency Power:* Battery, 150 hours, *Total Life Support:* 1460, *Solar Array:* None.

Ship Status Sheet Information: *Movement:* 5 hexes (unloaded; 3 hexes with common load), *Screens:* None, *Passive Signature:* 9, *Active Signature:* 7, *Passive Sensors:* 0, *Active Sensors:* 5, *Hull Hit Capacity:* 156/32/78, *Power Plant Hit Capacity:* 100/20, *Crew Complement:* 108, *Weapons:* none, *Remote Stations:* None.

Trilon and Associates Initial Survey Vessel, ISV-5

Trilon Industries has always been in the forefront of both ship design and corporate exploration around the Sol-Beta Canum Venaticorum trade route. After their initial survey and colonization of Xi Ursae Majoris (2250), and their ability to make the planet nearly Trilon exclusive, efforts have been redoubled to be the first on the scene of all potentially habitable worlds within their sphere of influence.

The Trilon ISV-5 is a direct extension of that corporation's policies—the obtaining of fast, quick survey information in order to make their contact with a potentially profitable system as soon as possible. The ISV-5 is a rather fast vessel, but has an extended range stutter warp capability. The prototype of the stutter warp drive used in the ISV-5 was originally manufactured and installed in its predecessor, the ISV-4. Unfortunately, the prototype developed quite a few operational problems, and indeed several missions were lost due to faulty design. The newer version, however, has a much greater serviceability and an acceptable breakdown rate.

Trilon spared no expense in getting the best of its MHD power plants for the ISV-5. Their top of the line small turbine was installed, giving fantastic performance for the size of the plant. Also, for obvious reasons, fuel processing equipment has been installed in the ship for frontier refuelling. Complete breakdown from raw to molecular to crystalline hydrogen takes roughly seven hours for the entire 1500 ton fuel supply necessary.

Ship sensors include fairly advanced navigational and system survey equipment. Since the task of the ship is to map out the system, noting points of interest for later inspection by more specialized vessels, further sensor equipment was deemed unnecessary. Also, there are no means for getting the crew members on or off-planet.

A fairly advanced vessel, the ISV-5 has only been in production for ten years. There are hundreds in use in all corners of human space, including a shipment of thirty copies delivered to the American Space Force at Ellis.

Streamlining: None.

Sensor Package: Deep system scan, navigational radar, minimal cartographic sensors.

Work Stations:

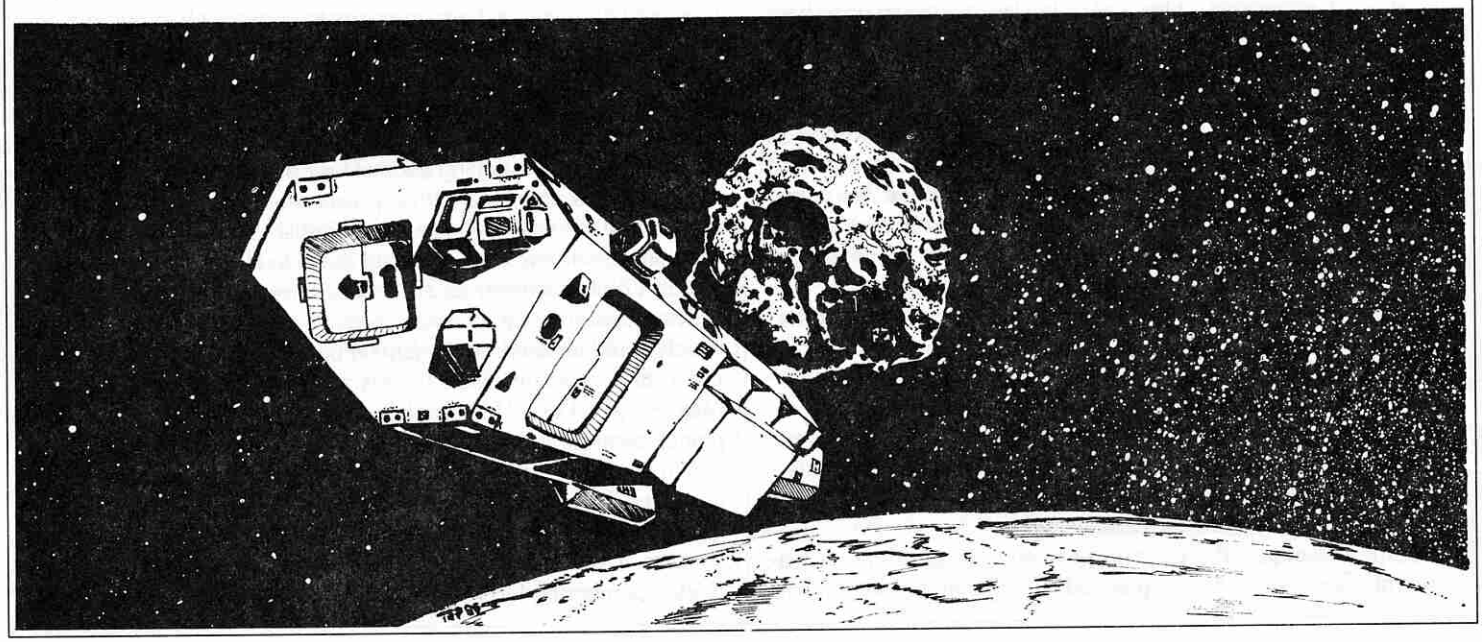
Off-Bridge: 2 Engineering.

Bridge: 1 Command, 1 Navigation, 1 Engineering, and 1 Computer.

Additional Crew Recommendations: None.

Note: The command figure on company vessels is generally an employee with a high security clearance for corporate intelligence. The reduce bridge crew also requires that some crewmembers double as a communications operator.

General Information: *Warp Efficiency:* 2.773 (unloaded), *Plant:* 5 MW MHD Turbine, *Fuel:* 500 tons, *Range:* 8.9, *Mass:*



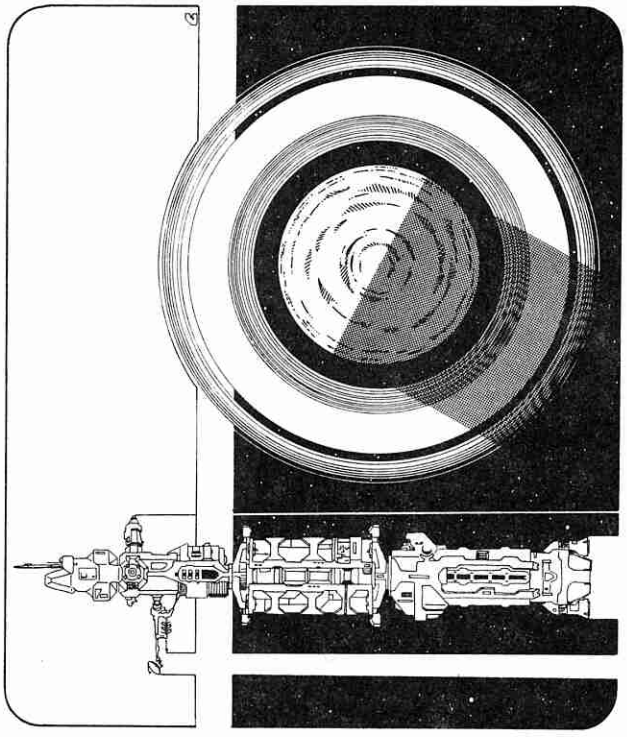
679 tons (unloaded), *Cargo Capacity:* 52.5 cubic meters, *Comfort:* 0, *Emergency Power:* Battery, 100 hours, *Total Life Support:* 16, *Solar Array:* 500 square meters, 3.5 days.

Ship Status Sheet Information: *Movement:* 6 hexes (unloaded), *Screens:* None, *Passive Signature:* 6, *Active Signature:* 7, *Passive Sensors:* 5, *Active Sensors:* 10, *Hull Hit Capacity:* 4/1/2, *Power Plant Hit Capacity:* 10/2, *Crew Complement:* 8, *Weapons:* None. *Remote Stations:* None.

Trilon Assoc C-System Special Services Vessel, SSV-21

Trilon also has need for more sophisticated vessels for such things as contacting new life forms and doing extended surveys of living worlds. Their chief vehicles for these missions is the SSV-21, a highly rated craft for its class, and sought after by anyone whiching to do fringe exploratory work on a larger scale.

The SSV-21 relies on a closed system fuel cell power plant. Fuel cells are usually used for smaller military vessels for their lower



radiated signature, but they also have the adaptive advantage of being easily able to retain their fuel supply after use. By simply deploying its solar array, the SSV-21 can re-break down the water exhaust of their oxygen and hydrogen fuel, without relying on bases or searches. Beyond the frontier, this is very important; it is a rare system that does not have a large quantity of water or ice, but finding it can take weeks off the travel time of a deep exploratory craft. Using a closed system alleviates this need altogether.

The SSV-21 is designed to take along up to twenty trained individuals for deep investigative surveys. They have been provided with quarters, a conference area, and a laboratory featuring such things as work stations for their needs and two quite good linguistics computers to help crack any new languages that come up.

The SSV-21 also features two space planes which can perform interface operations (the ship itself is not streamlined, and relies on these two craft for all interface requirements). These space planes each mass 120 tons and displace 200 cubic meters. They can carry 15 people and up to 11 tons of cargo, provided it fits into 22 cubic meters. They are VTOL craft for rough terrain landing, and are of rather rugged design to withstand the rigors of several months of continuous use out of reach of repair facilities.

Streamlining: None. Interface vehicles attached.

Sensor Package: Navigational radar, deep system scan, advanced cartographic sensors.

Work Stations:

Off-bridge: 3 Engineering, 1 Medical.

Bridge: 1 Command, 1 Navigational, 1 Communications, 1 Computer, 1 Engineering, 1 Sensor.

Additional Crew Recommendations: Up to twenty specialists in contact, investigation and computer work. Two space plane pilots may also be taken on.

General Information: *Warp Efficiency:* 2.076 (unloaded), *Plant:* 4 MW Fuel Cell, *Fuel:* 400 tons, enclosed system, *Range:* 7.7, *Mass:* 1295 tons (unloaded), *Cargo Capacity:* 2360 cubic meters, *Comfort:* 0, *Emergency Power:* Battery, 250 hours, *Total Life Support:* 56, *Solar Array:* 800 square meters, 1.75 days.

Ship Status Sheet Information: *Movement:* 4 hexes (unloaded), *Screens:* None, *Passive Signature:* 3, *Active Signature:* 9, *Passive Sensors:* 0, *Active Sensors:* None, *Hull Hit Capacity:* 10/2/5, *Power Plant Hit Capacity:* 16/4, *Crew Complement:* 24, *Weapons:* None, *Remote Stations:* None.

Fast Missile Carrier

American Space Forces are on the cutting edge of large warship design, and they have developed their Fast Missile Carrier to be the finest military craft in space.

Fusion powered, the Fast Missile Carrier has terrific performance at warp efficiency 4.068. The warp unit itself is a completely new design built by American Space Force engineers within the last five years. Most of the mass of the ship is centered in the fusion plant in order to take advantage of every bit of energy for greater speed. The American Fast Missile Carrier is perhaps the fastest ship in service today, but its overwhelming cost to firepower ratio makes its use prohibitive.

There are five remote stations to control up to ten deployed missiles. The most common missile for the Fast Missile Carrier is the Hyde Definite Kill Device. There are also five remote sensor drones, also of Hyde manufacture, issued as standard equipment.

Armament is variable. Most Fast Missile Carriers mount high output lasers in single mounts. However, as with all military craft, these weapons are often changed in favor of others according to the preference of the captain or gunner. There are a total of ten weapons mounts and gunner work stations on the Fast Missile Carrier.

Stealth characteristics for the Fast Missile Carrier are quite good, according to industry observers. Apparently the Americans are converting to a body style pioneered by the French in the 2280's for their newer craft.

There are between ten and twenty Fast Missile Carriers in service at this time (American Space Force security and disinformation is quite good—the actual number of craft in service is difficult to pinpoint). However, considering its performance and effectiveness, this design should continue for some time in order to fill what was a considerable hole in their table of organization.

Streamlining: None.

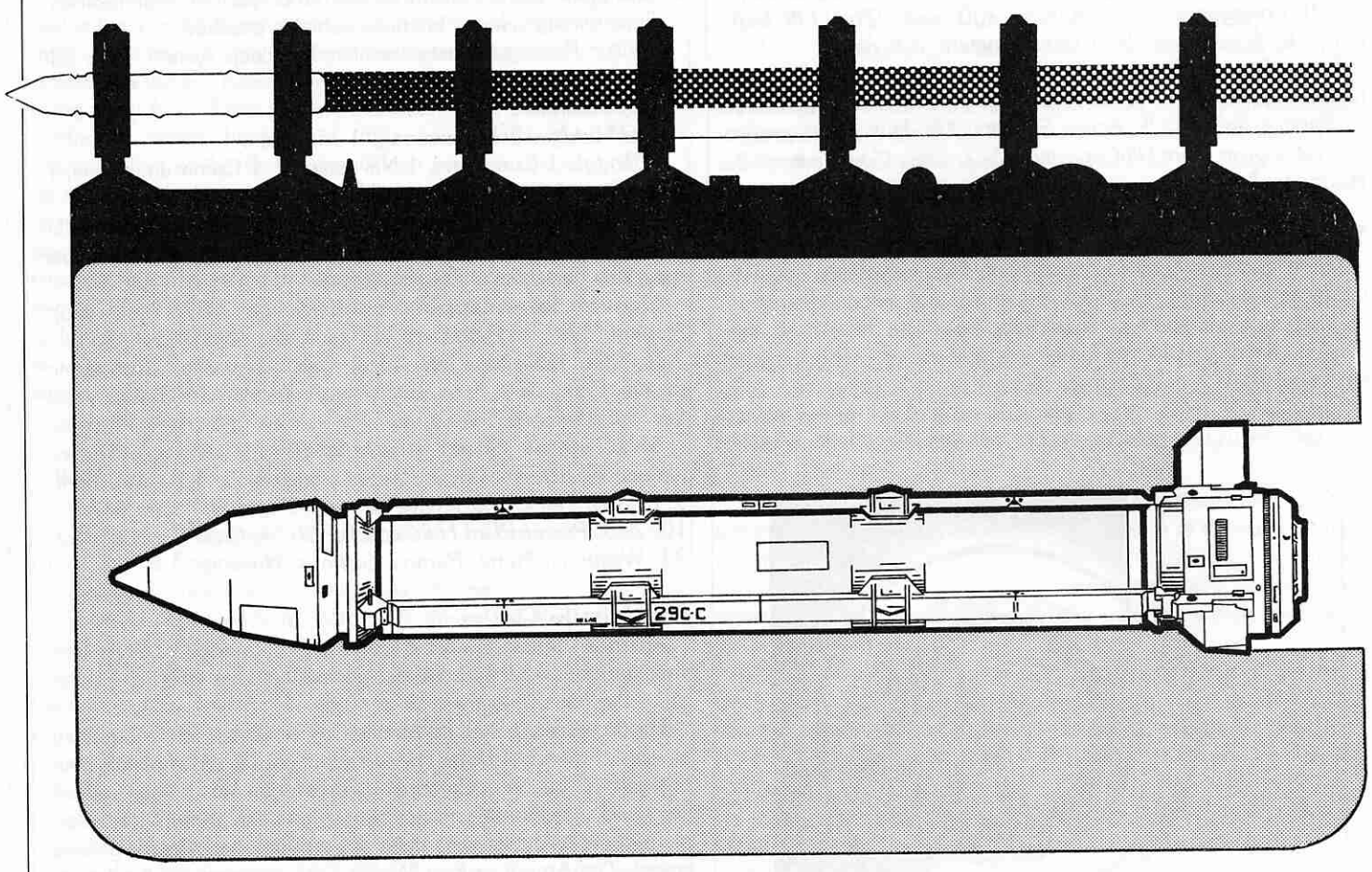
Sensor Package: Deep system scan, standard life sensors.

Work Stations:

Off-bridge: 23 Engineering, 5 Remote, 10 Gunnery, 2 Medical.

Bridge: 1 Command, 2 Navigation, 2 Communications, 3 Computer, 3 Engineering, 1 Sensor.

Additional Crew Recommendations: 20 Security personnel.



General Information: *Warp Efficiency:* 4.068 (unloaded), *Plant:* 150 MW Fusion, *Fuel:* NA, *Range:* 7.7, *Mass:* 6443 tons, *Cargo Capacity:* 600 cubic meters, *Comfort:* 0, *Emergency Power:* Battery, 90 hours, *Total Life Support:* 150, *Solar Array:* 3750 square meters (used only for additional emergency power).

Ship Status Sheet Information: *Movement:* 8 hexes (unloaded), *Screens:* None, *Passive Signature:* 3, *Active Signature:* 1, *Passive Sensors:* 10, *Active Sensors:* 15, *Hull Hit Capacity:* 15/3/8, *Power Plant Hit Capacity:* 100/20, *Crew Complement:* 74, *Weapons:* 10 High Output Hyde Lasers, x2, *Remote Stations:* 5.

Hyde Dynamic One-Mission Definite-Kill Missile.

Displacing only 2½ tons, the latest Hyde Dynamics missile is among the smallest high energy missiles on the market today. A very small power plant and stutter warp unit drives the entire unit at warp efficiency 1.908 for an entire day of defensive preparedness operations. Fueled by simple crystalline hydrogen, the missile can draw upon the fuel reserves of the mother ship indefinately.

The main weapon is a specially developed one-shot, nuclear detonation laser mounted in the nose. The laser has one burst, approximately equivalent to twenty bursts at close range from a typical near defense laser system. This much punch is certain to do massive damage to any but the most heavily armored ships.

An advanced sensor package makes the Hyde Dynamic missile an asset as a remote sensor drone, as well. The package also includes an active sensor device which can be used by the missile prior to detonation, in order to retrieve all the information possible from its vantage point.

Streamlining: None.

Sensor Package: Navigational sensors.

Work Stations: None.

General Information: *Warp Efficiency:* 3.304, *Plant:* .07 MW Fuel Cell, *Fuel:* 1 ton, *Range:* 7.7, *Mass:* 5.620 tons, *Displacement:* 6.77 cubic meters, *Cargo Capacity:* None, *Emergency Power:* None, *Solar Array:* None.

Ship Status Sheet Information: *Movement:* 7 hexes, *Screens:* None, *Passive Signature:* 1, *Active Signature:* 1, *Active Sensors:* 5, *Passive Sensors:* 8, *Hull Hit Capacity:* 4/1/2, *Power Plant Hit Capacity:* 1/1/1, *Weapons:* one Detonation Laser, 10x2.

French Ritage Missile

The French Ritage missile was the standard design of all French military craft up until the introduction of its successor, the Ritage 2, three years ago. Now, in large quantities, Ritage missiles are being sold off to local governments and other powers wishing to purchase cheap arms from the French Union.

The Ritage is not a detonation missile. Instead, the Ritage mounts a single particle weapon for close-in fighting. French doctrine has been against the use of high-cost detonation missiles since the 2270's, but is now returning to that school of thought.

The Ritage is a short performance missile, having only enough fuel on board to keep the fuel cell plant operating for twelve hours. However, due to their small size and ease of construction, each missile is quite cheap, and several could be deployed at any time to form a protective screen of sensors and weapons around a valuable ship in a potentially hostile situation.

The price given for the Ritage missile is that reported by the

French military upon original purchase. However, modern prices for Ritages run approximately 25-50% of this price as more and more examples are dumped onto the market.

Streamlining: None.

Sensor Package: Military sensors only.

General Information: *Warp Efficiency:* 2.861, *Plant:* .03 MW Fuel Cell, *Fuel:* 0.214 tons, *Range:* 7, *Mass:* 3.106 tons. *Displacement:* 3.82 cubic meters.

Ship Status Sheet Information: *Movement:* 6 hexes, *Screens:* None, *Passive Signature:* 1, *Active Signature:* 1, *Passive Sensors:* 5, *Active Sensors:* None, *Hull Hit Capacity:* 1/1/1, *Power Plant Hit Capacity:* 1/1/1, *Crew:* 0, *Weapons:* one French Mid-output Particle Beam Weapon, x1, *Remote Stations:* None.

Aquitaine Corporation Remote Sensor Drone

The remote sensor station has become a particularly useful piece of equipment for hostile space missions against the Kafers. The Aquitaine is a typical example of such a device.

There is no power plant to speak of; the device itself runs off batteries. Once deployed in an advanced position, the drone is left off until such time as it is needed. Due to its small size and lack of power plant, the remote sensor drone is particularly hard to spot, even though no special stealth procedures have been taken.

Without a stutterwarp to drive it, in the context of any space battle the device is completely immobile. Placing remote sensor drones in advance of combat can assist in detecting enemy vessels. However, this advanced placement is not always possible. One tactic used by pilots against Kafer adversaries is to deploy a sensor drone and then keep it between them and any "black globes" they may be aware of. While hiding this way, the ship's missiles and other remote objects can do the dirty, dangerous work and leave the mother vessel in relative safety.

The Aquitaine Corporation remote sensor drone is typical of such drones built by all serious space-faring nations in human space.

Streamlining: None.

Sensor Package: Military sensors only.

General Information: *Fuel:* Batteries, good for 40 hours of continuous operation, *Mass:* 0.67 tons, *Displacement:* 0.44 cubic meters.

Ship Status Sheet Information: *Movement:* 0 hexes, *Screens:* None, *Passive Signature:* 1, *Active Signature:* 1, *Passive Sensors:* 10, *Active Sensors:* 15, *Hull Hit Capacity:* 1/1/1, *Power Plant Hit Capacity:* 1/1/1, *Crew:* 0, *Weapons:* None, *Remote Stations:* None.

Hyde Dynamics Model X-2296 Fighter

In keeping with its commitment to military excellence, Hyde Dynamics completely rethought and redesigned its fighter development program in the early 2290's. Their emphasis was on the removal of old ideas in favor of the quest for and implementation of the latest technology and innovation. (However, this seems to have been a marketing ploy aimed at securing the lucrative Beta Hydri defense contracts so hotly contested at that time. The use of new ideas has not leaked into other areas of Hyde design, such as their traditional missile, sensor, and hull construction divisions.)

The first, and so far only, result of this restructuring has been the X-2296 fighter. It is indeed a unique design, though critics claim that many of the changes were made for changes sake, and not for the overall improvement of performance. However, in its own right, the X-2296 fighter holds its own against any comparably priced fighter craft in human space.

Specifically, the Hyde X-2296 is a one-man fighter craft, with extensive targeting and computer enhancement. The cockpit has been designed with a great deal of voice and/or eyesight directed mechanisms, all keyed to the pilot/helmet/computer link-up.

Hull, power plant, and stutterwarp design were completely reworked, though the end result was less than spectacular. The final warp efficiency of the craft is 1.489—impressive, but hardly worth the years and millions poured into the project. Synthetic hull design copies French boron composites of the 2280's, and does a good job protecting and masking the ship.

In the final analysis, the X-2296 is a good fighter. However, in light of overall speculation and the eventual drop in price of the spacecraft after introduction, it is certain the Hyde has taken it on the chin on this design, and several positions in their fighter design team will be subject to change in the near future.

Streamlining: As space plane.

Sensor Package: Navigational radar, minimal life sensors.

Work Stations:

Bridge: 1 Command.

Additional Crew Recommendations: Impossible.

General Information: *Warp Efficiency:* 2.824, *Plant:* .1 MW Fuel Cell, *Fuel:* 2.85 tons, *Range:* 7.7, *Mass:* 12.85 tons, *Cargo Capacity:* None, *Comfort:* 0, *Emergency Power:* Battery, 20 hours, *Total Life Support:* 1, *Solar Array:* 100 square meters, 0.7 days.

Ship Status Sheet Information: *Movement:* 6 hexes, *Screens:* None, *Passive Signature:* 1 (1), *Active Signature:* 4, *Passive Sensors:* 10, *Active Sensors:* 15, *Hull Hit Capacity:* 4/1/2, *Power Plant Hit Capacity:* 1/1, *Crew complement:* 1, *Weapons:* One High Output Hyde Laser, x2, Targeting +1, *Remote Stations:* None.

INTERFACE VEHICLES

Interface refers to that space which needs to be overcome between the surface of a world and orbits around it. Since this usually requires moving within a significant gravity well and through an atmosphere of some sort, a special type of vehicle is required.

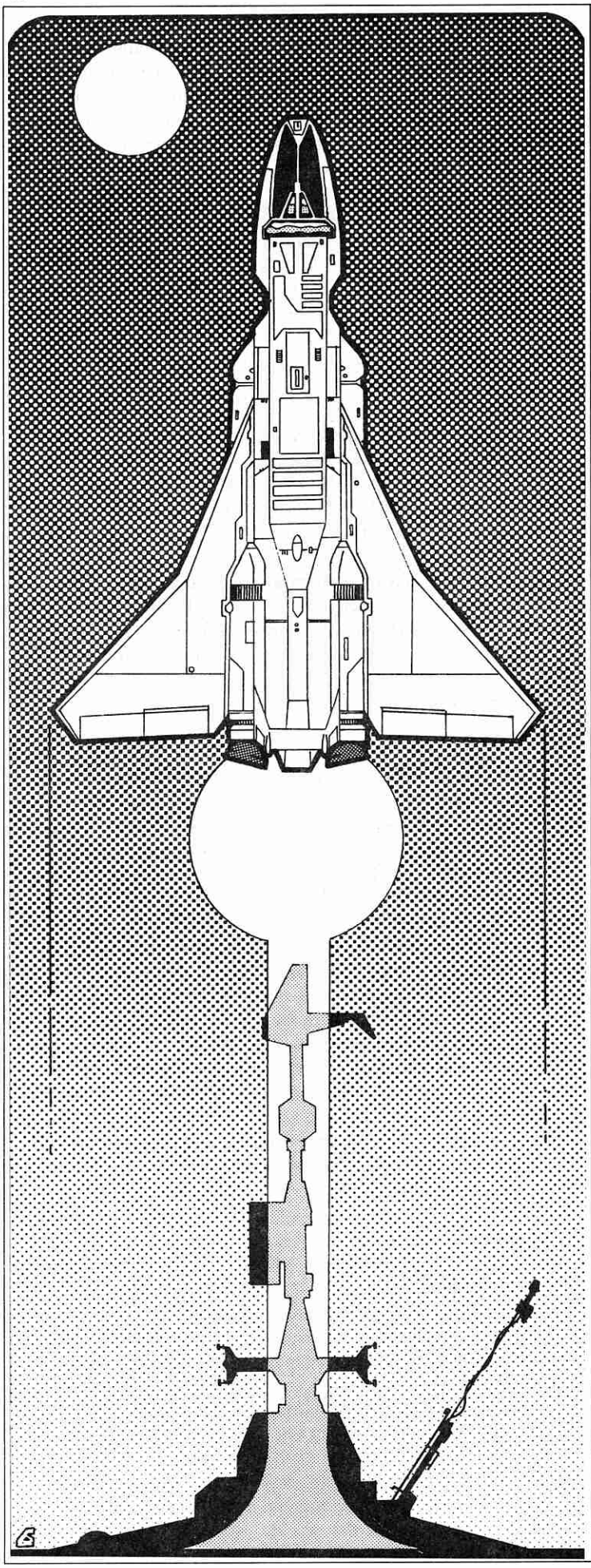
Streamlining: Most interstellar craft are not streamlined, and are therefore not interface capable. These ships rely on interface craft to deliver or load their cargo or passengers, and are indeed completely dependent on interface craft for all physical contact with the surface of a world with atmosphere. If properly powered, however, using reaction thrusters, a non-streamlined ship can land on the surfaces of worlds where there is no atmosphere present.

Streamlined ships are designed with some sort of airfoil, to give the ship lift when within an atmosphere. Streamlined spacecraft take off and land in the same manner as space planes or shuttles. The similarity to one of these two types of interface vehicles is given in the ship's description. When attempting to land or take off from a planetary surface, consult the appropriate section below for travel times and procedures.

Beanstalks

A beanstalk is an extremely advanced technological device which, as its name implies, is a linear stretch of material reaching from the surface of a world straight up to orbit. Elevators on or within the beanstalk allow the transport of cargo in either direction with the simple use of electrical energy, easily created by a number of means.

The chief drawback to a beanstalk is the required materials technology. A substance strong enough to support such a mammoth structure has only recently been developed. Also, the engineering problems of such a device have been extremely difficult to overcome. However, the end result is nearly effortless interface transportation for that world.



There are two beanstalks in existence in human space. The first was created by the French on Beta Canum Venaticorum, where, due to lower gravity and shorter days, the materials technology did not have to be so great. The second is a beanstalk on Earth, pioneered by the French, but financed by nearly every nation on the planet. The Earth beanstalk is, without a doubt, the greatest technological and engineering achievement of mankind to date.

Beanstalk travel times are approximately two hours in either direction (orbit to surface or surface to orbit).

Catapults

On a lower technological level than a beanstalk is the catapult or linear accelerator. Such accelerators are quite popular for moving materials from a surface to orbit (only). There were several catapults erected on Earth prior to the discovery of the stutterwarp, and they are still quite efficient as a method of placing cargos in orbit around a planet.

A catapult is usually designed to throw a specifically designed package, usually streamlined, into orbit. Different loads can be placed into these packages, and the energy put into the acceleration is adjusted to account for the overall mass of the object.

Catapults are used most heavily on agricultural and mineral-rich worlds. They are not open for human or live animal transport, and can only be used to get up. Once a package is taken to orbit and is unloaded, it is usually returned to the surface as a dead glider.

Catapult trip time is almost instantaneous; the entire journey takes only a few minutes.

Dead Gliders

A dead glider is any sort of unpowered re-entry vehicle. Dead gliders are quite often disposable, or at least collapsible for ease of transport back to orbit by means of some other interface vehicle. Dead gliders can only be used to get from orbit to surface, and then only on a world with an atmosphere.

Dead gliders take advantage of the world's gravity to power it toward the surface. The streamlined airfoil design of the glider gives it and its payload lift against the atmosphere, allowing it to simply glide to the surface under no power of its own.

Dead glider flights require virtually no energy input. However, returning the glider to orbit for reuse requires some other interface vehicle, and the cost of such operations reflects this fact. Dead glider landings take approximately three hours from orbit to surface.

Space Planes

Space planes are aerodynamic aircraft capable of flight directly into orbit around a world. They generally operate on a jet/ramjet/scramjet combination engine, propelling the craft from a horizontal or vertical takeoff, through the atmosphere and beyond to orbit.

Space planes are the most luxurious form of interface transport, in either direction, other than a beanstalk. They are usually employed in passenger service, but many larger models have been produced which carry cargo as well. Regular flights from the surface to orbital stations on nearly any human colony world are available, usually with many flights per day.

A space plane flight to orbit takes around two hours. A return trip takes the same amount of time.

Shuttles

Shuttles are still in use on many worlds for their chief means of cargo interface transport. A shuttle relies on a great amount of supplemental drives and engines to powerthe horizontal launch of the main craft. On the return trip, the shuttle uses a dead glider

method, landing at some predetermined port.

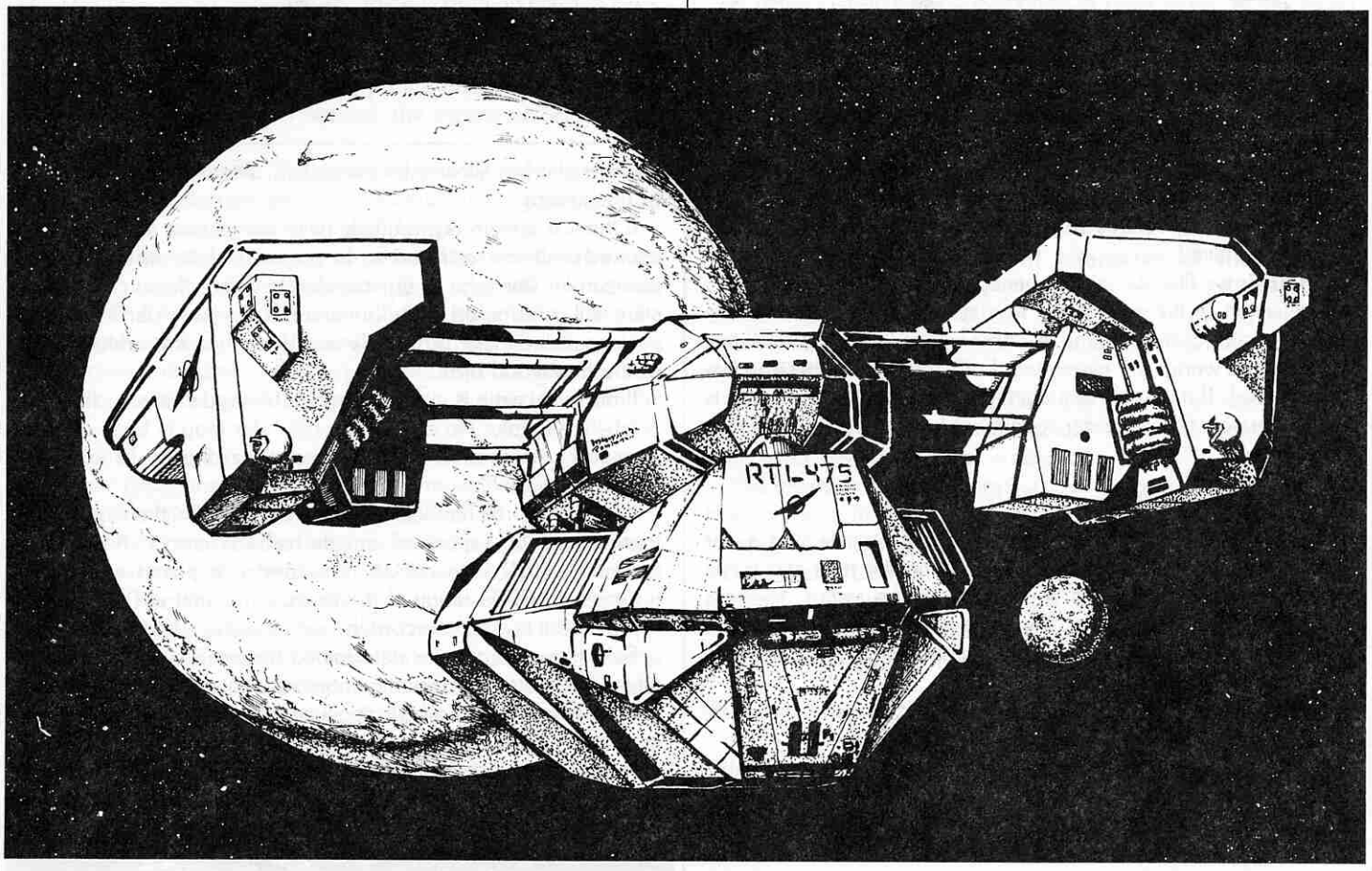
A shuttle has a greater cargo capacity than most space planes, and the surface to orbit flight is rather uncomfortable (high acceleration straight out of the gravity well). Also, the expended engines during a surface to orbit flight take time to refuel and reuse, making shuttle flights somewhat more expensive than an accelerator. However, many items cannot take the hyper-acceleration involved in a slingshot ride without sustaining damage, and a shuttle provides a viable alternative.

Shuttle flights to orbit take on the order of one hour. Return trips are similar to dead gliders, and take three hours to complete.

Availability of Interface Transportation: World descriptions will say what type of interface transport is available. However, it is safe to assume that any human colony world has both a shuttle and space plane service running regularly between the surface and any orbital facilities. Other types of transport, such as accelerator and dead gliders, will probably also be available, but these are not the methods of choice for most purposes.

Outposts will generally rely on streamlined spacecraft for their interface service. At best an outpost will have a limited number of space planes or shuttles in operation, making only specific runs when called for; they do not have regular transport.

Earth and Beta Canum both have beanstalks. Use of these is limited only by availability of time. Often these are booked up weeks in advance for both cargo and passenger service.



World Generation

Adventures that take place in star systems require a basic knowledge of what that star system contains. In preparation for an adventure, the referee must determine the details of the star systems involved.

Overview: The star system generation procedure begins with the selection of the central star in a system and determines the characteristics of the star and its companions, if any. Orbital data for the star's worlds are generated. For each world, physical data is generated. If the world is a colony, social data for the world is also generated. Once the star system has been generated, the data is recorded.

STAR SELECTION

The referee begins star system generation by selecting a star from the near star map and then consulting the near star list to determine what information is available for the star.

The near star list provides spectral type, size, and magnitude. The list also indicates if the star has any companions, which should be noted.

Companion Star Orbits: For each companion star, determine its orbit from the companion star orbit table.

Companion stars can interfere with the orbits of planets. Stable planetary orbits must have a radius of less than one-third or more than 3 times the distance between the star and each of its companions.

ORBIT INFORMATION

Knowing the basic data for the stars in the system, it is possible to compute orbital data for worlds in the system.

The Presence of Planets: Stars of spectral type O, B, and A do not form planets; they are too young for the planets to have coalesced around the stars.

Such stars may have some small planetoids in random orbits. Throw 1D6 for the number of planetoids (called chunks) present. Throw 1D10 plus (1D10 x 0.1) for the orbital radius of each in au.

Orbital Zones: The life zone (the region with life supporting temperatures) is found on the orbital zone table, which shows the optimum life zone orbital distance, as well as the inner and outer limits of the life zone.

World Orbits: Star systems are generated outward from the closest orbit to the star. The radius of each orbit and the world core in the orbit is determined. The values for successive orbital radii are dependent on previous orbits.

Consult the allowed orbits table and determine the maximum number of orbits allowed for the system. Throw once for each star in the system.

If the star system is a multiple (with companion stars) then the allowed orbits are restricted by the presence of the other stars. The companion star orbit radii table details where those companion stars will orbit based on information in the near star list.

Consult the initial orbit table and determine the orbital radius of the first world orbit.

If the initial orbit is close enough to be inside the star, the orbit is labelled empty. No star on the near star map is large enough to encompass an orbit at 0.1 au; a stellar radius of 20 would be necessary.

If the initial orbit has a temperature of 2,000°K then any planet there would be vaporized and the orbit is empty. A star with luminosity 130 is necessary to vaporize a planet at 0.1 au; luminosity 520 is required to vaporize a planet at 0.2 au.

If the orbit is empty, record the radius of the orbit for reference.

Subsequent orbits are determined from the subsequent orbit table. The table produces a number which is multiplied times the radius of the previous orbit to produce a new orbital radius. Record each new orbital radius until all allowed orbits are found.

If, during the course of orbit determination, two consecutive empty orbits are produced, then orbit determination is completed regardless of the number of allowed orbits previously determined.

WORLD DATA

World data must be generated for each world in an orbit around the star.

World Core Type: Determine the core type for the world. Worlds may have rocky or icy cores.

World Size: Consult the world size table to determine the throw required for world diameter and then make that throw and record the world diameter.

World Density: The density of the matter that forms a world is determined from the world density table. Using the table, determine the world density.

World Mass: World mass can be read from the world mass table using world size and density. Mass is given in earth masses.

Surface Gravity: The gravity table shows the gravity in Gs for the world based on diameter and density. Gs can be converted to escape velocity by multiplying by 11.2 (the escape velocity at 1 G is 11.2 kilometers per second; the escape velocity at 2 G is 22.4 kps).

World Atmosphere: The atmosphere component table shows the minimum molecular weight of the atmospheric gases retained by a world of specific diameter and density.

Note the diameter and density of the world and find the minimum molecular weight of atmospheric gases retained. Using that number, find the label for the world's atmospheric type and the specific gas with that molecular weight (or higher). The atmosphere will contain the gases listed on the atmosphere gas list with molecular weights equal to, or greater than, the number from the table.

Molecular weight is an indication of the mass of specific atmospheric gases; the higher the mass, the more likely that a world's gravity will retain the gas in the atmosphere.

Atmospheres are classified by type depending on the minimum molecular weight of the gases retained. The atmosphere type table shows the specific label attached to atmospheres based on minimum molecular weight retained.

Atmospheric Pressure: Atmospheric pressure is proportional to surface gravity. The atmospheric pressure table gives the average atmospheric pressure on a world surface. The atmospheric pressure (condensed) table provides roughly the same information.

World Type: It is possible to designate world type based on atmosphere type, world core type, and orbital zone. Consult the world type table and determine the world type.

If the world type is Garden, then further classification is necessary to determine where the world is in the time sequence of garden planets. Pregarden planets appear early in the life cycle of a star and its system, and soon transform themselves into another phase of the cycle, becoming either glacier planets or garden planets. Very old garden planets become postgarden planets. Throw 1D10 and apply the DM shown for stellar type. Record the result.

The world type determines many of the characteristics of the world. Consult the world characteristics chart to determine what they are and record them.

Water Presence: Consult the water presence table to determine if there is water available on the world.

Average Temperature: Consult the average temperature table to determine the average temperature for the world. This value may vary across the world surface, but the average temperature provides an indication of temperature levels on the world.

Atmospheric Oxygen: Free oxygen is present only on glacier and garden worlds. Consult the atmospheric oxygen table to determine the percentage of oxygen in the atmosphere.

Multiply the oxygen percentage times the atmospheric pressure (previously determined) to find the oxygen pressure in the atmosphere.

SOCIAL DATA

Most worlds are inhospitable to life, and they can be expected to have no more than a few small outposts, scientific stations, or mines. Habitable worlds, however, will have more extensive settlement and development.

Inhospitable Worlds: Consult the inhospitable world table to determine the installations to be expected on the world.

Hospitable Worlds: Hospitable worlds soon become colonies. Earth has produced seventeen colony worlds in star systems beyond Sol.

A colony world can be described in great detail by indicating its age, population, and settlement character.

Determine the age of the colony: This data may be found by consulting published material, by using the colony age table, or by arbitrarily determining the value.

Determine the colony population: First decide if the colony was the object of heavy colonization, median colonization, or light colonization. Using age as a guide, determine the current population level.

Determine the settlement character of the colony: Character is based primarily on age and indicates the degree of capital improvements that have been made in the colony. The referee will have to make a decision as to the settlement character in some cases.

Capital Improvements: Total the points provided by settlement character for the colony and add to that one point for each million (or fraction thereof) colonists.

The referee may then determine what capital improvements have been made to the colony by expending points to purchase items from the interface systems, orbital facilities, and surface facilities tables. Every colony must have an interface system and an orbital terminal. All points must be spent.

The items acquired should be described in the commentary about the colony.

SPECTRAL TYPE

Type	Color
O	Blue
B	Blue
A	Blue
F	White
G	Yellow
K	Orange
M	Red

STELLAR SIZE

Type	Label
Ia	Brightest Supergiants
Ib	Weaker Supergiants
II	Bright Giants
III	Normal Giants
IV	Subgiants
V	Main Sequence Stars
VI	Sub Dwarfs
VII	White Dwarfs

MAGNITUDE TO LUMINOSITY CONVERSION TABLE

Absolute Magnitude	Luminosity
15	.000083
14	.00021
13	.00052
12	.0013
11	.0033
10	.0083
9	.021
8	.052
7	.132
6	.33
5	.83
4	2.09
3	5.25
2	13
1	33
0	83
−1	209
−2	525
−3	1320

Luminosity for fractional magnitudes can be approximated by interpolation.

UNITS

Stellar radius, mass, and luminosity are all expressed in Sols, where 1 = Sol.

Effective temperature is in °K.

RANDOM PLANETOIDS

Star types O, B, and A do not naturally have planets. They may have captured planetoids (chunks) in random orbits.

Throw 1D6 for the number of chunks.

For each chunk, throw 1D10+(1D10×.1) for the orbital radius in au.

STELLAR RADIUS CHART

Spectral Class	Size Ia	Ib	II	III	IV	V	VI
B0	52	30	22	16	13	10	—
B5	75	35	20	10	5.3	4.4	—
A0	135	50	18	6.2	4.5	3.2	—
A5	149	55	14	4.6	2.7	1.8	—
F0	174	59	16	4.7	2.7	1.7	—
F5	204	60	18	5.2	2.6	1.4	1.14
G0	298	84	25	7.1	2.5	1.03	1.02
G5	454	128	37	11	2.8	.91	.55
K0	654	216	54	16	3.3	.90	.40
K5	1010	392	124	42	—	.56	.30
M0	1467	857	237	63	—	.54	.26
M5	3020	2073	712	228	—	.35	.10
M9	3499	2876	931	360	—	.20	.05

STELLAR MASS CHART

Spectral Class	Size Ia	Ib	II	III	IV	V	VI
B0	60	50	30	25	20	18	—
B5	30	25	20	15	10	6.5	—
A0	18	16	14	12	6	3.2	—
A5	15	13	11	9	4	2.1	—
F0	13	12	10	8	2.5	1.7	—
F5	12	10	8.1	5	2	1.3	.8
G0	12	10	8.1	2.5	1.75	1.04	.6
G5	13	12	10	3.2	2	.94	.52
K0	14	13	11	4	2.3	.82	.43
K5	18	16	14	5	—	.57	.33
M0	20	16	14	6.3	—	.48	.15
M5	25	20	16	7.4	—	.33	.10
M9	30	25	18	9.2	—	.21	.05

STELLAR LUMINOSITY CHART

Spectral Class	Size Ia	Ib	II	III	IV	V	VI
B0	560,000	270,000	170,000	107,000	81,000	56,000	—
B5	204,000	46,700	18,600	6,700	2,000	1,400	—
A0	107,000	15,000	2,200	280	156	90	—
A5	81,000	11,700	850	90	37	16	—
F0	61,000	7,400	600	53	19	8.1	—
F5	51,000	5,100	510	43	12	3.5	.97
G0	67,000	6,100	560	50	6.5	1.21	.32
G5	89,000	8,100	740	75	4.9	.67	.186
K0	97,000	11,700	890	95	4.67	.42	.117
K5	107,000	20,400	2,450	320	—	.08	.025
M0	117,000	46,000	4,600	470	—	.04	.011
M5	129,000	89,000	14,900	2,280	—	.007	.002
M9	141,000	117,000	16,200	2,690	—	.001	.00006

STELLAR EFFECTIVE TEMPERATURES CHART

Spectral Class	Size Ia	Ib	II	III	IV	V	VI
B0	22,000	24,000	25,000	26,000	27,000	28,000	—
B5	14,200	14,500	15,100	15,200	15,400	15,500	—
A0	9,000	9,100	9,300	9,500	9,700	9,900	—
A5	8,000	8,100	8,200	8,300	8,400	8,500	—
F0	6,900	7,000	7,100	7,200	7,300	7,400	—
F5	6,100	6,300	6,400	6,500	6,600	6,700	6,800
G0	5,400	5,600	5,700	5,800	5,900	6,000	6,100
G5	4,700	4,850	5,000	5,100	5,200	5,500	5,600
K0	4,000	4,100	4,300	4,500	4,700	4,900	5,000
K5	3,300	3,500	3,650	3,800	—	4,100	4,200
M0	2,800	2,900	3,100	3,400	—	3,500	3,600
M5	2,000	2,200	2,400	2,650	—	2,800	2,900
M9	1,900	2,000	2,100	2,200	—	2,300	2,400

COMPANION STAR ORBIT RADII

Spectroscopic Binary: Orbit is 1D10 times au. Spectroscopic binaries are identified as SB in the *Near Star List*.

Unseen Companion: Orbit is 1D100 au. Unseen companions are identified as UC in the *Near Star List*.

Different Coordinates: Orbit is the square root of

$$(X_1-X_2)^2 + (Y_1-Y_2)^2 + (Z_1-Z_2)^2$$

times 6,000 au.

Use this method for companion stars (in the *Near Star List*) which have different XYZ coordinates. X_1 is the X coordinate of the first star; X_2 is the X coordinate of the second star. By finding the square root of the sum of the differences in X, Y, and Z coordinates, it is possible to determine the distance separating the stars; multiply by 6,000 to convert au to light years.

Others: Orbit is 1D10 au.

Restrictions: Stable orbits must have a radius less than 1/3, or greater than 3 times the distance between companions.

UNTENABLE ORBITS

Planets are not tenable (they cannot exist) if their star produces a temperature of 2000 °K or more at their orbit.

This table shows the minimum stellar luminosity which creates a temperature of 2000 °K at the orbital distance shown.

Untenable Orbit	*Luminosity*
.1 au	130
.2 au	520
.3 au	1170
.4 au	2090
.5 au	3270

ALLOWED ORBITS

Star Type	*Quantity*
O	1D6 (chunks only)
B	1D6 (chunks only)
A	1D6 (chunks only)
F	1D10
G	3D6
K	2D6
M	1D6

When generating orbits, stop after rolling two consecutive empty orbits, regardless of the result on this table. White dwarfs (size VII or 7) have no allowed orbits.

TIDAL LOCKING

Planets of stars with a mass of less than .7 are tidally locked to the star if in the life or inner zones. Tidally locked worlds in the life zone may have small pockets of habitable terrain in the twilight zone between total day and total night.

LIFE ZONES

Luminosity	*Inner Limit*	*Optimum Distance*	*Outer Limit*
.3	.40	.55	.79
.4	.46	.63	.92
.5	.51	.71	1.03
.6	.56	.77	1.12
.7	.61	.84	1.21
.8	.65	.89	1.30
.9	.69	.95	1.38
1.0	.72	1.00	1.45
1.1	.76	1.05	1.52
1.2	.79	1.10	1.59
1.3	.83	1.14	1.65
1.4	.86	1.18	1.72
1.5	.89	1.22	1.76
1.6	.92	1.26	1.83
1.7	.94	1.30	1.89
1.8	.97	1.34	1.95
1.9	1.00	1.39	2.00
2.0	1.02	1.41	2.05
2.1	1.05	1.45	2.10
2.2	1.07	1.48	2.15
2.3	1.10	1.52	2.20
2.4	1.12	1.55	2.25
2.5	1.14	1.58	2.29
2.6	1.17	1.61	2.34
2.7	1.19	1.64	2.38
2.8	1.21	1.67	2.43
2.9	1.23	1.70	2.47
3.0	1.25	1.73	2.51
3.1	1.27	1.76	2.55
3.2	1.30	1.79	2.59
3.3	1.32	1.82	2.63
3.4	1.33	1.84	2.67
3.5	1.35	1.87	2.71
3.6	1.37	1.90	2.75
3.7	1.39	1.92	2.79
3.8	1.41	1.95	2.83
3.9	1.43	1.97	2.86
4.0	1.45	2.00	2.90
4.1	1.47	2.02	2.94
4.2	1.48	2.05	2.97
4.3	1.50	2.07	3.01
4.4	1.52	2.10	3.04
4.5	1.54	2.12	3.08
4.6	1.55	2.14	3.11
4.7	1.57	2.17	3.14
4.8	1.59	2.19	3.18
4.9	1.60	2.21	3.21
5.0	1.62	2.24	3.24
5.1	1.64	2.26	3.26
5.2	1.65	2.28	3.31
5.3	1.67	2.30	3.34
5.4	1.68	2.32	3.37
5.5	1.70	2.35	3.40
5.6	1.71	2.37	3.43
5.7	1.73	2.39	3.46
5.8	1.74	2.41	3.49
5.9	1.76	2.43	3.52
6.0	1.77	2.45	3.55
6.2	1.80	2.49	3.61
6.4	1.83	2.53	3.67

INITIAL ORBIT

1D10	*Orbit Radius*
0	Empty Orbit
1	.1 au
2	.2 au
3	.3 au
4	.4 au
5	.5 au
6	.6 au
7	.7 au
8	.8 au
9	.9 au

If empty orbit, roll again for its radius.

If orbit radius places it inside the star or produces a temperature above 2000 °K, then the orbit is empty.

Luminosity 130 would vaporize a world at .1 au; luminosity 520 would vaporize a world at .2 au.

SUBSEQUENT ORBITS

1D10	*Multiplier*
0	Empty Orbit
1	1.3
2	1.4
3	1.5
4	1.6
5	1.7
6	1.8
7	1.9
8	2.0
9	2.1

Multiply the previous orbit by the multiplier to determine subsequent orbit radius.

If empty orbit, roll again for the radius of its orbit.

OUTER LIFE ZONES

Luminosity	*Inner Limit*	*Optimum Distance*	*Outer Limit*
6.6	1.86	2.57	3.73
6.8	1.89	2.61	3.78
7.0	1.92	2.65	3.84
7.2	1.94	2.68	3.89
7.4	1.97	2.72	3.94
7.6	2.00	2.76	4.00
7.8	2.02	2.79	4.05
8.0	2.05	2.83	4.10
8.2	2.07	2.86	4.15
8.4	2.10	2.90	4.20
8.6	2.12	2.93	4.25
8.8	2.15	2.97	4.30
9.0	2.17	3.00	4.35
9.5	2.23	3.08	4.45
9.9	2.28	3.15	4.56

Life Zone Formula:

$$D = KL^{.5}$$

K is a constant which is different for each distance. At the inner limit, K = 0.72; at optimum distance, K = 1.0; at the outer limit, K = 1.45.

WORLD CORE

1D6	Inner Zone	Life Zone	Outer Zone
1	Rocky	Rocky	Rocky
2	Rocky	Rocky	Rocky
3	Rocky	Rocky	Icy
4	Rocky	Rocky	Icy
5	Rocky	Rocky	Icy
6	Rocky	Rocky	Icy

WORLD DIAMETER

1D6	Rocky Core	Icy Core
1	1D6 × 1,000	1D6 × 1,000
2	1D6 × 1,000	1D6 × 1,000
3	2D6 × 1,000	1D6 × 1,000
4	3D6 × 1,000	2D6 × 1,000
5	4D6 × 1,000	2D6 × 1,000
6	5D6 × 1,000	3D6 × 1,000

This table provides world diameter in kilometers. Circumference at the equator equals 3.14 times this amount.

WORLD DENSITY

1D10	Density of Rocky Core	1D6	Density of Icy Core
0	.4	1	.1
1	.5	2	.2
2	.6	3	.3
3	.7	4	.4
4	.8	5	.5
5	.9	6	.6
6	1.0		
7	1.1		
8	1.2		
9	1.3		

Density is in Earths (Earth = 1).

EQUIVALENT DENSITIES

Material	g/cc	Earths
Water	1.0	.18
Ice	.9	.16
Carbon	2.3	.41
Rock	3.5	.65
Iron	7.9	1.43
Gold	19.3	3.50

Body	g/cc	Earths
Sun	1.0	.18
Mercury (Rock Ball)	5.4	.98
Venus (Hot House)	5.2	.94
Earth (Garden)	5.5	1.00
Luna (Rock Ball)	3.3	.60
Mars (Desert)	3.9	.71
Jupiter (Gas Giant)	1.3	.23
Saturn (Gas Giant)	.7	.13
Uranus (Gas Giant)	1.6	.29
Neptune (Gas Giant)	1.7	.30
Pluto (Ice Ball)	1.0	.18

ATMOSPHERIC TYPES

Minimum Molecular Weight Retained	Atmosphere Type
1+	Massive
5+	Dense
20+	Standard
40+	Thin
80+	Very Thin
120+	Vacuum

ATMOSPHERIC PRESSURE (CONDENSED TABLE)

Surface Gravity (Gs)	Atmospheric Pressure (Atms)
.1	.1
.2	.2
.3	.3
.4	.4
.5	.5
.6	.6
.7	.7
.8	.8
.9	.9
1.0	1.0

Atmospheric pressure is roughly equivalent to Gs. Humans require a minimum pressure of .2 atm.

MOLECULAR WEIGHTS OF COMMON ATMOSPHERIC GASES

Constituent	Molecular Weight
Molecular Hydrogen (H_2)	2.0
Helium (He)	4.0
Methane (CH_4)	16.0
Ammonia (NH_3)	17.0
Water Vapor (H_2O)	18.0
Neon (Ne)	20.2
Molecular Nitrogen (N_2)	28.0
Carbon Monoxide (CO)	28.0
Nitric Oxide (NO)	30.0
Molecular Oxygen (O_2)	32.0
Hydrogen Sulfide (H_2S)	34.1
Argon (Ar)	39.9
Carbon Dioxide (CO_2)	44.0
Nitrous Oxide (N_2O)	44.0
Nitrogen Dioxide (NO_2)	46.0
Ozone (O_3)	48.0
Sulfur Dioxide (SO_2)	64.1
Sulfur Trioxide (SO_3)	80.1
Krypton (Kr)	83.8
Xenon (Xe)	131.3

ATMOSPHERIC COMPOSITION

A world atmosphere will have a gas shown on the molecular weights of common atmospheric gases table if the gas's molecular weight is equal to or greater than the value shown on the atmospheric type table for the world's atmosphere.

WORLDS

There are eleven broad types of worlds possible; they are:

Rock: A plain rock ball with no appreciable atmosphere. Most planets begin with a rocky core; if the total mass is below a certain limit, the planet cannot retain an atmosphere and becomes a plain rock ball. *Example:* Mercury.

Ice Ball: A plain ball of frozen gases. Ice balls occur only in the outer zone of a system. *Example:* Pluto.

Gas Giant: A large planet with an atmosphere primarily of hydrogen and helium. Gas giants occur when a planet accumulates a mass greater than four Earths; thereafter, gas continues to accumulate. *Example:* Jupiter.

Hot House: A planet with a large greenhouse-effect atmosphere. The initial planetary accumulation produces an atmosphere with a large amount of CO_2; the world retained too much heat and cannot generate life. *Example:* Venus.

Glacier: A planet with a heavy overburden of ice. If, for various reasons, the water content of a world becomes locked up in the ice caps, the world albedo increases, and heat from the star is reflected directly back into space; with less heat being retained, the icecaps expand. Ultimately, all water on the world is locked up in icecaps which cover much of the world's surface.

Pre-Garden: Given the right circumstances, a planet in the life zone will have the prerequisites for life. Given sufficient time, life will evolve on the world, shifting the atmosphere from methane and water vapor to nitrogen and oxygen. *Example:* Earth eons ago.

Garden: A world with a hospitable environment, an oxygen atmosphere, and locally evolved life. *Example:* Earth.

Post-Garden: A world which has a history of life, but which has since developed a high greenhouse effect. Post-garden planets are similar to hot houses, but they have a different history. *Example:* Earth eons from now.

Desert: The world has an atmosphere, but has never developed liquid water. *Example:* Mars.

Failed Core: A world which accumulated an atmosphere during the formation of the star system, but which never accumulated enough mass to become a gas giant.

Chunk: A small airless world less than 1,000 kilometers in diameter. *Example:* Ceres.

WORLD MASS

Diameter 1,000 km	Density (Earths) .1	.2	.3	.4	.5	.6	.7	.8	.9	1.0	1.1	1.2	1.3	1.4
1	.0001	.0001	.0001	.0001	.0002	.0002	.0002	.0003	.0003	.0004	.0004	.0004	.0005	.0005
2	.0003	.0007	.001	.001	.002	.002	.002	.003	.003	.003	.004	.004	.004	.005
3	.001	.002	.003	.005	.006	.007	.008	.010	.011	.012	.014	.015	.016	.017
4	.003	.006	.009	.012	.015	.018	.021	.024	.027	.030	.033	.036	.039	.042
5	.005	.011	.017	.023	.029	.035	.041	.047	.053	.059	.065	.071	.077	.083
6	.010	.020	.030	.041	.051	.061	.072	.082	.092	.10	.11	.12	.13	.14
7	.016	.032	.049	.065	.081	.098	.11	.13	.14	.16	.17	.19	.21	.22
8	.024	.048	.073	.097	.12	.14	.17	.19	.21	.24	.26	.29	.31	.34
9	.034	.069	.10	.13	.17	.20	.24	.27	.31	.34	.38	.41	.45	.48
10	.047	.095	.14	.19	.23	.28	.33	.38	.42	.47	.52	.57	.61	.66
11	.063	.12	.19	.25	.31	.38	.44	.50	.57	.63	.69	.76	.82	.88
12	.082	.16	.24	.32	.41	.49	.57	.65	.74	.82	.90	.98	1.07	1.15
13	.10	.20	.31	.41	.52	.62	.73	.83	.94	1.04	1.15	1.25	1.36	1.46
14	.13	.26	.39	.52	.65	.78	.91	1.04	1.17	1.30	1.43	1.57	1.70	1.83
15	.16	.32	.48	.64	.80	.96	1.12	1.28	1.44	1.60	1.77	1.93	2.09	2.25
16	.19	.39	.58	.78	.97	1.17	1.36	1.56	1.75	1.95	2.14	2.34	2.53	2.73
17	.23	.46	.70	.93	1.17	1.40	1.64	1.87	2.10	2.34	2.57	2.81	3.40	3.28
18	.27	.55	.83	1.11	1.39	1.66	1.94	2.22	2.50	2.78	3.05	3.33	3.61	3.89
19	.32	.65	.98	1.30	1.63	1.96	2.28	2.61	2.94	3.27	3.59	3.92	4.25	4.57
20	.38	.76	1.14	1.52	1.90	2.28	2.67	3.05	3.43	3.81	4.19	4.57	4.96	5.34
21	.44	.88	1.32	1.76	2.20	2.65	3.09	3.53	3.97	4.41	4.85	5.30	5.74	6.18
22	.50	1.01	1.52	2.03	2.53	3.04	3.55	4.06	4.57	5.07	5.58	6.09	6.60	7.10
23	.58	1.16	1.74	2.32	2.90	3.48	4.06	4.64	5.22	5.80	6.38	6.96	7.54	8.12
24	.65	1.31	1.97	2.63	3.29	3.95	4.61	5.27	5.93	6.59	7.25	7.91	8.57	9.23
25	.74	1.49	2.23	2.98	3.72	4.47	5.21	5.96	6.70	7.45	8.19	8.94	9.68	10.00
26	.83	1.67	2.51	3.35	4.19	5.02	5.86	6.70	7.54	8.38	9.22	10.05	10.89	11.73
27	.93	1.87	2.81	3.75	4.69	5.63	6.57	7.50	8.44	9.38	10.32	11.26	12.20	13.14
28	1.04	2.09	3.14	4.18	5.23	6.28	7.32	8.37	9.42	10.46	11.51	12.56	13.61	14.65
29	1.16	2.32	3.48	4.65	5.81	6.97	8.14	9.30	10.46	11.63	12.79	13.95	15.12	16.28
30	1.28	2.57	3.86	5.15	6.43	7.72	9.01	10.30	11.58	12.87	14.16	15.45	16.74	18.02

WORLD GRAVITY

Diameter 1,000 km	Density (Earths) .1	.2	.3	.4	.5	.6	.7	.8	.9	1.0	1.1	1.2	1.3	1.4
1	.024	.035	.043	.049	.055	.060	.065	.070	.074	.078	.082	.086	.089	.093
2	.049	.070	.086	.099	.111	.121	.131	.140	.149	.157	.165	.172	.179	.186
3	.074	.105	.129	.149	.167	.182	.197	.211	.224	.236	.247	.258	.269	.279
4	.099	.140	.172	.199	.222	.243	.263	.281	.298	.314	.330	.345	.359	.372
5	.124	.176	.215	.248	.278	.304	.329	.352	.373	.393	.412	.431	.448	.465
6	.149	.211	.258	.298	.334	.365	.395	.422	.448	.472	.495	.517	.538	.558
7	.174	.246	.301	.348	.389	.426	.461	.492	.522	.551	.578	.603	.628	.652
8	.192	.281	.345	.398	.445	.487	.527	.563	.597	.629	.660	.690	.718	.745
9	.224	.316	.388	.448	.501	.548	.592	.633	.672	.708	.743	.776	.807	.838
10	.248	.352	.431	.497	.556	.609	.658	.704	.746	.787	.825	.862	.897	.931
11	.273	.387	.474	.547	.612	.670	.724	.774	.821	.866	.908	.948	.987	1.024
12	.298	.422	.517	.597	.668	.731	.790	.845	.896	.944	.991	1.035	1.077	1.117
13	.323	.457	.560	.647	.723	.792	.856	.915	.971	1.023	1.073	1.121	1.167	1.211
14	.348	.492	.603	.697	.779	.853	.922	.985	1.045	1.102	1.156	1.207	1.256	1.304
15	.373	.528	.646	.746	.835	.914	.988	1.056	1.120	1.181	1.238	1.293	1.346	1.397
16	.398	.563	.690	.796	.890	.975	1.054	1.126	1.195	1.259	1.321	1.380	1.436	1.490
17	.423	.598	.733	.846	.946	1.036	1.119	1.197	1.269	1.338	1.403	1.466	1.526	1.583
18	.448	.633	.776	.896	1.002	1.097	1.185	1.267	1.344	1.417	1.486	1.552	1.615	1.676
19	.473	.669	.819	.946	1.057	1.158	1.251	1.338	1.419	1.496	1.569	1.638	1.705	1.770
20	.497	.704	.862	.995	1.113	1.219	1.317	1.408	1.493	1.574	1.651	1.725	1.795	1.863
21	.522	.739	.905	1.045	1.169	1.280	1.383	1.478	1.568	1.653	1.734	1.811	1.885	1.956
22	.547	.774	.948	1.095	1.224	1.341	1.449	1.549	1.643	1.732	1.816	1.897	1.975	2.049
23	.572	.809	.991	1.145	1.280	1.402	1.515	1.619	1.718	1.811	1.899	1.983	2.064	2.142
24	.597	.845	1.035	1.195	1.336	1.463	1.581	1.690	1.792	1.889	1.982	2.070	2.154	2.235
25	.622	.880	1.078	1.244	1.391	1.524	1.646	1.760	1.867	1.968	2.064	2.156	2.244	2.329
26	.647	.915	1.121	1.294	1.447	1.585	1.712	1.831	1.942	1.047	2.147	2.242	2.334	2.422
27	.672	.950	1.164	1.344	1.503	1.646	1.778	1.901	2.016	2.125	2.229	2.328	2.423	2.515
28	.697	.985	1.207	1.394	1.558	1.707	1.844	1.971	2.091	2.204	2.312	2.415	2.513	2.608
29	.722	1.021	1.250	1.444	1.614	1.768	1.910	2.042	2.166	2.283	2.394	2.501	2.603	2.701
30	.746	1.056	1.293	1.493	1.670	1.829	1.976	2.112	2.240	2.362	2.477	2.587	2.693	2.794

MINIMUM MOLECULAR WEIGHT RETAINED

Diameter 1,000 km	Density (Earths) .1	.2	.3	.4	.5	.6	.7	.8	.9	1.0	1.1	1.2	1.3	1.4
1	299	299	299	299	299	299	299	299	299	299	299	299	299	299
2	299	299	299	299	299	299	299	299	299	287	262	240	220	205
3	299	299	299	299	256	212	181	160	142	127	116	106	97	90
4	299	299	237	178	143	118	101	89	79	71	64	59	54	50
5	299	227	152	114	91	76	65	56	50	45	41	38	35	32
6	299	158	105	79	63	52	45	39	35	31	28	26	24	22
7	232	116	77	58	46	38	33	29	25	23	21	19	17	16
8	178	89	59	44	35	29	25	22	19	17	16	14	13	12
9	141	70	46	35	28	23	20	17	15	14	12	11	10	10
10	114	56	38	28	22	18	16	14	12	11	10	9	8	8
11	94	47	31	23	18	15	13	11	10	9	8	7	7	6
12	79	39	26	19	15	13	11	9	8	7	7	6	6	5
13	67	33	22	16	13	11	9	8	7	6	6	5	5	4
14	58	29	19	14	11	9	8	7	6	5	5	4	4	4
15	50	25	16	12	10	8	7	6	5	5	4	4	3	3
16	44	22	14	11	8	7	6	5	4	4	4	3	3	3
17	39	19	13	9	7	6	5	4	4	3	3	3	3	2
18	35	17	11	8	7	5	5	4	3	3	3	2	2	2
19	31	15	10	7	6	5	4	3	3	3	2	2	2	2
20	28	14	9	7	5	4	4	3	3	2	2	2	2	2
21	25	12	8	6	5	4	3	3	2	2	2	2	1	1
22	23	11	7	5	4	3	3	2	2	2	2	1	1	1
23	21	10	7	5	4	3	3	2	2	2	1	1	1	1
24	19	9	6	4	3	3	2	2	2	1	1	1	1	1
25	18	9	6	4	3	3	2	2	2	1	1	1	1	1
26	16	8	5	4	3	2	2	2	1	1	1	1	1	1
27	15	7	5	3	3	2	2	1	1	1	1	1	1	1
28	14	7	4	3	2	2	2	1	1	1	1	1	1	1
29	13	6	4	3	2	2	1	1	1	1	1	1	1	0
30	12	6	4	3	2	2	1	1	1	1	1	1	0	0

ATMOSPHERIC PRESSURE (Atm x 1,000)

Diameter 1,000 km	Density (Earths) .1	.2	.3	.4	.5	.6	.7	.8	.9	1.0	1.1	1.2	1.3	1.4
1	23	34	41	47	54	59	63	68	72	76	80	83	87	90
2	47	68	83	96	108	118	128	136	145	153	160	168	175	181
3	72	102	125	145	163	178	192	205	218	230	241	252	262	273
4	96	136	168	194	217	238	257	274	291	307	321	336	350	363
5	121	171	210	242	271	297	321	343	364	383	403	421	438	454
6	145	205	252	291	326	356	385	412	437	461	483	505	526	546
7	170	240	294	340	380	417	450	481	510	538	564	589	613	636
8	194	274	336	389	434	476	514	550	583	615	644	673	701	727
9	218	308	378	437	489	535	579	618	656	691	726	758	788	819
10	242	343	421	486	543	595	643	687	729	768	806	842	876	910
11	267	377	463	534	597	655	707	756	802	846	887	926	965	1000
12	291	412	505	583	652	714	772	825	875	923	967	1011	1052	1092
13	315	446	547	632	706	774	836	894	948	1000	1048	1095	1140	1183
14	340	481	589	680	761	834	900	963	1021	1076	1129	1179	1227	1273
15	364	515	631	729	815	893	965	1032	1094	1153	1210	1264	1315	1365
16	389	550	673	778	869	952	1029	1101	1167	1231	1290	1348	1403	1456
17	413	584	716	827	924	1013	1094	1169	1240	1308	1371	1432	1491	1547
18	437	618	758	875	979	1072	1158	1238	1313	1384	1452	1516	1578	1638
19	461	653	800	924	1033	1131	1222	1307	1386	1461	1533	1601	1666	1729
20	486	687	842	972	1088	1191	1287	1376	1459	1538	1613	1685	1754	1820
21	510	722	884	1021	1142	1251	1351	1445	1532	1615	1694	1769	1842	1911
22	534	756	926	1070	1196	1310	1416	1513	1605	1692	1774	1854	1930	2002
23	559	791	968	1118	1251	1370	1480	1582	1678	1769	1856	1938	2017	2093
24	583	825	1011	1167	1305	1430	1544	1651	1751	1846	1936	2022	2105	2184
25	608	859	1053	1216	1359	1489	1609	1719	1824	1923	2017	2107	2192	2275
26	632	894	1095	1265	1414	1549	1673	1788	1897	2000	2097	2191	2280	2367
27	656	928	1137	1313	1468	1609	1738	1857	1970	2077	2178	2275	2368	2458
28	680	963	1179	1362	1523	1668	1801	1926	2043	2154	2259	2359	2456	2548
29	705	997	1221	1410	1577	1728	1866	1995	2116	2231	2340	2444	2543	2640
30	729	1032	1264	1459	1631	1787	1931	2064	2189	2308	2420	2528	2631	2731

WORLD TYPES

Atmosphere Type	*Inner Zone Rocky*	*Life Zone Rocky*	*Outer Zone Rocky*	*Outer Zone Icy*
Vacuum	Rock	Rock	Rock	Ice Ball
Very Thin	Rock	Rock	Rock	Ice Ball
Thin	Desert	Desert	Desert	Failed Core
Standard	Hot House	Desert	Failed Core	Failed Core
Dense	Hot House	Garden	Failed Core	Failed Core
Massive	Gas Giant	Gas Giant	Gas Giant	Gas Giant
Chunk	Chunk	Chunk	Chunk	—

Note: Consult the garden worlds table to determine the nature of the garden world.

WATER

World Type	*Inner Zone*	*Life Zone*	*Outer Zone*
Rock	Rare Ice	Rare Ice	Rare Ice
Ice Ball	—	—	Plentiful
Desert	No	Rare Ice	Rare Ice
Hot House	No	—	—
Failed Core	—	—	Ice Sheets
Gas Giant	Crystals	Crystals	Crystals
Glacier	—	Ice Sheets	—
Garden	—	Oceans	—
Pre-Garden	—	Oceans	—
Post-Garden	—	No	—
Chunk	Rare Ice	Rare Ice	Rare Ice

Surface Coverage: *No:* None. *Rare Ice:* Ice less than 1%. *Plentiful:* 1D6×10%. *Crystals:* 1% ice crystals floating in atmosphere. *Oceans:* (2D6−2)×10%. *Ice Sheets:* (2D6−2)×10%.

AVERAGE TEMPERATURES

World Type	*Inner Zone*	*Life Zone*	*Outer Zone*
Rock	Hot-VHot	Temperate	Cold-VCold
Ice Ball	—	—	Cold-VCold
Desert	Hot-VHot	Cold-Hot	Cold-VCold
Hot House	VHot	Hot-VHot	—
Failed Core	—	—	Cold-VCold
Gas Giant	—	—	—
Pre-Garden	—	Temperate	—
Glacier	—	Cold	—
Garden	—	Temperate	—
Post-Garden	—	Hot	—
Chunk	Hot-VHot	Cold-Hot	Cold-VCold

Ranges (in °K): *VHot (Very Hot):* 60° or more. *Hot:* 30° to 60°. *Temperate:* 0° to 30°. *Cold:* −30° to 0°. *VCold (Very Cold):* −30° or less.

SATELLITES

Use the following procedure for the generation of satellites of planets.

1. **Satellite Presence:** For each planet (except gas giants), the number of satellites is 1D6−3. For each gas giant, the number of satellites is 2D6. A result of 0 or less indicates no satellites.

2. **Satellite Core:** Throw on the world core table to determine if the satellite core is icy or rocky.

3. **Satellite Size:** Throw 1D10−4 for satellite size. If the satellite diameter is greater than the parent world diameter, halve it (more than once, if necessary) until the satellite diameter is less than the world diameter. If satellite diameter is 0, it is a chunk (even if icy core) with diameter of 1D10 times 100 kilometers. If diameter is less than 0 (and satellite orbit is close), then it is a ring.

GARDEN WORLDS

1D10	*World Type*
0	Pre-Garden
1	Glacier
2	Glacier
3	Glacier
4	Garden
5	Garden
6	Garden
7	Garden
8	Post-Garden
9	Post-Garden
10	Post-Garden

DMs: Star type F, −1; G, 0; K, +1; M, +3.

OXYGEN PRESSURE

Multiply % oxygen by atmospheric pressure for oxygen pressure in atms.

Human Acceptable Oxygen Levels: 0.40 atm maximum; 0.05 atm minimum. Beyond these limits, humans require supplements or protective devices.

ATMOSPHERIC OXYGEN

% Water	*% Oxygen*
0	5
10	10
20	12
30	14
40	16
50	18
60	19
70	20
80	22
90	24
100	26

Life in oceans produces oxygen. Use this table to determine the oxygen level present in the atmosphere of garden and glacier worlds (other world types do not have free oxygen in their atmospheres).

Ice Coverage: Treat the surface coverage of ice as 1/3 its actual percentage when using this table. Round down to match a value on the table.

GRAVITY TO ESCAPE VELOCITY CONVERSION

Multiply gravity in G's by 11.2 to determine escape velocity in kilometers per second.

SATELLITE ORBITS

1D10	*Orbit Type*	*Close*	*Far*	*Extreme*
0	Close	1	15	70
1	Close	2	20	80
2	Close	3	25	90
3	Far	4	30	100
4	Far	5	35	110
5	Far	6	40	120
6	Extreme	7	45	130
7	Extreme	8	50	140
8	Extreme	9	55	150
9	Extreme	10	60	160

Rings are always in close orbit.

4. **Satellite Orbits:** Place satellites into orbits using the satellite orbits table. Throw 1D10 for the orbit type, and then throw on the correct orbit type column. Orbit radii are given in planetary diameters of the parent planet (thus, an orbital result of 30 for the satellite of a world of 12,000 kilometers diameter produces an orbital radius of 360,000 kilometers). More than one satellite may occupy the same orbital radius.

5. **Satellite Density:** Throw on the density table.

Additional Satellite Information. Using the above information, it is possible to determine more details about satellites using the world generation procedures. These details include: mass, surface gravity, escape velocity, atmosphere type, world type, water presence, average temperature, and oxygen levels.

STAR SYSTEM CHECK LIST

1. Select Star from *Near Star Map.*
A. Determine data from *Near Star List.*
1) Spectral Type and Size.
2) Magnitude.
3) XYZ Coordinates.
B. Determine data from charts.
1) Radius (Stellar Radius Chart).
2) Mass (Stellar Mass Chart).
3) Luminosity (Stellar Luminosity Chart).
a. Alternative: Convert Magnitude to Luminosity.
4) Effective Temperature (Stellar Effective Temperature Chart).
2. Orbital Information.
A. Locate Companion Star Orbits (Stellar Companion Radii Table).
B. Orbit Restrictions.
1) Companion Restrictions (Companion Restrictions Note).
2) Untenable Orbits (Untenable Orbit Table).
3) Orbital Zones (Orbital Zone Table).
C. Existing Orbits.
1) Allowed Orbits (Allowed Orbits Table).
2) Innermost Orbit (Initial Orbit Table).
3) Subsequent Orbits (Subsequent Orbits Table).
3. World Data.
A. Basic Data.
1) World Core Type (World Core Table).
2) World Size (World Size Table).
3) World Density (World Density Table).
B. Computed Data.
1) Mass (World Mass Table).
2) Surface Gravity (World Gravity Table).
3) Escape Velocity (Gravity to Escape Velocity Conversion Table).
C. Atmosphere Data.
1) Minimum Retained Molecular Weight (Retained Molecular Weight Table).
2) Atmospheric Pressure (Atmospheric Pressure Table and Atmospheric Pressure—Condensed—Table).
D. World Type Data.
1) World Type (World Type Table and Garden World Table).
2) Water Presence (Water Table).
3) Average Temperature (Average Temperature Table).
4) Atmospheric Oxygen Levels (Atmospheric Oxygen Table).
E. Social Data.
1) Colony Age (Colony Age Table).
2) Colony Population (Colony Population Table).
3) Settlement Character (Settlement Character Table).
4) Colony Facilities.
a. Points Available.
b. Interface Systems.
c. Orbital Facilities.
d. Surface Facilities.

COLONY POPULATION

Age	*Colonization Effort (in thousands)*		
(Years)	*Heavy*	*Light*	*Median*
0	100	10	50
10	400	44	194
20	900	96	407
30	1,700	172	723
40	2,500	285	1,119
50	3,700	452	1,882
60	5,500	700	2,905
70	8,000	1,066	4,421
80	12,000	1,600	6,664
90	18,000	2,411	9,985
100	26,000	3,500	14,900

Heavy Colonization: Assumes 100,000 colonists, 25,000 immigration for 30 years, and 4% growth rate.

Light Colonization: Assumes 10,000 initial, 2,500 immigration constant to date, and 4% growth rate.

Median Colonization: Assumes 50,000 colonists, 10,000 immigration constant to date, and 4% growth rate for first 50 years, 2% thereafter.

COLONY AGE

1D6	*Age Determiner*
1	10+3D10
2	20+4D10
3	30+4D10
4	40+4D10
5	50+4D10
6	60+4D10

SETTLEMENT CHARACTER

Type	*Typical Age*	*Points*
Initial	1- 20	10
Frontier	20- 40	15
Developing	40- 60	20
Expanding	60-100	30
Mature	80-140	40
Declining	60+	30

Points available for improvements to a colony are derived from this table, plus 1 point per 1,000,000 population.

POSSIBLE LOCAL BASES

Military
Scientific
Foundation
Naval
Outpost

Representatives of all five types will be present; a base of each of these types is present on 8+ (1D10).

INTERFACE SYSTEMS

Description	*Point Cost*
Orbital Catapult	5
Scram Aircraft	3
Rocket Planes	2
Rockets	1

ORBITAL FACILITIES

Description	*Point Cost*
Solar Power Satellite	10
Orbital Factory	3
Defense Installation	1
Terminal (one required)	2

SURFACE FACILITIES

Description	*Point Cost*
Fusion Power Plant	4
Power Transmission Net (per hex)	1
Heavy Industry	5
Rail Net (per hex)	1
Air Film Net (per hex)	2
Maglev Net (per hex)	3
Hydrogen Road Net (per hex)	1
University	4
Mining (per hex)	1
Farming (per hex)	1

DETAILS

There can be more than one colony on a world (but only one per nationality). Each colony develops separately, but colonies may elect to share some facilities.

Typical colonies develop territory in contiguous hexes; all developed hexes must be connected by a transport net of some type.

INHOSPITABLE WORLD INSTALLATIONS

World	*Very Hot*	*Hot*	*Temperate*	*Cold*	*Very Cold*
Rock	Mine 2	Mine 1	Mine 3	Mine 2	Mine 1
Ice Ball	—	—	—	Mine 1	Mine 0
Desert	Mine 1	Mine 1	Mine 2	Mine 1	Mine 0
Hot House	Research 0	Research 1	—	—	—
Failed Core	—	—	—	Research 1	Research 0
Gas Giant	—	—	—	—	—
Pre-Garden	—	—	Mine 2	—	—
Garden	—	—	Research	—	—
Glacier	—	—	Mine 2	—	—
Post-Garden	—	Research 1	—	—	—
Chunk	Mine 1	Mine 1	Mine 1	Mine 1	Mine 1

Installations are either mines (commercial or for profit) or research bases (academic or not-for-profit).

Throw the number after the type or less to determine if the installation is present on the world.

Non-Player Characters

Non-player characters are the characters the referee gets to play, whether in cooperation with, or in opposition to, the adventurers.

MOTIVATION

Because the referee plays NPCs, an understanding of many different motivations is important.

In many cases the motivations of NPCs are either obvious or unimportant. General background characters, such as merchants or enemy soldiers, do not require a precise definition of motivation. Motivation is only necessary for influential or important NPCs.

Procedure: To determine NPC motivation, draw two cards from a standard deck of playing cards. The highest value card is the NPC's prime motivation, the other is his secondary motivation. The particular motive is determined by the suit of the card. Card values may be low (2, 3, or 4), middle (5, 6, or 7), or high (8, 9, or 10). Aces and face cards have their own special meaning.

Clubs (Violence)

Low means the NPC is not frightened or intimidated by violence or its threat. Middle means he is aggressive and accepts violence as a means of solving problems. High means he loves a good fight. Even a high rating does not, however, indicate cruelty or brutality. **Jack:** He is subject to sudden, violent, and uncontrollable rages. **Queen:** He is stubborn and pig-headed, nearly impossible to persuade once he has made up his mind. **King:** He is a sadistic brute who enjoys inflicting pain on others. **Ace:** The NPC is a natural military leader with an instinctive grasp of tactics and a good eye for terrain. The referee should assume that he can anticipate many situations and make allowances for them.

Diamonds (Wealth)

Low means he is cost-conscious and interested in making money. Middle means that making money is always his first consideration, and he will always haggle over prices and wages. High means he is easy to bribe, and might betray his friends if the price is right. **Jack:** He is a total coward and will run from danger at every opportunity. **Queen:** The NPC is driven by lust for the opposite sex, either for a particular person or just in general. **King:** He is obsessed with money, believes everything has a price, and will do anything if the price is right. **Ace:** He is generous to a fault and gladly gives whatever he has to those in need.

Hearts (Fellowship)

Low means he is amiable and cooperative. Middle means he has a strong sense of loyalty to his group. High means he has a strong commitment to fairness, and reacts with anger to injustice and brutality. **Jack:** The NPC is very wise, shows good judgement, and offers sound advice. **Queen:** The NPC loves a person (friend, spouse, parent, or child) so completely that he would willingly sacrifice himself. **King:** He is scrupulously honest and his word of honor is his absolute bond. He has contempt for liars and anyone who breaks his word. **Ace:** He sees justice as the greatest virtue and the only important consideration in deciding on a course of action. He hates cheaters and will always assist any attempt to right an injustice.

Spades (Power)

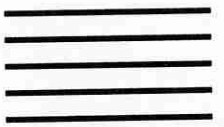
Low level indicates a braggart who wishes to impress everyone with his importance. Middle level indicates a willingness to assume responsibility and a desire to achieve a position of importance. High level means he is ambitious and manipulates the people around him for his own end. **Jack:** He is pompous and arrogant and clearly considers himself superior to others. **Queen:** He will let nothing stand in the way of achieving any goal. He can appear to be considerate, generous, loyal, or anything else which serves his purpose, but beneath the exterior, he ruthlessly uses others for his own gain. **King:** A liar, and probably a traitor as well. **Ace:** A charismatic natural leader to whom others are naturally drawn and are extremely loyal.

Jokers (Sanity)

Jokers affect the NPCs sanity. **Red:** The NPC is a harmless and entertaining eccentric. **Black:** The NPC may appear to be completely normal or very eccentric, but is genuinely and hopelessly insane. The direction his insanity leads him in is directed by his other motivation card.

PERSUASION

Most disputes with NPCs are resolved by means other than force. When players attempt to persuade an NPC to a particular view it is a task, using the player character's eloquence and taking one minute. The actual conversation is role-played between the player and referee, and the referee will determine the difficulty level of the task based on the quality of the arguments used by the player. If, for example, the NPC is a coward, threats of violence will make persuasion fairly easy. If he is unafraid of violence and also has a strong sense of justice, such attempts at intimidation will make the task nearly impossible.



World Mapping

Adventures on worlds very often involve travelling from one point to another. Travelling is an important part of an adventure, providing an opportunity for the adventurers to learn more about the world they are on, and about the goals that they seek.

Overview: Worlds are mapped using a geodesic hex map which is successively divided into triangles, regions, and terrain hexes.

The geodesic map is always divided into twenty triangles numbered 1 to 20. The length of each triangle side is measured in regions; the number of regions is determined by the diameter of the world.

Regions (also called big hexes) are always 1,000 km across. They provide a rough view of terrain on a world, indicating terrain type (flatland, upland, mountain, and ocean). Regions can be further divided into terrain hexes.

Terrain hexes are 100 km across, and provide a more detailed view of the terrain present.

MAPPING

Mapping is an imaginative process. The referee, using known data about a world, must establish what types of terrain are present on a world, and where that terrain is located. Mapping can be performed in any order, depending on the requirements of the situation or the adventure; the following is a suggested, logical order.

1. Complete the geodesic map. Using the blank geodesic map, draw in rough continental outlines and sea areas. Fill in mountains, hills, and rough terrain areas. Locate cities, settlements, and connecting transportation routes.

The completed geodesic map is a reference for players and the referee, allowing them to know information that is reasonably available through computer services or orbital surveillance.

2. Complete the map triangles. Using the geodesic map triangle size chart, determine the length of the side of a triangle. Count off that number of hexes along side A and side B, and then draw a line connecting those two hexes. Note the number of the geodesic map triangle and compare it to the completed geodesic map.

Now it is possible to map the specific map triangle in detail at the 1,000 km per hex scale. At this scale, the only important terrain features are hills, mountains, oceans and seas, major rivers, settlements, and transportation routes. They should be noted to allow reasonable evaluation of the quality and restrictions terrain may provide.

3. Complete the region map for those triangle hexes which have further interest. Important areas on the world surface can be mapped at the 100 km per hex scale to show the location of specific terrain types, settlements, and resources. Adventurers travelling on the world surface will probably need to journey through well-mapped region hexes in order to determine time elapsed and events occuring along the way.

TERRAIN

There are many types of terrain which can be encountered on the worlds of the universe. The following list is certainly not all inclusive, but it serves two purposes: it shows typical terrain types that are often encountered, and it shows what information is important in creating other terrain types.

Contour Types

Contour terrain types deal with the relative elevation of the terrain, and range from flat to mountain.

Flat terrain has little difference in elevation, allowing an individual to see to the horizon (assuming no vegetation or atmospheric obstructions).

Hilly terrain shows some minor changes in elevation, primarily created by small streams and drainage. Slopes in hilly terrain are generally smooth and easily traversed.

Broken terrain is badly eroded or heavily interrupted by ravines, cliffs, or geological outcrops that make straight line surface travel difficult.

Mountain terrain is the highest elevated of territory, marked by sparse vegetation and rocky outcrops. It is nearly impassible to surface transportation.

Vegetation Types

Prairie is open grassland characterized by many area-type producers.

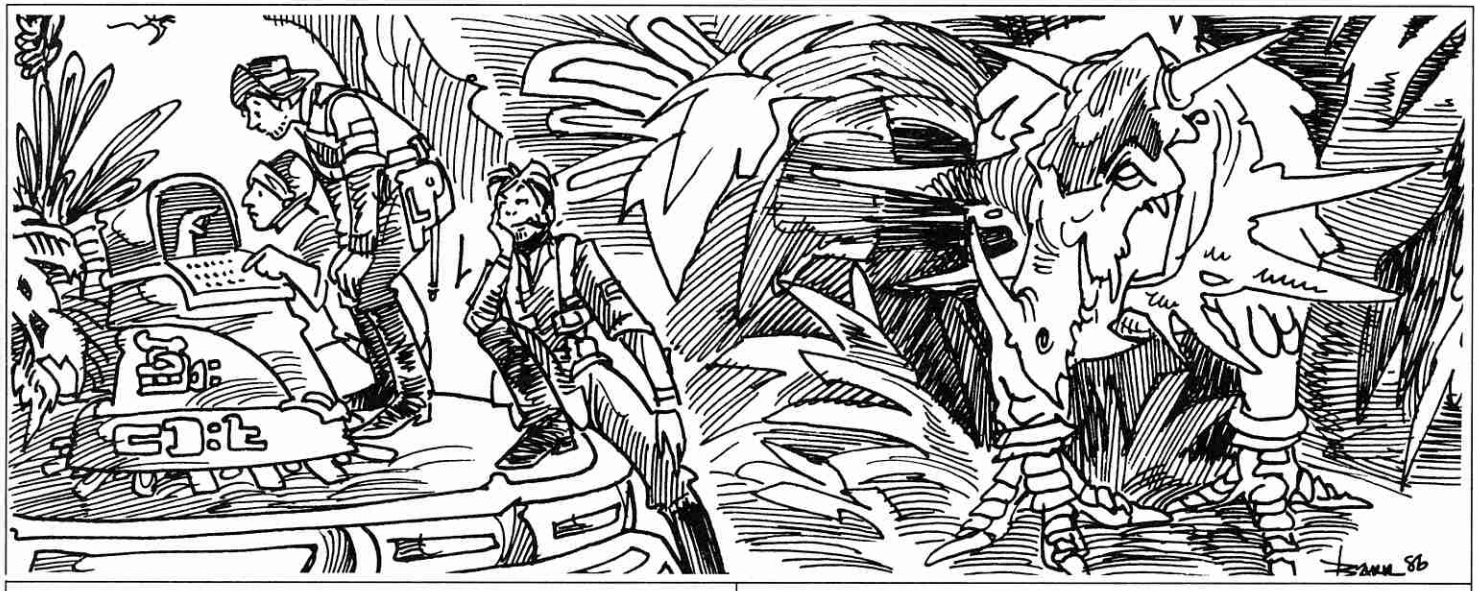
Savannah is open grassland with many area-type producers and a few scattered point-type producers.

Woods are characterized by an even mix of area-type producers and point-type producers.

Forest is characterized by a predominance of point-type producers.

Swamp is low-lying wetland characterized by an even mix of area-type producers and point-type producers (marsh has a predominance of area-type producers).

Desert experiences little rainfall; it has little indigenous life.



Geological Types

Volcanos are eruption points where interior magma on geologically active worlds reaches through the crust and to the surface. Inactive volcanos are similar to mountains; active volcanos are sources of molten rock and ash clouds.

Craters are impact scars from meteor strikes. Erosion removes craters from the surface over thousands of years, but craters remain undisturbed on vacuum worlds. Craters may be water-filled lakes. Many craters are sources of heavy metals.

Maritime Types

Ocean is a major body of water on a world surface. Oceans, because of their age and because they receive river drainage, have large quantities of dissolved minerals (salt); the fact that they are salt water distinguishes them from fresh water lakes.

Coast is the demarcation line between dry land and ocean.

Archipelago is a series or chain of islands in the ocean. Archipelagos are created by the tips of mountains on the sea floor reaching above the ocean surface, or by minor variations in land elevation poking above a shallow sea floor.

Continental Shelf is the edge of the continental plate which is submerged below the surface of the ocean. Continental shelves occur when the ocean level is high enough to encroach on the land; it is possible that some worlds will not have continental shelves.

River is a drainage path for water which naturally makes its way to lakes, seas, or oceans.

Lakes are accumulations of water in low areas of the land, usually fed by drainage from surrounding terrain and serving as the source of larger rivers draining to the sea.

Special Types

Icecap is an accumulation of frozen water at one or both of the poles of a planet. An icecap may be hundreds of meters thick and may be growing or receding, depending on the local climate.

Glacier is an accumulation of frozen water in a mountainous region under circumstances where the ice does not fully melt each year.

Improvements

City is a large settlement which acts as a center of government, industry, and marketing. Cities are accumulations of population which then serve as the work force for heavy industry and government.

Town is a middle-sized settlement providing markets for major types of goods and supporting skilled trades, medicine, and repair services.

Village is a small settlement providing basic services to its immediate area. Villages are primarily residential.

Croplands are cultivated fields producing agricultural products. They are usually surrounded by a roadgrid (to allow access). Surface travel through croplands (not on the roadgrid) is considered inappropriate.

Transportation Routes

Railroad is a heavy freight transportation route designed to carry high tonnages, bulk cargos, and passengers great distances at relatively cheap prices. Railroads are easily constructed with cheap, low technology easily available to developing colonies. Advanced railroads may be monorails. Railroads stop for passengers and cargo at most settlements along their route.

Airfilm Line is a very smooth roadbed used exclusively for airfilm transports. Airfilm systems require higher technology than railroads, but they are more efficient and can carry greater tonnages. Airfilm transports stop for passengers and cargo at most settlements along their route.

Maglev Line is an advanced rail system which depends on magnetic levitation above a steel roadbed. Maglev lines are common surface transport systems in vacuum. Maglev lines stop for passengers and cargo at most settlements along their route.

Highway allows transportation between major points such as cities, bases, or markets. Highways are built in a variety of qualities which then affect the speed possible on them. Highways may be designed for wheeled or hover vehicles, or both; the design used affects the speed vehicles may achieve on the highway. Highways can be expected to have fuel stations (alcohol, petroleum, or hydrogen, depending on the world) at intervals of 200 km or less.

Roadgrid is a dense collection of roads of varying quality. A roadgrid allows access to nearly all points within the area. Roadgrids are established in farming areas to allow access to croplands, and in settled areas to allow access to homes and businesses. Roadgrids have fuel stations at intervals of 50 km or less.

Airfield is a designated point for aircraft landing and takeoff. Such improved airfields are essential for sophisticated aircraft capable of reaching orbit (most other aircraft are VTOL or STOL and can use ordinary roads, open fields, or less elaborate facilities).

Animal Encounters

All native life on a world can be described in terms of its place in the food chain. A very simplified food chain is used in the game to make generation of animal encounters easier. The diagram below presents the food chain in terms of a pyramid. The bottom tier consists of plant life (flora). The next tier is made up of herbivores and omnivores which subsist largely on plants. The three uppermost tiers are carnivores which subsist on the animals below them in the food chain.

The food chain pyramid is actually several pyramids of varying size. The smallest pyramid (to the left of the chart) is used for barren regions, and consists of only two major types of plants and one animal. The next pyramid, representing sparse regions, adds one additional plant type and two animal types. The third pyramid, representing abundant life regions, adds another plant and three animals. The complete pyramid represents regions teeming with life and uses all five plants and all ten animals.

TYPES OF PLANTS

There are only two broad categories of plants considered: point producers and area producers. Point producers concentrate considerable biological energy in a single robust organism. A good Terran example of a point producer is a tree. Area producers tend to be widespread, such as Terran grasses. The type of producer has no material effect on the game, but will assist referees in determining the type and density of vegetation in a region and in describing it to players.

ENCOUNTERING ANIMALS

When characters are travelling in the wild, the referee will roll 1D10 once every four hours of game time. The result of the roll indicates whether the party has encountered an animal and, if so, what type. Each of the ten animal niches on the food chain pyramid has a number from one to ten. The number rolled by the referee is the number of the beast encountered. However, if the number rolled is the number of an animal not part of the food chain pyramid for the region the characters are in then there is no encounter.

For example, players are travelling in an area of abundant life. If the referee rolls a 2 the players encounter an animal, as the number 2 niche is part of the abundant life pyramid. If, on the other hand, the referee rolled a 10 there would be no encounter at that time since the number 10 niche is only part of the teeming life food chain pyramid.

Once the niche number of the encounter is determined, the referee should read the brief description of the animal or animals occupying that niche and determine whether the animals attack the party or flee from it. If an actual struggle takes place, the referee should determine the characteristics of the animal.

The following procedure determines the specific animal encounter statistics:

1. Initiative: The animal's listed initiative rating is used as its initiative in combat.

2. Melee Hit Chance: The animal descriptions indicate whether an attack by the animal is an easy, routine, or difficult task.

3. Size: Roll 2D6. If the animal description lists a size modifier, add or subtract it from the die roll. If the animal is from a low-gravity world (0.8 Gs or less) subtract one from the die roll. If the animal is from a high gravity world (1.4 Gs or more), add one to the die roll. The table indicates the size of the animal in terms of its mass in kilograms. This affects most of the other characteristics of the animal. In addition, if the animal masses 1500 kg or more, it is treated as a large target; weapons with range finders may use them when firing at the animal and the animal may be attacked by missiles.

4. Speed: To determine the running speed of the animal, look at the speed column corresponding to the animal's weight (not the original die roll). If the animal description lists a speed modifier, add or subtract it as if it were a die roll modifier. If the animal is from a low-G world, add one; if from a high-G world, subtract one. The result on the chart is the number of meters the animal can run each action.

5. Armor: To determine the armor rating of the animal, look at the armor column corresponding to the animal's weight (not the original die roll). If the animal description lists an armor modifier, add or subtract it as if a die roll modifier. The result is the armor of the animal. Animal armor is considered rigid for potential kills and non-rigid for all other wounds.

6. Wound Potential Modification: To determine the wound potential modification of the animal, consult the wound potential table of the animal chart. The modification used is that corresponding to the animal's weight. The wound potential modification is an addition to or subtraction from the wound potential die roll for all hits inflicted on the animal, making small animals fairly easy to kill with one hit and large animals somewhat more difficult. This does not affect wounds inflicted by the animal.

7. Consciousness Level: The animal's consciousness level is its weight in kilograms divided by 20. However, the maximum consciousness level of the animal is 10, regardless of size.

8. Life level: The animal's life level is its weight in kilograms

divided by 10. However, the maximum life level of the animal is 12, regardless of size.

9. Damage Point Value: All animals attack as if conducting an armed melee strike and do normal damage. In addition, all animals 150 kg in weight or larger may conduct an additional blunt melee attack each action. In both cases, the DPV of the attack is determined from the animal chart. Locate the spot on the DPV column of the chart that corresponds to the animal's weight. Make any adjustments called for by the animal description, treating them as if they were die roll modifications.

10. Signature: The animal's signature is the die roll modifier used with sensors. To determine the animal's signature consult the signature column of the chart and note the correct value corresponding to the animal's weight. Some animals have a signature of "none" indicating that they may not be detected by sensors due to their extreme small size.

Random Characteristic: In order to prevent animals from being totally predictable based on their size, the referee should roll a 10-sided die and randomly alter the characteristic corresponding to the number rolled. If, for example, a 6 was rolled, the referee would change the wound potential modification of the animal. To do so, roll 1D6. On an even roll modify the characteristic up; on an odd roll down. Then roll the die again and apply the roll as a modifier. For results read off the animal characteristic table apply the roll as a shift up or down on the table. For characteristics such as initiative, apply the roll as a modification to the actual value. If desired, more than one characteristic may be modified and 1D10 may be used instead. The important thing is that animals not be totally predictable.

NICHE DESCRIPTIONS

The following descriptions are numbered to correspond to those on the animal encounter pyramid.

1. Gatherer: An omnivorous animal which displays a greater tendency toward herbivorous than carnivorous behavior. (Terran example: raccoon.) They will attack on a roll of 3 or less and flee on any other result.

Number Appearing: 1D6-2 *Initiative:* 3 *Size:* -2 *Speed:* +1 *Armor:* +1 *DPV:* -1 *Hit:* difficult

2. Intermittents: Herbivores which do not devote full time to eating. They will attack on a roll of 2 or less and flee on any other result. (Terran example: elephant.)

Number Appearing: 1D6 *Initiative:* 2 *Size:* normal *Speed:* +1 *Armor:* +1 *DPV:* normal *Hit:* difficult

3. Chasers: A pack of carnivores which kill their prey by attacking after a chase. They will attack on a roll of 6 or less and flee on any other result. For each chaser in the pack in excess of the characters in the party encountered, subtract 1 from the die roll. (Terran example: wolf.)

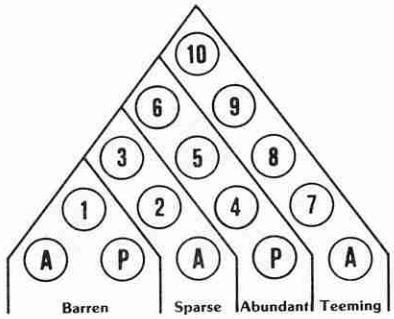
Number Appearing: 2D6 *Initiative:* 6 *Size:* -1 *Speed:* -2 *Armor:* -2 *DPV:* normal *Hit:* routine

4. Hunter: Omnivorous animals which display a greater tendency toward carnivorous than herbivorous behavior. They will attack on a roll of 5 (1D10) or less and flee on any other result. (Terran example: bear.)

Number Appearing: 1D6 *Initiative:* 4 *Size:* +1 *Speed:* normal *Armor:* +1 *DPV:* normal *Hit:* routine

5. Pouncer: A solitary carnivore which attacks from hiding or by surprise or by stalking and springing. They will attack if they surprise the party but will flee otherwise. (Terran example: mountain lion.)

Number Appearing: 1 *Initiative:* 5 *Size:* normal *Speed:* -1 *Armor:* -1 *DPV:* normal *Hit:* easy



6. Large Chaser: A large solitary carnivore which kills its prey by attacking after a chase. It will attack on a roll of 6 (1D10) or less and flee on any other result.

Number Appearing: 1 *Initiative:* 7 *Size:* +2 *Speed:* -2 *Armor:* -1 *DPV:* normal *Hit:* routine

7. Grazers: Herbivores which devote most of their time to eating. Generally in herds, their primary defense is flight. They will attack on a roll of 1 (1D10) but flee on any other result. (Terran example: antelope.)

Number Appearing: 1D6 x 1D10 *Initiative:* 2 *Size:* normal *Speed:* -2 *Armor:* +1 *DPV:* -1 *Hit:* difficult

8. Killer: A carnivore which devotes much attention to killing, apparently for the act itself, in a kind of blood lust. Attacks by killers are fierce and violent. They will attack on a roll of 8 (1D10) or less and flee on any other result. (Terran example: shark.)

Number Appearing: 1 *Initiative:* 10 *Size:* +1 *Speed:* normal *Armor:* +1 *DPV:* +1 *Hit:* easy

9. Large Pouncer: A very large solitary carnivore which kills its prey by stalking and springing and actively and aggressively defends its hunting territory. They will attack if they surprise the party. If they do not surprise the party they will attack on a roll of 7 (1D10) or less and flee on any other result. (Terran example: tiger.)

Number Appearing: 1 *Initiative:* 8 *Size:* +2 *Speed:* -1 *Armor:* -1 *DPV:* normal *Hit:* easy

10. Hijacker: Scavenging carnivores which rely on their superior strength to steal the kills of other carnivores. They will attack on a roll of 9 (1D10) or less and flee on any other result. (Terran example: Tyrannosaurus Rex.)

Number Appearing: 1 *Initiative:* 9 *Size:* +3 *Speed:* +2 *Armor:* +2 *DPV:* +2 *Hit:* routine

ANIMAL CHARACTERISTICS

1D10	*Size*	*Speed*	*Armor*	*DPV*	*Wound*	*Signature*
1	−2	130	0	0.1	−6	none
2	5	120	0	0.1	−5	none
3	10	110	0	0.1	−4	none
4	20	100	0	0.1	−3	− 6
5	40	95	0	0.1	−2	− 3
6	60	90	0	0.2	−1	− 1
7	80	85	0	0.2	—	0
8	100	80	0	0.3	—	0
9	150	75	0.1	0.4	—	0
10	200	70	0.1	0.5	—	0
11	300	65	0.2	0.8	—	0
12	500	60	0.2	1	—	+ 1
13	1500	55	0.3	2	+1	+ 2
14	3000	50	0.3	4	+1	+ 4
15	6000	40	0.4	6	+1	+ 6
16	12000	30	0.4	8	+1	+ 8
17+	24000	20	0.4	12	+1	+10

In This Game

The future is an exciting place, and this box provides you with what you need to begin role-playing immediately in the universe of **Traveller: 2300.**

Traveller: 2300 contains several separate items which provide information and background about the universe of the future. Look them over and familiarize yourself with them.

Player's Manual

The **Player's Manual** is directed at the individual players of **Traveller: 2300**, giving them information they will find useful while playing the game. It provides background on the future universe, describing what nations exist on Earth and what colonies they have out among the stars. It covers character generation and the varieties of equipment that can be purchased and used. The referee should also read the **Player's Manual.**

Referee's Manual

The **Referee's Manual** is directed at the referee, providing basic game rules that govern **Traveller: 2300.** These rules cover task resolution, starships, personal combat, and world generation, as well as other topics important to the game.

Forms Book

Behind this cover sheet is a collection of blank forms which are used during the game. Each form can be photocopied and then filled in with information drawn from the rules or generated during play. Be careful to only use photocopies of the forms, keeping the originals for photocopies.

Near Star Map

The **Near Star Map** shows the locations of stars within 50 light years of Earth. Each is color-coded to show its spectra and identified by name. Smaller maps show the major exploration routes of Earth's future, with connections of 7.7 light years or less drawn to show spacial relationships.

Near Star List

The more than 750 stars on the **Near Star Map** are cataloged in the **Near Star List**. Stars are listed in alphabetical order, and the listing includes spectral and size data, magnitude, and XYZ coordinates. Data in this **Near Star List** is the most accurate information available on stars within 50 light years of Earth.

The Tricolor's Shadow

To allow a referee to begin an adventure immediately, **The Tricolor's Shadow** is included as an introductory adventure set on Beta Canum 4. Introductory does not mean perfunctory however, and this adventure introduces players and referees to many of the concepts and rules of **Traveler: 2300.**

Dice

Traveller: 2300 requires dice as random number generators. Dice are important to the game because they make the outcome of events reasonable yet individually unpredictable. This game includes four six-sided dice (D6) and one ten-sided die (D10).

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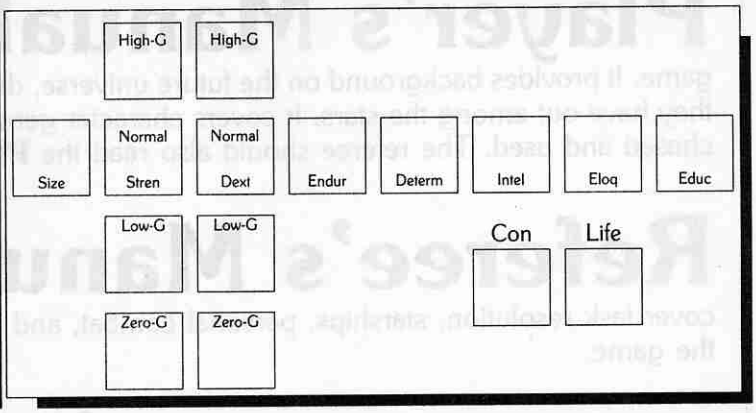
CC-1000/R4

Character Data

Name		Nationality	Homeworld	Gravity	Frontier/Core?
Gender	Birthdate	Mass	Eyesight	Hearing	Body Type
Throw Range	Coolness Under Fire	Encumbrance	Native Language	Other Languages	

First Career	Second Career
Skills	



List Possessions and Money

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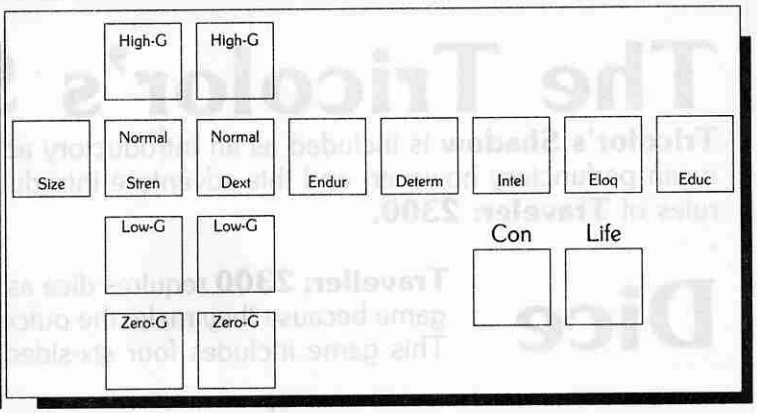


List Possessions and Money

Character Generation

HOMEWORLD

1D10	Core/Frontier	Frontier	Core
0	Core	Zero-G	Zero-G
1	Core	Zero-G	Zero-G
2	Core	Low-G	Normal
3	Frontier	Low-G	Normal
4	Frontier	Low-G	Normal
5	Frontier	Normal	Normal
6	Frontier	Normal	Normal
7	Frontier	Normal	Normal
8	Frontier	High-G	Normal
9	Frontier	High-G	Normal

This table is optional. The player may select specific homeworld gravity and core/frontier type instead.

BODY TYPE

1D10	Zero	Low	Normal	High
1	Ecto	Ecto	Ecto	Endo
2	Ecto	Ecto	Ecto	Endo
2	Ecto	Ecto	Endo	Endo
4	Ecto	Normal	Endo	Normal
5	Ecto	Normal	Normal	Normal
6	Normal	Normal	Normal	Normal
7	Normal	Normal	Normal	Normal
8	Normal	Meso	Normal	Meso
9	Normal	Meso	Meso	Meso
10	Normal	Meso	Meso	Meso

This table is optional. The player may select a specific body type, but only corresponding to his gravity background.

PHYSICAL ATTRIBUTES

Body Type	Stren	Dext	Endur
Mesomorph	+4	−2	+2
Ectomorph	−2	+3	0
Endomorph	+1	−1	+3
Normal	0	0	0

EDUCATION MODIFIERS

If Intelligence or Determination is...	Change Education by...
1 to 4	−4
5 or 6	−3
7 or 8	−2
9 or 10	0
11 or 12	+1
13 or 14	+2
15 to 20	+4

Note: Consult this table once for intelligence and once for determination.

CAREER SKILL POINTS

A character receives one skill point for each year spent prior to a turning point.

If intelligence plus determination is less than 10, subtract two career skill points (but the number available is never less than 1).

If intelligence plus determination is more than 30, add two career skill points.

GRAVITY TABLE (STRENGTH)

	Gravity of Homeworld			
	Zero-G	Low-G	Normal	High-G
Zero-G	0	+1	+1	+4
Low-G	−1	0	+1	+2
Normal	−2	−1	0	+1
High-G	−4	−2	−1	0

GRAVITY TABLE (DEXTERITY)

	Gravity of Homeworld			
	Zero-G	Low-G	Normal	High-G
Zero-G	0	−1	−2	−4
Low-G	+1	0	−1	−2
Normal	+2	+1	0	−1
High-G	+4	+2	+1	0

BACKGROUND SKILLS

Background skill points equal education divided by 2 (round fractions up).

Frontier Skills: Combat Rifleman, Sidearm, Melee, Ground Vehicle, Hover Vehicle, Sea Vehicle, First Aid, Survival, Electronic, Mechanical, Riding, Prospecting, Swim, Vacc Suit.

Core Skills: Computer, Ground Vehicle, Hover Vehicle, Sea Vehicle, Bureaucracy, Information Gathering.

SPECIAL ATTRIBUTES

Characters have special attributes:

Mass: Mass (in kilograms) begins with a base of 50 plus 3 times size. If mesomorph, add +35; if endomorph, add +20; if ectomorph, subtract −20.

Coolness Under Fire: Throw 1D6 and add +1 for each turning point in a military, law enforcement, field agent, or extralegal career.

Throw Range: Strength times 8 gives throw range (for a 1 kg object) in meters.

Encumbrance: Twice the sum of size plus strength is the limit of carrying capacity in kilograms.

Money: Character has Lv1,000 times the number of years spent in service.

Nationality: Taken from any available on homeworld.

SECONDARY ATTRIBUTES

1D10	Eyesight/Hearing	Appearance
0	Average	Unattractive
1	Average	Plain
2	Average	Plain
3	Average	GoodLooking
4	Average	GoodLooking
5	Average	GoodLooking
6	Average	GoodLooking
7	Excellent	Attractive
8	Excellent	Attractive
9	Exceptional	Exceptional

CHARACTER GENERATION CHECKLIST

1. Select Homeworld.
   A. Determine if core or frontier.
   B. Find homeworld gravity.
2. Select Body Type.
3. Generate Attributes.
   A. Physical Attributes.
      1) Size. 4D6−4.
      2) Strength. Size+physical attributes table.
      3) Dexterity. 4D6−4+physical attributes table.
      4) Endurance. 4D6−4+physical attributes table.
   B. Psychological Attributes.
      1) Determination. 4D6−4.
      2) Intelligence. 4D6−4.
      3) Eloquence. 4D6−4.
      4) Education. 4D6−4+education modifiers.
   C. Rerolling. Any one physical and one psychological attribute may be rerolled and the old or the new die roll may be selected.
   D. Determine strength and dexterity values in alternate gravities.
4. Background Skills.
   A. Background skill points equal education divided by 2.
   B. Select background skills.
5. Career Skills.
   A. Select Career.
   B. Receive initial training.
   C. Throw years to turning point (1D10).
      1) Career skill points equals years.
      2) Apply career skill point modifiers.
      3) Select skills.
      4) Resolve turning point.
      5) If success, go to next turning point.
      6) If failure, go to character finalization.
6. Character Finalization.
   A. Eyesight/Hearing/Appearance.
   B. Consciousness and Life Level.
   C. Age. 18+years in careers; add 1 if character had two careers.
   D. Mass.
   E. Nationality and languages.
   F. Coolness Under Fire.
   G. Throw Range (in meters).
   H. Encumbrance (in kilograms).
   I. Money.

LANGUAGES

Native language is determined by nationality. Government and civilian careers also provide French. Mercantile, space military, exploratory, and ship crew receive English. Academics receive one additional language of choice. Linguistics provides one language per level of skill.

Vehicle Data

Type		Mass/Weight	Crew	Armor
Combat Movement		Evasion	Sensor Range	Signature
Max Speed	Cruise Speed	Cargo	Endurance	Price
Comments				

Weapons Data

Weapon	Mass/Wt	Bulk	Ammunition					Range		AFV	Area Fire Value	DPV	Damage Point Value
			ROF	Rate of Fire	RPB	Rounds per Burst	Mag	Magazine Capacity	Aimed	Area				

Starship Data

Ship Name	Class	Movement
Registry (or Armed Force)	Nationality	Year Built

Sensor Operator Skill Level	Passive Signature	Passive Sensors
	Active Signature	Active Sensors

Hull Hit Capacity	Sensors
Power Plant Hit Capacity	Computer
Crew	Remote
	Targeting
Screens	Continuing

Damage Control

List characters and skill levels of damage control personnel.

Weapons

List weapons with gunner skill, targeting bonus and damage.

List remote objects and remote pilot skill.

TRAVELLER: 2300

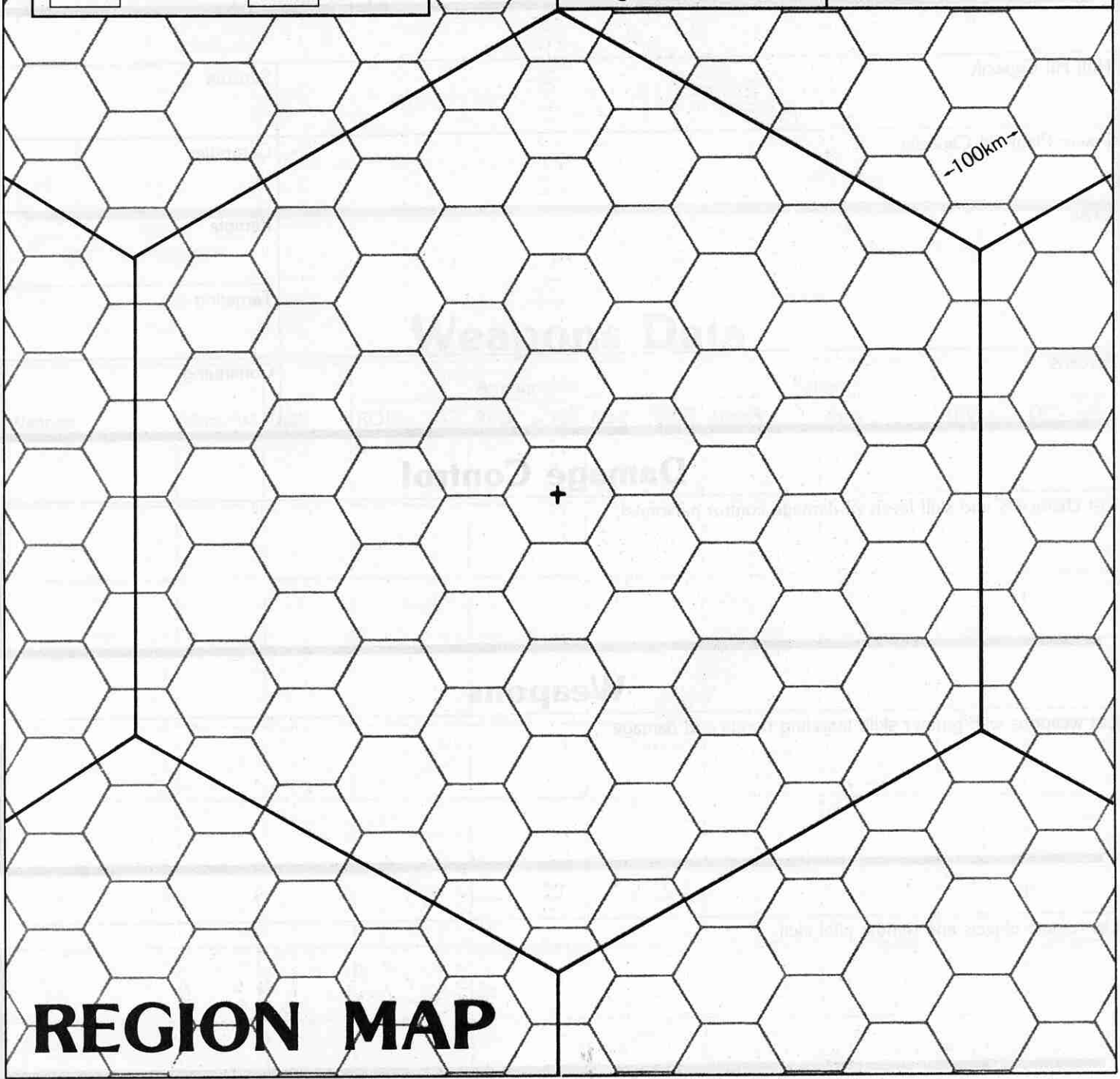
TERRAIN KEY

Symbol	Terrain	Symbol	Terrain
	Plain, Flat		
	Hilly		
	Mountains		

World Name

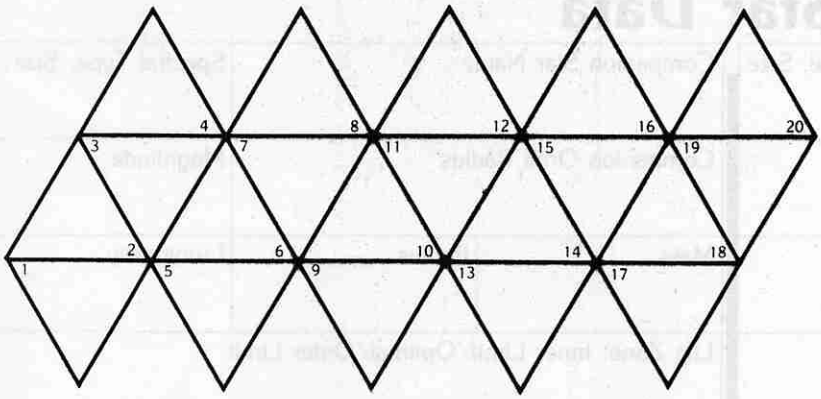
Geodesic Map Triangle No.

Triangle Hex No.



REGION MAP

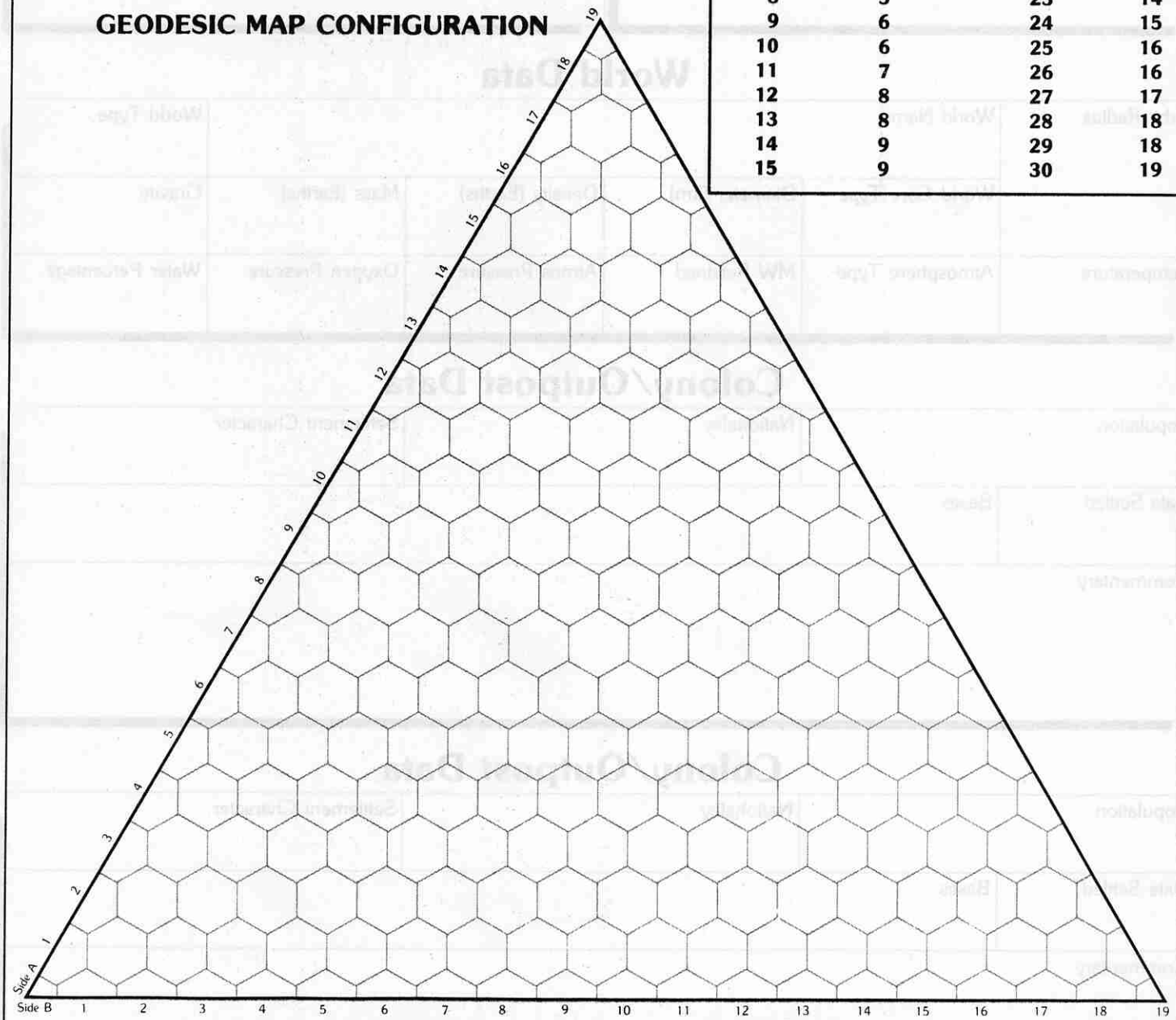
GEODESIC TRIANGLE



GEODESIC MAP CONFIGURATION

GEODESIC MAP TRIANGLE SIZES

WORLD SIZE	TRIANGLE SIDE	WORLD SIZE	TRIANGLE SIDE
1	1	16	10
2	1	17	11
3	2	18	11
4	3	19	12
5	3	20	13
6	4	21	13
7	4	22	14
8	5	23	14
9	6	24	15
10	6	25	16
11	7	26	16
12	8	27	17
13	8	28	18
14	9	29	18
15	9	30	19



GEODESIC MAP TRIANGLE NO. ☐

⟷ = 1000 kilometers

Star Data

Primary Star Name		Spectral Type, Size
XYZ Coordinates		Magnitude
Mass	Radius	Luminosity
Life Zone: Inner Limit/Optimal/Outer Limit		

Companion Star Name		Spectral Type, Size
Companion Orbit Radius		Magnitude
Mass	Radius	Luminosity
Life Zone: Inner Limit/Optimal/Outer Limit		

World Data

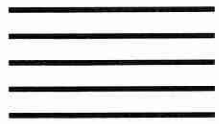
Orbit Radius	World Name				World Type
	World Core Type	Diameter (km)	Density (Earths)	Mass (Earths)	Gravity
Temperature	Atmosphere Type	MW Retained	Atmos Pressure	Oxygen Pressure	Water Percentage

Colony/Outpost Data

Population	Nationality	Settlement Character
Date Settled	Bases	
Commentary		

Colony/Outpost Data

Population	Nationality	Settlement Character
Date Settled	Bases	
Commentary		



Near Star List

This *Near Star List* provides basic information for stars within 50 light years of Sol. Based on Gliese's *Catalog of Nearby Stars*, edition 1969 (with updates by Halliwell and others), it is the best compilation of accurate data currently available in one place.

INFORMATION

This *Near Star List* contains the following:

Star Name (and Spectral Data): This list provides a generally accepted name or catalog number for each star. The cataloged spectral type and size of the star is given with the name; because some data for stars are incomplete, this may conflict with the standard data provided in the spectra column. Size is given as a number or Roman numeral; a number indicates less certain data.

X, Y, and Z Coordinates: Each star's position is specified in terms of X, Y, and Z axes in units of one light year.

Spectra: Stars are identified by their spectra and size.

Magnitude: Known absolute magnitude is provided.

Identification Number: Stars are given a unique identification number based on the sequential numbers in Gliese. Gliese numbers are multiplied by 10 (Gliese number 457 is 4570.0 in this catalog). Members of a multiple system (aside from the primary component) are identified by decimal tenths: .1, .2, etc.

Star Name		X	Y	Z	Spectra	Magn	No.
26 Draconis G1 V	A	-2.6	-22.8	42.9	G1 V	4.46	6840.0
26 Draconis M0.5 5	B	-2.6	-22.8	42.9	M0 V	7.19	6840.1
44 I Bootis G1 5	A	-18.3	-18.6	28.7	G1 V	4.87	5750.0
44 I Bootis G2 5	B	-18.3	-18.6	28.7	G2 V	5.47	5750.1
44 I Bootis SB G2 5	C	-18.3	-18.6	28.7	G2 V	6	5750.2
61 Cygni A K5 VE	A	6.2	-6.0	6.8	K5 V	7.58	8200.0
61 Cygni A UC	B	6.2	-6.0	6.8	M0 V	13	8200.1
61 Cygni B K7 VE	C	6.2	-6.0	6.8	K7 V	8.39	8200.2
61 Ursae Majoris G8 VE	A	-24.4	2.2	16.7	G8 V	5.55	4340.0
70 Ophiuchi K0 VE	A	0.2	-16.7	0.7	K0 V	5.67	7020.0
70 Ophiuchi UC	B	0.2	-16.7	0.7	M0 V	13	7020.1
82 Eridani G5 V	A	9.5	11.2	-13.9	G5 V	5.29	1390.0
85 Pegasi G3 V	A	34.6	-0.1	17.5	G3 V	5.38	9140.0
AC+ 1 1951-103 M1 5E	A	13.0	46.1	1.4	M1 V	8.8	1820.0
AC+ 2 2155-242 M4 5	A	9.9	-31.7	1.6	M4 V	11.13	7480.0
AC+ 3 2259-31 M2 5	A	30.0	14.1	2.3	M2 V	10.9	700.0
AC+ 3 2528-176 M2 5	A	10.1	-48.3	2.6	M2 V	9.83	7300.0
AC+ 8 142-393 M2 5E	A	7.9	-33.8	5.0	M2 V	9.9	7350.0
AC+10 22-181 M4 5	A	33.8	31.7	8.6	M4 V	11.4	1200.0
AC+10 95-26 M4	A	-45.4	-6.5	8.1	M4 VI	10.6	4760.0
AC+12 1800-213 M5.5 5		1.7	18.8	4.1	M5 V	12.73	2130.0
AC+13 1185-145 3 C	A	24.2	-37.6	10.5	M2 V	11.8	7841.0
AC+13 1301-119 M2 5	A	-34.5	24.4	10.1	M2 V	9.8	3610.0
AC+13 14332 M4 5	A	-18.8	-1.8	39.1	M4 V	11	4630.0
AC+16 247-80 M2 5E	A	8.4	-38.7	11.7	M2 V	9.59	7310.0
AC+16 734-144 M2 V	A	31.8	-18.5	10.7	M2 V	10.3	8440.0
AC+17 534-105 M4 5E	A	15.9	-12.6	6.3	M4 V	11.27	8290.0
AC+17 536-125 M2 5E	A	36.0	-19.0	13.3	M2 V	9.5	8510.0
AC+18 1890-112 M4	A	-20.0	-26.8	10.7	M4 V	11.8	5890.0
AC+19 1165-38 M5	A	9.5	42.8	15.6	M5 VI	10.5	1920.0
AC+20 1463-148 M2 6	A	7.1	-24.6	9.7	M2 VI	11.15	7450.0
AC+20 1463-154 M2 6	B	7.1	-24.6	9.7	M2 VI	11.14	7450.1
AC+20 76187 A 7	A	19.6	-23.5	-11.3	A0 VII	12	7991.0
AC+22 308-605 M3	A	26.7	-28.0	15.7	M3 V	11.4	8130.0
AC+23 468-46 M3 5	A	-19.2	5.3	8.4	M3 V	10.93	4080.0
AC+24 747-102 A 7	A	24.9	-31.9	18.7	A0 VII	10.85	7940.0
AC+25 7918 M4 5E	A	17.5	14.8	10.8	M4 V	11.12	1090.0
AC+32 54804 M5 5	A	6.3	-21.7	14.3	M5 V	12.2	7470.0
AC+32 54804 M5 5	B	6.3	-21.7	14.3	M5 V	12.5	7470.1
AC+32 86401 A 7	B	39.8	-3.3	25.2	A0 VII	12.1	9052.1
AC+32 86422 M5 5	A	39.7	-3.3	25.2	M5 V	10.9	9052.0
AC+33 10883 M1	A	17.8	32.6	24.6	M1 VI	9.5	1620.0
AC+33 25644 M4 5	A	-3.7	15.7	10.6	M4 V	11.03	2510.0
AC+38 23616 M5 5E	A	-4.4	14.4	12.0	M5 V	12.62	2680.0
AC+38 23616 SB	B	-4.4	14.4	12.0	M0 V	13	2680.1
AC+39 57322	C	25.4	-25.9	30.2	M0 V	12.3	8150.2
AC+39 57322 M3 5	B	25.4	-25.9	30.2	M3 V	11.4	8150.1
AC+39 57322 M3 5E	A	25.4	-25.9	30.2	M3 V	10.7	8150.0
AC+39 60670	B	26.4	-19.5	26.7	M0 V	11.6	8340.1
AC+39 60670 M0 5	A	26.4	-19.5	26.7	M0 V	9.6	8340.0
AC+41 726-154 M4	A	-5.4	-29.2	26.4	M4 VI	11	6710.0
AC+44 871-589 M3 5	A	17.9	-20.8	26.7	M3 V	10.5	8060.0
AC+45 133-65 M2 5E	A	20.9	22.0	31.0	M2 V	9.5	1250.0
AC+47 256-150 M2 5	A	-10.9	29.8	33.1	M2 V	10	2720.0
AC+54 1646-56 M2 5	A	-11.2	-25.2	38.4	M2 V	9.6	6250.0
AC+56 13511 M4 B	A	18.6	8.2	31.4	M4 V	11.4	630.0
AC+58 13565 M4 5E	A	18.2	10.1	33.8	M4 V	11.7	820.0
AC+58 25001 M4 5	A	3.4	8.0	14.5	M4 V	12.51	1691.0
AC+58 25002 A D	B	3.4	8.0	14.5	A0 VII	12.51	1691.1
AC+60 3496 M2.5 5E	A	19.0	4.9	35.6	M2 V	10.2	470.0
AC+61 26806 M1 VE	A	-2.6	-23.0	42.8	M1 V	9.08	6850.0
AC+65 6955 M3 5	A	6.5	-8.6	23.3	M3 V	10.95	7930.0
AC+65 6955 SB	B	6.5	-8.6	23.3	M0 V	13	7930.1
AC+66 3955 M4 5E	A	-11.1	-2.3	25.7	M4 V	11.2	4870.0
AC+70 4336 M3 5	A	-10.6	7.5	36.0	M3 V	10.25	3600.0
AC+70 4337 M4 5	A	-10.6	7.4	36.0	M4 V	10.9	3620.0
AC+70 8247 A 7	A	3.4	-12.8	37.4	A0 VII	12.75	7420.0
AC+71 532 M3.5 5E	A	7.9	2.0	24.3	M3 V	10.34	480.0
AC+79 1584 M2	A	4.2	4.7	35.2	M2 V	11.1	1330.0
AC+79 3888 M4 6	A	-3.2	0.2	16.3	M4 VI	12.38	4450.0
AC+82 1111 M3 5	A	0.0	4.3	31.3	M3 V	10.56	2260.0
AC- 7 342-397 M5 5	B	10.3	-29.3	-4.3	M5 V	12.83	7541.1
AC- 7 342-402 A 7WK	A	10.3	-29.3	-4.3	A0 VII	12.44	7541.0
AC-12 2306-155 M4	A	-30.7	-23.2	-8.3	M4 V	13	5531.0
Alpha Centauri G2 V	A	-1.7	-1.4	-3.9	G2 V	4.35	5590.0
Alpha Centauri K0 V	B	-1.7	-1.4	-3.9	K0 V	5.69	5590.1
Alpha Crucis F2 V	A	-45.0	-1.2	-20.5	F2 V	3.1	4553.0
Alpha Fornacis B	B	25.9	28.3	-21.5	M0 V	6.5	1270.1
Alpha Fornacis F8 IV	A	25.9	28.3	-21.5	F8 IV	3.5	1270.0
Alpha Hydri F0 V	A	19.4	10.9	-41.7	F0 V	2.9	830.0
Alpha Mensae G5 V	A	-0.4	7.4	-27.4	G5 V	5.39	2310.0
Altair A7 V	A	7.4	-14.5	2.4	A7 V	2.24	7680.0
Arcturus K2 IIIE	A	-28.0	-18.4	11.7	K2 III	-0.24	5410.0
Augereau M2 VE	A	-12.3	3.1	12.1	M2 V	10.12	4120.0
BPM 94172 A 7N	A	13.5	-37.6	10.3	A0 VII	12.5	7551.0
Barnard's Star M5 V	A	-0.2	-5.9	0.4	M5 V	13.25	6990.0
Berthier K2 V	A	-21.5	1.7	24.5	K2 V	7.8	4381.0
Bessieres M2 VE	A	-6.5	1.7	4.8	M2 V	10.49	4110.0
Bessieres UC	B	-6.5	1.7	4.8	M0 V	13	4110.1
Beta Aquilae G8 IV	A	21.8	-40.8	5.0	G8 IV	3.5	7710.0
Beta Aquilae M3 5	B	21.8	-40.8	5.0	M3 V	10.6	7710.1
BetaCanumVenaticorum	G0 V	-22.2	-3.1	19.8	G0 V	4.46	4750.0
Beta Cassiopei F2 IV	A	25.5	0.7	42.2	F2 IV	1.37	80.0
Beta Cassiopei SB	B	25.5	0.7	42.2	M0 V	13	80.1
Beta Comae Berenices	G0 V	-22.9	-7.2	12.8	G0 V	4.66	5020.0
Beta Hydri G1 IV	A	4.4	0.4	-20.1	G1 IV	3.8	190.0
Beta Trianguli Australis	F2 IV	-10.1	-15.9	-37.4	F2 IV	2.4	6010.0
Beta Virginis F8 V	A	-32.6	1.6	1.1	F8 V	3.6	4490.0
Botany Bay K7 V	A	-8.6	-24.7	17.3	K7 V	8.19	6380.0
Broward M5 5	A	-5.1	-11.8	-2.9	M5 V	12.1	6280.0
C1 A 7	A	-16.4	-1.0	21.6	A0 VII	13.7	4591.0
Capella A G8 III	A	6.1	29.5	31.2	G8 III	-0.6	1940.0
Capella B F5 III	B	6.1	29.5	31.2	F5 III	.34	1940.1
Capella H A M2 5	A	6.1	30.0	31.5	M2 V	9.55	1950.0
Capella H B M5 5	B	6.1	30.0	31.5	M5 V	13	1950.1
Castor A A1 V	A	-15.6	36.9	25.0	A1 V	2.1	2780.0
Castor A SB A1 V	B	-15.6	36.9	25.0	A1 V	2.1	2780.1
Castor B A5 V	C	-15.6	36.9	25.0	A5 V	2.9	2780.2
Castor B SB A5 V	D	-15.6	36.9	25.0	A5 V	2.9	2780.3
Catherine's Star	B	-22.7	0.9	17.7	M0 V	12	4510.1

Star Name		X	Y	Z	Spectra	Magn	No.
Chi Draconis F7 V	A	0.7	-7.8	24.0	F7 V	4.13	7130.0
Chi Draconis SB	B	0.7	-7.8	24.0	M0 V	13	7130.1
Chi1 Orionis G0 V	A	1.1	30.2	11.1	G0 V	4.43	2220.0
Clarkesstar M4.5 5E	A	-5.8	-19.2	-3.0	M4 V	10.79	6440.0
D'Artagnon M	A	-0.8	-10.4	-16.2	M0 V	14	6930.0
DM+ 0 2989 M0.5 VE	A	-35.1	-7.5	0.3	M0 V	8.31	4880.0
DM+ 0 4810 K8 5E	A	27.6	-16.1	0.6	K8 V	9.2	8460.0
DM+ 1 2447 M2 5	A	-23.1	9.9	0.4	M2 V	10.2	3930.0
DM+ 1 4774 M2 VE	A	18.5	-1.1	0.6	M2 V	10.19	9080.0
DM+ 2 348 M3 5	A	27.4	17.4	1.9	M3 V	10.03	870.0
DM+ 2 3482 K6 VE	C	0.2	-16.7	0.7	K6 V	7.45	7020.2
DM+ 2 4076 K4 5E	A	21.4	-37.1	2.3	K4 V	6.9	7750.0
DM+ 3 3465 K3 5	A	-4.1	-40.0	2.5	K3 V	6.06	6880.0
DM+ 4 123 K2 V	A	22.0	4.4	1.9	K2 V	6.55	330.0
DM+ 4 4048 M3.5 VE	A	5.9	-17.8	1.6	M3 V	10.31	7520.0
DM+ 4 4157 M1 5	A	16.3	-38.4	3.2	M1 V	8.82	7630.0
DM+ 5 1668 M5 5	A	-4.5	11.4	1.1	M5 V	11.98	2730.0
DM+ 5 1668 UC	B	-4.5	11.4	1.1	M0 V	13	2730.1
DM+ 5 3409	B	-4.5	-31.5	3.1	M0 V	14	6781.1
DM+ 5 3409 M1 V	A	-4.5	-31.5	3.1	M1 V	9.36	6781.0
DM+ 5 3993 M2 V	A	9.1	-37.1	3.9	M2 V	8.87	7400.0
DM+ 6 2182 K3 VE	A	-29.0	22.7	3.7	K3 V	6.93	3490.0
DM+ 6 398 K3 V	A	18.2	14.4	2.7	K3 V	6.54	1050.0
DM+ 6 398 M4 5	C	18.2	14.4	2.7	M4 V	12.37	1050.2
DM+ 6 398 UC	B	18.2	14.4	2.7	M0 V	13	1050.1
DM+ 7 4052 K5 V	A	15.5	-42.2	5.8	K5 V	7.4	7562.0
DM+ 9 2636 M1 5	A	-44.4	-5.6	7.1	M1 V	9.1	4710.0
DM+10 1032	B	-1.1	30.8	5.6	M0 V	12.7	2280.1
DM+10 1032 M3 5	A	-1.1	30.8	5.6	M3 V	10.65	2280.0
DM+10 2531 G0 V	A	-39.6	-13.3	7.1	G0 V	4.65	5040.0
DM+11 2576 M1 V	A	-22.7	-9.2	4.5	M1 V	9.65	5140.0
DM+11 2576 SB	B	-22.7	-9.2	4.5	M0 V	13	5140.1
DM+11 878 M0 5	A	4.2	36.5	7.3	M0 V	8.5	2080.0
DM+12 1944 M5 5	A	-32.4	33.9	9.8	M5 V	9.8	3300.0
DM+13 2618 M2 5E	A	-37.6	-9.8	8.7	M2 V	9.4	4940.0
DM+13 2901 G6 5	A	-30.7	-32.5	10.6	G6 V	4.6	5791.0
DM+15 2620 M4 VE	A	-14.1	-6.9	4.2	M4 V	10.02	5260.0
DM+15 3364 G6	A	0.9	-43.6	12.4	G6 VII	8	7030.0
DM+15 4733 M2 5E	A	20.5	-6.1	6.2	M2 V	9.5	8800.0
DM+15 4733 SB	B	20.5	-6.1	6.2	M0 V	13	8800.1
DM+16 2404 K8 5	A	-45.6	-7.8	12.9	K8 V	7.3	4810.0
DM+16 2658 M3 5	A	-34.5	-25.8	12.1	M3 V	10	5520.0
DM+16 2708 M0 5E	A	-23.9	-22.3	9.5	M0 V	10.1	5690.0
DM+17 1320 M1 5	A	-4.5	29.5	9.4	M1 V	9.71	2390.0
DM+17 2611 K2 V	A	-34.0	-11.5	11.1	K2 V	6.28	5050.0
DM+17 2611 M2 5E	B	-34.0	-11.5	11.1	M2 V	9.3	5050.1
DM+18 1214 K3 5E	A	-3.8	36.9	12.6	K3 V	6.4	2330.0
DM+18 2776 M1 5	A	-28.8	-13.9	10.4	M1 V	9.76	5250.0
DM+18 3606 M1 5	A	2.6	-46.1	15.4	M1 V	8.8	7080.0
DM+18 683 M2.5 5E	A	10.8	29.8	10.8	M2 V	9.87	1760.0
DM+19 279 K1 V	A	20.7	9.6	8.3	K1 V	5.88	680.0
DM+19 2881 K1 V	A	-26.9	-24.9	12.8	K1 V	5.66	5670.0
DM+19 2881 SB	B	-26.9	-24.9	12.8	M0 V	13	5670.1
DM+19 5036 G4 V	A	40.1	-11.8	15.6	G4 V	4.82	8820.0
DM+19 5116 M4 5E	A	19.6	-2.7	7.0	M4 V	11.33	8960.0
DM+19 5116 M6 5E	B	19.6	-2.7	7.0	M6 V	13.4	8960.1
DM+20 5046 K5 V	A	19.6	-12.1	8.8	K5 V	13	8411.0
DM+20 802 K3 V	A	15.3	41.3	16.7	K3 V	7.3	1740.0
DM+20 85 K0 V	A	31.6	5.1	12.2	K0 V	5.75	270.0
DM+21 587 G1 5	A	21.5	38.1	17.6	G1 V	5.09	1600.0
DM+21 652 M1 5EB	A	12.8	29.5	12.8	M1 V	8.1	1690.0
DM+22 2302 M2 5E	A	-34.3	9.1	14.5	M2 V	9.2	4100.0
DM+24 2733 M1 5	A	-34.9	-27.7	19.6	M1 V	8.84	5480.0
DM+24 2733 M2 5	B	-36.1	-26.1	19.6	M2 V	9.1	5480.1
DM+24 2786 G2 5	A	-31.6	-28.5	19.0	G2 V	5.15	5640.0
DM+24 2786 SB	B	-31.6	-28.5	19.0	M0 V	13	5640.1
DM+25 2874 K7 V	A	-27.2	-28.5	18.4	K7 V	9.32	5790.0
DM+25 3173 M2 5	A	-8.5	-29.7	14.9	M2 V	9.6	6490.0
DM+25 3719 K2 5	A	10.6	-37.7	18.9	K2 V	6.6	7432.0
DM+25 613 K7.5 E	A	21.3	31.4	18.5	K7 VII	9	1540.0
DM+26 4734 M5 V	B	34.6	-0.1	17.5	M5 V	10.6	9140.1
DM+26 4734 SB M3 V	C	34.6	-0.1	17.5	M3 V	10.6	9140.2
DM+27 2055 K3 V	A	-40.2	2.7	20.7	K3 V	8	4431.0
DM+27 2296 K6 5	B	-24.9	-12.6	14.3	K6 V	7.7	5280.1
DM+27 28217 M3 5	A	-29.0	2.5	14.7	M3 V	10.7	4360.0
DM+27 4120 M0 5E	A	32.9	-24.0	21.1	M0 V	9.11	8350.0
DM+27 4120 SB	B	32.9	-24.0	21.1	M0 V	13	8350.1
DM+28 1660 G8 V	A	-26.1	28.5	21.0	G8 V	5.3	3240.0
DM+28 4704 KO VE	A	39.1	0.6	21.4	K0 V	5.46	50.0
DM+30 2512 K8 V	A	-29.8	-20.8	20.8	K8 V	8	5460.0
DM+31 2240 K9 VE	A	-33.8	7.7	20.5	K9 V	7.9	4140.0
DM+31 2240 M2 5	B	-33.8	7.7	20.5	M2 V	9.5	4140.1
DM+31 3767 M1 5	A	15.8	-32.3	22.3	M1 V	9.72	7670.0
DM+31 3767 M2	B	15.8	-32.3	22.3	M2 V	10.7	7670.1
DM+32 2896 G2 V	A	-6.8	-37.1	24.0	G2 V	4.71	6720.0
DM+32 828 M	A	20.8	13.4	-15.7	M0 V	10.4	910.0
DM+33 529 M0 5	A	30.2	27.4	27.7	M0 V	8.7	1160.0
DM+34 2323 K4 V	A	-35.0	-4.5	23.5	K4 V	8.2	4711.0
DM+35 2436 M0 5	A	-25.4	-8.9	19.0	M0 V	9.5	5070.0
DM+35 2436 M3	B	-25.4	-8.9	19.0	M3 V	12.1	5070.1
DM+36 1638 M3.5 5E	A	-11.3	27.6	21.9	M3 V	10.32	2770.0
DM+36 1638 SB	B	-11.3	27.6	21.9	M0 V	13	2770.1
DM+36 1970 M2 5	A	-30.5	23.5	28.5	M2 V	9.4	3530.0
DM+36 1979	B	-19.4	14.4	17.5	M0 V	13.2	3560.1
DM+36 1979 G8 IV	A	-19.4	14.4	17.5	G8 IV	5.6	3560.0
DM+36 2219 M1 VE	A	-27.9	1.2	19.9	M1 V	9.7	4500.0
DM+36 2393 M2 5E	A	-23.5	-10.4	18.5	M2 V	9.1	5190.0
DM+37 748 M1.5 5E	A	23.1	26.4	27.5	M1 V	9.6	1340.0
DM+38 3095 K2 V	A	0.9	-27.5	21.7	K2 V	6.24	7060.0
DM+39 154 K2 VE	A	34.2	5.7	29.0	K2 V	6.6	280.0
DM+39 2376	B	-28.3	9.9	24.0	M0 V	11.8	4000.1
DM+39 2376 M2 5E	A	-28.3	9.9	24.0	M2 V	8.95	4000.0
DM+39 2947 G8 V	A	-15.4	-27.6	25.7	G8 V	6.18	6110.0
DM+40 45 M0 5	A	35.2	2.2	30.3	M0 V	8.3	140.0
DM+41 2147 G0 V	A	-32.2	9.1	28.7	G0 V	4.4	4070.0
DM+41 219 F8 V	A	31.8	9.6	29.7	F8 V	4.2	534.0
DM+41 2695 M0 5P	A	-15.9	-33.7	32.4	M0 V	8.1	6190.0
DM+42 1956	B	-22.9	23.4	29.4	M0 V	5.33	3320.1
DM+42 1956 F5 V	A	-22.9	23.4	29.4	F5 V	3.5	3320.0
DM+42 2296 M0 VE	A	-33.4	-2.9	30.5	M0 V	8.5	4620.0
DM+43 1953 K5 V	A	-28.4	19.8	32.1	K5 V	7.31	3650.0
DM+43 2796 M3 5	A	-1.8	-23.0	21.7	M3 V	10.6	6940.0
DM+43 4305 M4.5 5E	A	10.3	-3.6	10.5	M4 V	11.65	8730.0
DM+43 4305 SB	B	10.3	-3.6	10.5	M0 V	13	8730.1
DM+44 4548 M2 5E	A	24.3	0.2	24.7	M2 V	9.76	20.0
DM+45 2014 K4 V	A	-27.9	-1.8	27.6	K4 V	8.2	4592.0
DM+45 2247 M0 5	A	-20.3	-20.1	29.1	M0 V	8.6	5720.0
DM+45 2505 M3.5	B	-3.2	-16.4	15.0	M3 V	11.28	6610.1
DM+45 2688 M0 5	A	2.1	-33.1	33.7	M0 V	9.3	7090.0
DM+45 2743 M2 5	A	4.0	-27.5	28.4	M2 V	9.4	7200.0
DM+45 4408 K9 5E	A	24.5	0.3	25.0	K9 V	8.8	40.0
DM+45 4408 M0 5E	C	24.5	0.3	25.0	M0 V	8.84	40.2
DM+45 4408 SB	B	24.5	0.3	25.0	M0 V	13	40.1
DM+46 1551 G1 V	A	-28.5	18.9	35.6	G1 V	4.2	3680.0
DM+46 1635 K7 V	A	-29.5	12.4	32.9	K7 V	8.1	3970.0
DM+46 1889 M2 5	A	-19.4	-8.8	22.2	M2 V	10.1	5210.0
DM+47 2112 M3 5E	A	-24.3	-14.1	29.5	M3 V	9.5	5370.0
DM+47 2112 M3 5E	B	-24.3	-14.1	29.5	M3 V	9.6	5370.1
DM+47 612 M1.5 5E	A	17.3	12.0	23.1	M1 V	9.5	960.0
DM+48 1829 M2 5	A	-27.6	16.0	35.8	M2 V	9.2	3780.0
DM+48 2108	B	-17.6	-6.2	20.7	M0 V	10.1	5080.1
DM+48 2108 M2 5E	A	-17.6	-6.2	20.7	M2 V	9.3	5080.0
DM+49 1280 M2 5E	A	7.7	26.5	32.7	M2 V	9.2	1810.0
DM+50 1832 K3 V	A	-24.0	3.1	28.6	K3 V	8	4312.0
DM+50 2030 M0 5P	A	-25.4	-13.2	34.3	M0 V	8.3	5320.0
DM+51 2402 K6 VE	A	4.0	-28.2	36.0	K6 V	7.9	7190.0
DM+51 2402 SB	B	4.0	-28.2	36.0	M0 V	13	7190.1
DM+52 2294 G8 5	A	5.6	-25.3	34.2	G8 V	13	7321.0
DM+52 857 K8 VE	A	7.3	18.5	26.2	K8 V	8.6	1720.0
DM+52 911 M0 5	A	7.6	28.2	38.8	M0 V	9.06	1840.0
DM+53 1320 M0 VE	A	-8.8	7.9	15.6	M0 V	8.72	3380.0
DM+53 1321 M0 VE	B	-8.8	7.9	15.6	M0 V	8.82	3380.1

Star Name		X	Y	Z	Spectra	Magn	No.
DM+53 934 K1 VE	A	2.0	20.7	28.1	K1 V	6.07	2110.0
DM+53 935 M1 5	A	2.0	20.7	28.1	M1 V	9.62	2120.0
DM+55 1519 M2 5E	A	-24.5	-1.1	34.5	M2 V	9.3	4580.0
DM+56 1458 K7 VE	A	-20.1	8.5	32.6	K7 V	8.29	3940.0
DM+56 1459 F8 V	A	-20.1	8.5	32.6	F8 V	4.44	3950.0
DM+56 2966 K3 V	A	11.8	-2.6	18.5	K3 V	6.41	8920.0
DM+57 2735 M2 5E	A	20.2	-3.4	32.3	M2 V	9.7	8950.0
DM+59 1915 M4 5	A	1.0	-5.8	9.9	M4 V	11.15	7250.0
DM+59 1915 M5 5	B	1.0	-5.8	9.9	M5 V	11.94	7250.1
DM+60 1003 M0 5P	A	-4.8	23.5	42.2	M0 V	7.7	2470.0
DM+61 195 M2 5E	A	13.7	3.6	26.9	M2 V	9.72	490.0
DM+61 195 SB	B	13.7	3.6	26.9	M0 V	13	490.1
DM+61 2068 M2 VE	A	7.6	-8.2	21.0	M2 V	9.18	8090.0
DM+61 366 K5 V	A	13.4	7.6	28.6	K5 V	7.4	833.0
DM+62 1916 G5	A	17.0	-15.1	43.8	G5 VII	8.1	8230.0
DM+62 274 K1 V	A	18.7	7.9	39.7	K1 V	6.1	593.0
DM+63 137 K7 V	A	19.3	5.5	40.5	K7 V	8.29	520.0
DM+63 229 K5 V	A	17.5	8.1	38.9	K5 V	7.78	690.0
DM+63 238 K0 V	A	11.4	5.5	25.6	K0 V	5.91	750.0
DM+63 869 M1 5	A	-15.2	9.4	35.0	M1 V	8.6	3730.0
DM+66 1281 G5 V	A	10.8	-16.0	44.6	G5 V	5.07	7880.0
DM+66 34 M2.5 5E	A	13.1	1.6	31.2	M2 V	10.42	220.0
DM+66 34 M4.5	B	13.1	1.6	31.2	M4 V	12.3	220.1
DM+66 717 M1 V	A	-10.9	2.0	25.0	M1 V	9.7	4240.0
DM+67 1014 K0 V	A	-2.6	-16.6	40.1	K0 V	5.81	6750.0
DM+67 1014 SB	B	-2.6	-16.6	40.1	M0 V	13	6750.1
DM+67 552 M1 5	A	-9.9	12.6	38.5	M1 V	8.76	3100.0
DM+67 552 SB	B	-9.9	12.6	38.5	M0 V	11.7	3100.1
DM+67 935 M0 VE	A	-6.2	-12.7	33.7	M0 V	8.37	6170.0
DM+67 935 M3 5	B	-6.2	-12.7	33.8	M3 V	10.47	6170.1
DM+68 946 M3.5 V	A	-0.6	-5.7	14.2	M3 V	10.79	6870.0
DM+68 946 SB	B	-0.6	-5.7	14.2	M0 V	13	6870.1
DM+71 482 K5 V	A	-8.0	8.5	33.8	K5 V	8.48	3250.0
DM+71 482 M0 5	B	-8.0	8.5	33.8	M0 V	8.7	3250.1
DM+74 1047 K3 V	A	8.9	-0.4	33.8	K3 V	6.25	9090.0
DM+74 1047 M2	C	8.9	-0.4	33.8	M2 V	11.5	9090.2
DM+74 1047 SB	B	8.9	-0.4	33.8	M0 V	13	9090.1
DM+74 456 K5 5	A	-12.1	2.5	42.2	K5 V	7.05	4200.0
DM+74 456 M2	B	-12.1	2.5	42.2	M2 V	10.7	4200.1
DM+76 785 M0 5	A	5.2	-8.1	41.8	M0 V	8.3	7860.0
DM+80 238 G8 5	A	-3.6	6.9	45.9	G8 V	5.78	2900.0
DM- 1 2892 M0 5	A	-30.8	-17.6	-1.5	M0 V	9.6	5360.0
DM- 1 3220 K0 VE	A	-13.2	-33.3	-1.4	K0 V	5.56	6310.0
DM- 1 3474 M1 5E	A	3.4	-45.2	-1.6	M1 V	8.7	7100.0
DM- 1 4323 M1 5	A	45.2	-18.0	-1.0	M1 V	9.15	8640.0
DM- 1 565 K5 5E	A	23.4	38.6	-1.1	K5 V	7.6	1570.0
DM- 1 565 M3 5E+	B	23.4	38.6	-1.1	M3 V	11	1570.1
DM- 1 565 SB	C	23.4	38.6	-1.1	M0 V	13	1570.2
DM- 2 129 K1	A	45.2	11.0	-1.7	K1 VII	8.3	440.0
DM- 2 2901 F6 V	A	-36.0	28.4	-2.1	F6 V	3.9	3480.0
DM- 2 2902 K0	B	-36.0	28.4	-2.1	K0 VI	6.4	3480.1
DM- 2 3000 M0 5	A	-36.2	22.8	-2.6	M0 V	9.8	3720.0
DM- 3 1061 K3 V	A	8.2	43.2	-2.4	K3 V	7.11	2000.0
DM- 3 1061 M2	B	8.2	43.2	-2.5	M2 V	12	2000.1
DM- 3 1110 K5 V	A	6.6	44.6	-2.8	K5 V	6.9	2040.0
DM- 3 1123 M1 VE	A	2.5	18.9	-1.3	M1 V	9.12	2050.0
DM- 3 2001 K2 VE	A	-18.4	40.5	-2.8	K2 V	6.5	2820.0
DM- 3 2002 K5 5	B	-18.5	40.5	-2.8	K5 V	8.3	2820.1
DM- 3 2870 M2 5	A	-25.8	13.4	-1.8	M2 V	9.6	3820.0
DM- 3 2870 SB	B	-25.8	13.4	-1.8	M0 V	13	3820.1
DM- 3 3508 K6 5	A	-43.0	-19.5	-3.3	K6 V	8.8	5211.0
DM- 3 3508 SB	B	-43.0	-19.5	-3.3	M0 V	13	5211.1
DM- 3 4233 M2 5	A	0.2	-23.6	-1.3	M2 V	10.08	7010.0
DM- 4 2226 M3	A	-17.7	28.9	-2.6	M3 VI	9.9	2970.0
DM- 4 2490 G3 5	A	-26.1	27.9	-3.6	G3 V	5.65	3270.0
DM- 4 4225 K5 V	A	-8.9	-34.6	-3.2	K5 V	7.53	6530.0
DM- 4 4226 M3.5 V	A	-8.9	-34.6	-3.2	M3 V	9.87	6540.0
DM- 5 1123 K3 V+	A	7.9	28.6	-3.1	K3 V	6.4	1830.0
DM- 5 1123 SB	B	7.9	28.6	-3.1	M0 V	13	1830.1
DM- 5 1844 K6 5	A	-6.8	30.4	-2.8	K6 V	6.68	2500.0
DM- 5 1844 M2	B	-6.8	30.4	-2.9	M2 V	10.2	2500.1

Star Name		X	Y	Z	Spectra	Magn	No.
DM- 5 5674 K2 5	A	35.2	-21.2	-3.4	K2 V	13	8421.0
DM- 5 5715 M3 5	A	25.5	-13.8	-2.5	M3 V	10.67	8490.0
DM- 5 642 K5 V	A	28.1	34.3	-4.4	K5 V	7.2	1410.0
DM- 6 4663 M2 5	A	-2.3	-42.1	-4.5	M2 V	9.5	6960.0
DM- 6 4663 SB	B	-2.3	-42.1	-4.5	M0 V	13	6960.1
DM- 7 4003 M5 5	A	-13.8	-16.0	-2.8	M5 V	11.5	5810.0
DM- 7 699 M0 5	A	22.5	36.1	-5.3	M0 V	8.44	1560.0
DM- 7 781 A 7	B	7.0	14.0	-2.2	A0 VII	11.09	1660.1
DM- 7 781 M4.5 5E	C	7.0	14.0	-2.2	M4 V	12.73	1660.2
DM- 8 2582 M0 5	A	-33.2	31.9	-7.0	M0 V	8.7	3340.0
DM- 8 2582 SB	B	-33.2	31.9	-7.0	M0 V	13	3340.1
DM- 8 4352 M4.5 5	B	-5.8	-19.2	-3.0	M4 V	10.8	6440.1
DM- 9 3413 K0 IV	A	-40.1	0.3	-7.2	K0 IV	5.06	4540.0
DM-11 2741 M2 5	A	-33.1	21.3	-8.5	M2 V	9.54	3690.0
DM-11 3759 M4 5	A	-15.8	-12.3	-4.4	M4 V	12.38	5550.0
DM-12 2449 G8 V	A	-22.6	33.3	-9.0	G8 V	5.49	3020.0
DM-12 2918 M4 5	A	-22.8	17.6	-6.9	M4 V	11.02	3520.0
DM-12 2918 M4 5	B	-22.8	17.6	-6.9	M4 V	11	3520.1
DM-12 4523 SB	B	-5.1	-11.8	-2.9	M0 V	13	6280.1
DM-13 2267	B	-21.1	40.7	-11.3	M0 V	5.36	2910.1
DM-13 2267 G1 V	A	-21.1	40.7	-11.3	G1 V	4.91	2910.0
DM-13 544 K0 VE	A	18.4	16.9	-5.8	K0 V	6.57	1170.0
DM-14 5936 K1 VE	A	34.5	-33.3	-12.1	K1 V	6.25	8190.0
DM-14 5936 M0	B	34.5	-33.3	-12.1	M0 VI	9.3	8190.1
DM-15 6290 M5 5	A	14.4	-4.6	-4.0	M5 V	11.77	8760.0
DM-16 214 K3	A	43.6	14.8	-13.1	K3 VII	8.8	560.0
DM-17 3813 G6 V	A	-24.7	-8.5	-8.5	G6 V	5.12	5060.0
DM-17 6768	B	40.1	-5.3	-12.4	M0 V	10.8	8970.1
DM-17 6768 M5	A	40.1	-5.3	-12.4	M5 VI	10.4	8970.0
DM-17 6769 K5 5E	A	40.1	-5.3	-12.5	K5 V	8	8980.0
DM-17 954 G1 5	A	12.9	38.3	-12.4	G1 V	4.92	1770.0
DM-18 3019 M C	A	-31.1	10.7	-11.3	M0 V	12.3	4010.0
DM-18 359 M3 5	A	23.4	13.8	-8.8	M3 V	10.46	840.0
DM-18 4986 K3 V	A	5.6	-45.7	-15.8	K3 V	6.2	7160.0
DM-19 3242 M C	B	-30.2	5.4	-11.3	M0 V	11	4250.1
DM-19 3242 M0 5	A	-30.2	5.4	-11.3	M0 V	8.7	4250.0
DM-19 5899	B	29.5	-35.3	-16.0	M0 V	13.1	8000.1
DM-19 5899 M2 5	A	29.5	-35.3	-16.0	M2 V	9.5	8000.0
DM-20 4123 M2 V	B	-12.3	-11.7	-6.6	M2 V	9.21	5700.1
DM-20 4125 K5 VE	A	-12.3	-11.7	-6.6	K5 V	7.06	5700.0
DM-20 643 K7 V	A	23.0	28.8	-13.5	K7 V	8	1420.0
DM-21 1051	B	5.9	22.3	-9.1	M0 V	11.1	1850.1
DM-21 1051 M1 5	A	5.9	22.3	-9.1	M1 V	9.04	1850.0
DM-21 1377 M1 VE	A	-0.7	17.3	-7.0	M1 V	9.33	2290.0
DM-21 3781 K6 V	A	-33.8	-17.1	-15.2	K6 V	7.67	5290.0
DM-21 4352 K5	A	-18.5	-40.6	-17.9	K5 VII	9.5	6220.0
DM-21 5081 G4 5	A	7.1	-45.6	-17.8	G4 V	5	7220.0
DM-21 6267 M2 5E	A	23.6	-9.1	-9.7	M2 V	9.5	8670.0
DM-21 6267 SB	B	23.6	-9.1	-9.7	M0 V	13	8670.1
DM-22 1210 K2 V	B	1.8	24.4	-10.2	K2 V	6.6	2160.1
DM-22 2345 F6 V	C	-27.7	33.8	-18.1	F6 V	5.8	3140.2
DM-22 6219 M0 5	A	45.7	-1.6	-18.6	M0 V	9.7	9110.0
DM-23 11940 K5 V	A	-32.9	-29.9	-19.9	K5 V	7	5650.0
DM-23 15935 G7 5	A	17.4	-30.8	-15.0	G7 V	5.6	7735.0
DM-23 17699 M1 5	A	22.2	-6.3	-9.8	M1 V	8.46	8840.0
DM-23 332 M0 5E	A	43.7	9.5	-19.2	M0 V	8.06	400.0
DM-23 693 M1 5E	A	29.2	15.3	-13.9	M1 V	8.6	790.0
DM-23 8646 G0 V	A	-34.0	23.7	-18.2	G0 V	4.2	3640.0
DM-23 9765 M	A	-28.7	6.7	-13.3	M0 V	12.1	4131.0
DM-24 12677 M2 5	A	-17.9	-38.4	-19.4	M2 V	9.6	6200.0
DM-24 15668 K5 5	A	19.0	-36.1	-18.3	K5 V	5.5	7700.0
DM-24 16193 G8 V	A	26.9	-33.0	-19.0	G8 V	5.6	7960.0
DM-25 225	B	39.4	6.0	-18.7	M0 V	5.7	250.1
DM-25 225 G5 V	A	39.4	6.0	-18.7	G5 V	5.7	250.0
DM-25 3913 K0 VE	A	-10.3	38.8	-19.5	K0 V	6	2590.0
DM-26 12026 K1 VE	A	-3.3	-15.6	-8.0	K1 V	6.38	6630.0
DM-26 12026 K1 VE	B	-3.3	-15.6	-8.0	K1 V	6.41	6630.1
DM-26 12036 K5 VE	C	-3.3	-15.6	-7.9	K5 V	7.66	6640.0
DM-26 16501 K	A	41.2	-9.7	-20.9	K0 VII	11.6	8910.0
DM-26 828 G5 V	A	35.0	23.8	-20.9	G5 V	5.6	950.0
DM-26 8883 K5 V	A	-28.4	0.5	-14.8	K5 V	7	4530.0

Star Name		X	Y	Z	Spectra	Magn	No.
DM-27 14659 K1 V	A	13.1	-20.3	-12.5	K1 V	6.13	7850.0
DM-27 14659 SB	B	13.1	-20.3	-12.5	M0 V	13	7850.1
DM-28 16676 M3	A	21.5	-29.5	-19.4	M3 V	11.1	7910.0
DM-28 302 M	A	20.5	5.0	-40.8	M0 V	11.8	460.0
DM-28 694 K2 V	A	31.5	19.7	-20.2	K2 V	6.5	861.0
DM-29 8019 M4	A	-33.0	19.1	-22.2	M4 VI	10	3770.0
DM-30 19175 K5 V	A	33.5	-14.6	-21.4	K5 V	7.1	8620.0
DM-30 19255 K5 VE	A	36.2	-13.6	-22.3	K5 V	7.2	8680.0
DM-31 17815 M0 VE	A	15.9	-18.7	-15.1	M0 V	8.87	8030.0
DM-31 325 K3 V+	A	39.1	8.7	-23.8	K3 V	6.4	420.0
DM-31 325 SB	B	39.1	8.7	-23.8	M0 V	13	420.1
DM-31 6229 K0 V	A	-21.1	27.1	-21.0	K0 V	5.9	3090.0
DM-31 9113 M2.5	A	-30.1	3.5	-19.2	M2 VI	9.6	4330.0
DM-32 16135 M4.5 5E	A	15.5	-18.7	-15.6	M4 V	11.09	7990.0
DM-32 16135 M4.5 5E	B	15.5	-18.7	-15.6	M4 V	11.2	7990.1
DM-32 17321 K5 VE	A	20.7	-6.2	-13.5	K5 V	7.03	8790.0
DM-32 5613 A 7S	A	-15.6	18.6	-15.7	A0 VII	12.3	3180.0
DM-32 8179 K0 V	A	-26.0	3.1	-16.8	K0 V	6.09	4320.0
DM-34 11626 K3 V	A	-3.7	-18.8	-13.4	K3 V	7.03	6670.0
DM-34 11626 K5 V	B	-3.7	-18.8	-13.4	K5 V	7.9	6670.1
DM-34 11626 M2	C	-3.7	-18.8	-13.4	M2 V	10.89	6670.2
DM-34 4036 F5 V	A	-17.9	34.0	-22.8	F5 V	4.4	2920.0
DM-34 4036 K3	B	-17.9	34.0	-22.8	K3 VI	7	2920.1
DM-35 3233	B	-9.3	37.3	-27.4	M0 V	5.1	2550.1
DM-35 3233 F8 V	A	-9.3	37.3	-27.4	F8 V	4.8	2550.0
DM-36 13940 K3 V	A	7.8	-12.6	-10.9	K3 V	6.56	7830.0
DM-36 13940 M5 5	B	7.8	-12.6	-10.9	M5 V	12.7	7830.1
DM-36 2458 M2	A	1.7	27.8	-20.6	M2 V	11.5	2180.0
DM-37 10500 A 7S	B	-19.8	-29.3	-27.4	A0 VII	12.1	5990.1
DM-37 10500 G6 V	A	-19.8	-29.3	-27.4	G6 V	5.34	5990.0
DM-37 10765 M4	A	-8.7	-17.8	-15.2	M4 VI	11.2	6180.0
DM-37 10765 M7	B	-8.7	-17.8	-15.2	M7 V	16.6	6180.1
DM-37 8437 G3 5	A	-33.9	-10.6	-27.3	G3 V	4.6	5012.0
DM-38 1058 M5	A	22.6	24.8	-26.6	M5 VI	11.4	1300.0
DM-38 4789 K1 V	A	-17.2	20.1	-21.3	K1 V	6.46	3200.0
DM-39 10940	B	-10.6	-36.7	-31.5	M0 VI	9.5	6460.1
DM-39 10940 K5 V	A	-10.6	-36.7	-31.5	K5 V	7.6	6460.0
DM-39 14192 M0 VE	A	7.2	-6.5	7.8	M0 V	8.75	8250.0
DM-39 7301 G5 V	A	-25.4	1.7	-21.5	G5 V	4.85	4420.0
DM-40 5404 M	A	-20.9	14.9	-22.3	M0 V	12.3	3580.0
DM-40 9712 M4	A	-8.9	-11.5	-12.7	M4 VI	11.2	5880.0
DM-41 1288 K	A	16.1	29.6	-29.3	K0 VII	9.5	1612.0
DM-41 328 G2 V	A	25.1	11.5	25.2	G2 V	4.66	670.0
DM-42 249	B	31.6	6.0	-29.2	M0 VI	8.3	320.1
DM-42 249 K5 V	A	32.4	6.2	-30.0	K5 V	7.8	320.0
DM-42 5678 K5 V	A	-20.2	12.9	-22.6	K5 V	7.62	3700.0
DM-43 12343 K7 VE	A	1.2	-32.4	-30.8	K7 V	7.71	7070.0
DM-43 7228 K5 VE	A	-28.8	2.6	-28.1	K5 V	7.3	4350.0
DM-44 3045 M4.5	A	-5.0	19.6	-19.8	M4 V	11.8	2570.0
DM-44 3045 M4.5	B	-5.0	19.6	-19.8	M4 V	12	2570.1
DM-44 775 K6 VE+	A	19.2	15.0	-23.6	K6 V	8.4	1030.0
DM-44 775 SB	B	19.2	15.0	-23.6	M0 V	13	1030.1
DM-45 1184 M4.5 B	A	16.6	21.9	-27.4	M4 VI	10.7	1450.0
DM-45 13677 M0 V	A	7.5	-11.8	-14.2	M0 V	9.04	7840.0
DM-45 5378 M4	A	-17.3	11.8	-21.4	M4 VI	10.8	3670.0
DM-45 5627 M5.5	A	-25.9	15.4	-31.4	M5 VI	11	3750.0
DM-45 7872 M1	A	-29.7	-4.4	-30.7	M1 V	10.9	4770.0
DM-46 11370 G8 V	A	-3.4	-16.8	-18.1	G8 V	6.12	6660.0
DM-46 11370 M0 V	B	-3.4	-16.8	-18.1	M0 V	9.28	6660.1
DM-46 11540 M4	A	-1.6	-10.3	-11.1	M4 VI	11.03	6740.0
DM-46 12902	B	10.1	-30.8	-33.5	M0 VI	9.3	7500.1
DM-46 12902 K9 V	A	10.1	-30.8	-33.5	K9 V	9.3	7500.0
DM-46 3046	B	-8.8	25.3	-28.7	M0 V	7.5	2690.1
DM-46 3046 K2 V	A	-8.8	25.3	-28.7	K2 V	6.7	2690.0
DM-46 943 K4	A	19.8	21.7	-31.3	K4 VII	11.9	1260.0
DM-47 13928 G2 V	A	25.0	-16.8	-33.0	G2 V	4.9	8380.0
DM-47 502 M0	A	30.8	13.9	-36.0	M0 V	10	652.0
DM-48 1011 K7 V	A	14.6	19.6	-27.8	K7 V	8.29	1460.0
DM-48 11837 M0	A	-3.3	-25.8	-29.5	M0 V	10.1	6800.0
DM-48 12818 M4	A	6.2	-25.4	-29.4	M4 VI	10.6	7390.0
DM-49 2340 K0	A	-4.7	29.5	-35.7	K0 VII	9.2	2400.0

Star Name		X	Y	Z	Spectra	Magn	No.
DM-51 10924 M	B	-3.5	-23.6	-30.1	M0 V	14.4	6760.1
DM-51 10924 M0	A	-3.5	-23.6	-30.1	M0 V	10.1	6760.0
DM-51 12998 K2 V	A	23.4	-17.5	-36.3	K2 V	6.4	8330.0
DM-51 13128 M0	A	25.1	-15.5	-36.9	M0 VI	9.6	8410.0
DM-51 532 K0 V	A	19.4	12.2	-28.5	K0 V	5.86	860.0
DM-51 5974 K0	A	-16.9	1.4	-21.3	K0 VII	11.7	4380.0
DM-51 6859 M3	A	-16.5	-2.6	-21.2	M3 V	11.06	4790.0
DM-53 8617 K7 V	A	14.9	-18.1	-31.0	K7 V	8.45	7980.0
DM-53 889 K5 V	A	10.9	22.0	-33.2	K5 V	7.15	1670.0
DM-54 487 M	A	21.3	14.3	-35.8	M0 V	12	930.0
DM-54 9222	B	21.0	-10.4	-32.2	M0 VI	9.6	8530.1
DM-54 9222 G1 V	A	21.0	-10.4	-32.2	G1 V	4.9	8530.0
DM-56 328 K5 VE	B	10.7	4.8	-17.8	K5 V	6.83	660.1
DM-57 6303 K0 V	A	-12.4	-23.6	-41.7	K0 V	6.64	6150.0
DM-58 5564 K3 V	A	-13.4	-9.0	-27.0	K3 V	6.74	5420.0
DM-58 7076 K	A	2.7	-24.4	-39.7	K0 VII	11.1	7140.0
DM-58 8327 G4 V	A	22.7	-10.5	-40.1	G4 V	4.5	8570.0
DM-59 2351 M1	A	-12.0	10.0	-27.2	M1 V	11	3410.0
DM-60 3532 K7 V	A	-17.2	2.8	-31.8	K7 V	7.34	4280.0
DM-60 3532 M0 VE	B	-17.2	2.8	-31.8	M0 V	8.36	4280.1
DM-60 7821 K	A	17.6	-10.7	-35.8	K0 VII	10.9	8420.0
DM-62 780 M0 5EP	A	2.4	19.5	37.4	M0 V	8.45	2150.0
DM-63 110 K5 V	A	30.6	38.5	3.1	K5 V	7.2	1430.0
DM-68 1095 K0 V	A	-17.5	-2.4	-44.6	K0 V	6.3	4720.0
DM-68 47 K	A	10.4	3.2	-26.7	K0 VII	11.5	540.0
DM-73 1672 K3 V	A	10.4	-1.1	-34.3	K3 V	6.9	9020.0
Davout M5	A	-1.3	-10.9	-10.7	M5 V	12.8	6820.0
Delta Aquilae F0 IV	A	16.4	-43.5	2.4	F0 IV	2.6	7600.0
Delta Aquilae SB	B	16.4	-43.5	2.4	M0 V	13	7600.1
Delta Eridani K0 IVE	A	16.5	23.7	-5.1	K0 IV	3.77	1500.0
Delta Pavonis G8 V	A	3.8	-6.5	-17.1	G8 V	4.76	7800.0
Delta Trianguli G0 VE+	A	23.2	15.3	18.7	G0 V	4.8	920.0
Delta Trianguli SB	B	23.2	15.3	18.7	M0 V	13	920.1
Denebola A3 V	A	-41.4	2.4	10.9	A3 V	1.54	4480.0
Ellis G0 V	A	-6.5	-14.3	17.6	G0 V	10.97	6230.0
Epsilon Ceti	B	35.7	29.2	-9.9	M0 V	4.8	1054.1
Epsilon Ceti F8 V	A	35.7	29.2	-9.9	F8 V	4.77	1054.0
Epsilon Eridani K2 VE	A	6.4	8.4	-1.9	K2 V	6.13	1440.0
Epsilon Eridani UC	B	6.4	8.4	-1.9	M0 V	13	1440.1
Epsilon Indi K5 VE	A	5.2	-3.1	-9.4	K5 V	7	8450.0
Eta Bootis G0 IV	A	-26.8	-14.3	10.2	G0 IV	2.72	5340.0
Eta Bootis SB	B	-26.8	-14.3	10.2	M0 V	13	5340.1
Eta Cassiopei G0 V+	A	10.0	2.0	16.1	G0 V	4.6	340.0
Eta Cassiopei M0 V	B	10.0	2.0	16.1	M0 V	8.66	340.1
Eta Cephei K0 IVE	A	14.1	-16.3	39.8	K0 IV	2.72	8070.0
Fomalhaut A3 V	A	18.2	-5.4	-10.9	A3 V	2.03	8810.0
G 5-43 M3 6	A	22.7	29.3	9.3	M3 VI	11.9	1433.0
G 7-17 M9 7	A	22.2	38.0	14.8	M9 V	14.7	1572.0
G 24-16 M6 5E	A	18.1	-24.3	5.0	M6 V	13.2	7912.0
G 29-38 A 7	A	42.2	-6.3	3.7	A0 VII	12.5	8952.0
G 44-42 M4	A	-35.5	11.2	9.4	M4 V	13.5	4030.0
G 47-9 M5	B	-26.2	28.5	21.0	M5 V	12.5	3240.1
G107-69 M6 6	A	-10.8	26.8	32.4	M6 VI	13.2	2752.0
G107-69 SB M5 5	B	-10.8	26.8	32.4	M5 V	15.8	2752.1
G107-70 A 7	C	-10.1	25.1	30.4	A0 VII	15.4	2752.2
G107-70 SB M5 V	D	-10.3	25.1	30.4	M5 V	15.4	2752.3
G195-19 A D	A	-20.6	18.4	37.5	A0 VII	13	3391.0
G197-50 3 C	B	-24.4	-1.1	34.5	M3 V	14.7	4580.1
G200-38 K1	C	-23.1	-16.8	38.5	K1 VII	12.7	5490.2
Gamma Leporis F6 V	A	1.8	24.4	-10.2	F6 V	4.05	2160.0
Gamma Pavonis F8 V	A	8.9	-7.4	-25.6	F8 V	4.53	8270.0
Gamma Serpenti F6 V	A	-20.3	-33.1	10.9	F6 V	3.4	6030.0
Gamma Virginis F0 V	A	-32.5	-5.6	-0.7	F0 V	3.46	4820.0
Gamma Virginis F0 V	B	-32.5	-5.6	-0.7	F0 V	3.48	4820.1
Groombridge 34 M1 V	A	8.1	0.5	7.8	M1 V	10.32	150.0
Groombridge 34 M6 V	C	8.3	0.5	7.9	M6 V	13.29	150.2
Groombridge 34 SB	B	8.3	0.5	7.9	M0 V	13	150.1
Haifeng M8 5E	A	13.0	7.3	3.3	M8 V	13.91	831.0
Henry's Star G8 VI	A	-22.7	0.9	17.7	G8 VI	6.71	4510.0
Hochbaden K6 5	A	-24.9	-12.6	14.3	K6 V	7.26	5280.0
Hunjiang M4 V	A	11.4	0.1	-8.9	M4 V	10.39	10.0

Star Name		X	Y	Z	Spectra	Magn	No.
Iota Horologii G3 IV	A	22.3	18.9	-36.2	G3 IV	4.63	1080.0
Iota Pegasi F5 V	A	34.4	-19.0	18.4	F5 V	3.14	8480.0
Iota Pegasi SB	B	34.4	-19.0	18.4	M0 V	13	8480.1
Iota Persei G4 V	A	17.0	17.8	28.7	G4 V	3.72	1240.0
Iota Piscium F7 V	A	45.4	-4.6	4.2	F7 V	3.39	9040.0
Iota Ursae Majoris	D	-22.9	23.6	36.8	M0 V	10.2	3310.3
Iota Ursae Majoris A7 V	A	-22.9	23.6	36.8	A7 V	2.24	3310.0
Iota Ursae Majoris M1 5	B	-22.9	23.6	36.8	M1 V	9.9	3310.1
Iota Ursae Majoris SB	C	-22.9	23.6	36.8	M0 V	13	3310.2
Kapetyn's Star M0 V	A	1.9	8.7	-9.1	M0 V	10.85	1910.0
Kappa Reticuli G5 VE	A	19.8	23.0	1.6	G5 V	4.99	1370.0
Kimanjano K4 V	A	-20.8	-3.6	14.3	K4 V	8.2	4802.0
King K7 V	A	-4.0	-24.2	0.9	K7 V	8.15	6730.0
Kruger 60 A M3 5	A	6.3	-2.8	10.8	M3 V	11.87	8600.0
Kruger 60 B M4.5 5E	B	6.3	-2.8	10.8	M4 V	13.3	8600.1
L 24 52 A 7	A	4.1	-4.0	-40.9	A0 VII	13	8201.0
L 49-19 K	A	6.3	-2.0	-25.9	K0 VII	12.1	8770.0
L 68-27 M	B	-6.9	-0.8	-20.3	M0 V	14.4	4670.1
L 68-28 K0	A	-6.9	-0.8	-20.3	K0 VII	12.5	4670.0
L 74-113 M	A	-4.7	-13.4	-45.9	M0 V	12.2	6370.0
L 89-27 M	A	16.5	10.1	-45.5	M0 V	12.6	850.0
L 97-12	A	-3.4	6.3	-17.5	M5 V	15.5	2930.0
L 115-21 M	A	8.8	-15.5	-39.7	M0 V	12.5	7740.0
L 115-21 M	B	8.8	-15.5	-39.7	M0 V	13.8	7740.1
L 119-21 K	A	14.4	-5.7	-34.2	K0 VII	12.7	8650.0
L 127-97 M	A	12.8	11.8	-35.7	M0 V	10.3	1180.0
L 145-141 A0 7	A	-6.8	.5	-14.3	A0 VII	13.01	4400.0
L 182-44 M	A	-3.5	23.4	-38.6	M0 V	12.2	2380.0
L 192-72 M C	A	-22.5	4.5	-35.7	M0 V	12.2	4220.0
L 258-146 K	A	-20.3	-9.6	-30.7	K0 VII	14	5240.0
L 283-7 A	B	25.2	-15.5	-36.9	A0 V	11.7	8410.1
L 316-62 M3	A	-21.0	21.3	-32.4	M3 V	13.7	3330.0
L 339-19 G	A	-7.7	-20.3	-22.3	G0 VII	14.5	6330.0
L 347-14 M7.5	A	4.3	-12.3	-13.4	M7 V	14.9	7540.0
L 355-62 M	A	21.0	-13.3	-26.9	M0 V	11.9	8386.0
L 362-81 A 7S	A	19.4	-0.1	-18.4	A0 VII	13.48	9150.0
L 396-7 M C	A	-28.8	3.8	-25.1	M0 V	12.5	4310.0
L 480-69 K	A	-18.9	-25.3	-24.4	K0 VII	13.4	5900.0
L 489-58	B	7.3	-33.2	-27.2	M0 V	15	7320.1
L 489-58 G0 6	A	7.3	-33.2	-27.2	G0 VI	11.4	7320.0
L 597-31 M	A	-5.6	42.3	-21.8	M0 V	11.9	2360.0
L 674-15 M 5	A	-9.6	14.9	-7.0	M0 V	15	3000.0
L 675-81 M	A	-16.5	19.8	-11.2	M0 V	13.5	3170.0
L 678-39 K	A	-20.0	14.8	-9.8	K0 VII	13.1	3570.0
L 714-88 M5	A	32.0	-23.3	-18.0	M5 V	14	8360.0
L 715-89 M	A	33.5	-19.6	-14.0	M0 V	12.8	8430.0
L 717-22 M4 5E	C	23.6	-9.1	-9.7	M4 V	11.8	8670.2
L 724-32 M5 5E	A	20.4	6.3	-6.7	M5 V	12.4	541.0
L 736-30 M3	A	10.9	35.7	-12.1	M3 V	12.1	1800.0
L 737-9 M5.5	A	7.8	33.0	-11.2	M5 V	11.9	1900.0
L 745-46 F0 7	A	-13.8	30.1	-10.4	F0 VII	12.9	2830.0
L 745-46 M 5	B	-13.8	30.1	-10.4	M0 V	18.4	2830.1
L 768-119 M5	A	-16.0	-22.7	-9.8	M5 V	11.9	5950.0
L 789-6 M7 5E	A	9.5	-3.7	-2.9	M7 V	14.6	8660.0
L 820-19	B	-26.4	28.3	-8.9	M0 V	12.3	3260.1
L 820-19 M6	A	-26.4	28.3	-8.9	M6 V	12	3260.0
L 824-28 M0 5	A	-33.7	16.7	-7.8	M0 V	10.8	3860.0
L 829-26 M	A	-38.4	2.5	-7.9	M0 V	13	4430.0
L 850-62 M5.5	A	11.6	-43.1	-10.9	M5 V	13.9	7410.0
L 856-54	B	27.0	-28.8	-10.1	M0 V	15.2	8100.1
L 856-54 M5	A	27.0	-28.8	-10.1	M5 V	14	8100.0
L 870-2 A 7	A	37.5	16.6	-3.8	A0 VII	12.3	640.0
L 886-6 A 7	A	-11.9	44.7	-5.2	A0 VII	15.2	2610.0
L 897-16 M C	A	-29.5	11.1	-3.7	M0 V	12.8	3990.0
L 901-10 M4.5	A	-39.0	1.5	-4.9	M4 V	11.6	4520.0
L 935-50 A	A	41.6	-8.9	-5.1	A0 V	14.9	8931.0
L 968-22 M0 5	A	-24.9	13.0	-1.2	M0 V	11.12	3810.0
L 989-20	B	-8.9	-39.3	-1.3	M0 V	11.7	6600.1
L 989-20 G	A	-8.9	-39.3	-1.3	G0 VII	11.5	6600.0
L 997-21 A 7S	A	16.8	-31.2	-0.8	A0 VII	13.51	7720.0
L1064-75 M5	A	2.9	-49.3	1.3	M5 VI	11.6	7083.0
L1113-55 M4 5E	A	2.9	-49.3	1.4	M5 VI	11.6	7083.0
L1154-29 M5 5	A	35.9	2.0	8.5	M5 V	13.5	120.0
L1272-21 M6	B	-20.0	-26.8	10.7	M6 V	15	5890.1
L1303-10 M6	A	17.6	13.6	10.2	M6 V	15.1	1020.0
L1346-53 M4	A	-15.4	-26.8	11.6	M4 V	14.2	6090.0
LP101-15 M4 5E	A	-9.9	-24.9	41.5	M4 V	12	6301.0
LP101-15 SB	B	-9.9	-24.9	41.5	M0 V	13	6301.1
LP101-16 7	C	-9.9	-24.9	41.5	M0 V	14.1	6301.2
LP425-140	A	-14.1	17.2	7.4	M6 V	19.9	3161.0
LP658-2 K 7E	A	0.6	19.5	-1.5	K0 VII	15.62	2232.0
Lacaille 9352 M2 VE	A	8.9	-2.3	-6.8	M2 V	9.59	8870.0
Lambda Aurigae G0 V	A	7.1	36.5	31.3	G0 V	3.84	1970.0
Lambda Serpenti G0 V	A	-19.3	-28.6	4.5	G0 V	4.3	5980.0
Lowne 1	A	18.9	40.3	15.6	M6 V	15	1681.0
Mu Arae G5 V	A	-2.4	-27.2	-34.7	G5 V	4.9	6910.0
Mu Cassiopei G5 VI	A	13.9	4.0	20.4	G5 VI	5.75	530.0
Mu Cassiopei M8 5	B	13.9	4.0	20.4	M8 V	8.75	530.1
Mu Herculis G5 IV	A	-1.6	-23.3	12.2	G5 IV	3.89	6950.0
Mu Herculis M4 5	C	-1.6	-23.3	12.2	M4 V	11.26	6950.2
Mu Herculis M4 5E	B	-1.6	-23.3	12.2	M4 V	10.8	6950.1
Neubayern K7 VE	A	-8.4	4.4	11.1	K7 V	8.32	3800.0
New Melbourne M1 5	A	-2.6	-24.2	8.1	M1 V	10.14	6860.0
Nu Phoenicis F8 V	A	29.5	9.7	-32.1	F8 V	4.2	550.0
Nyotekundu M8 5E	A	-7.3	2.1	0.9	M8 V	16.68	4060.0
Omicron2 Eridani K1 VE	A	7.0	14.0	-2.2	K1 V	5.99	1660.0
Pi3 Orionis F6 V	A	7.7	23.6	3.0	F6 V	3.76	1780.0
Pollux K0 III	A	-13.4	27.8	16.5	K0 III	.98	2860.0
Procyon A F5 IV	A	-4.7	10.3	1.0	F5 IV	2.64	2800.0
Procyon B F 7	B	-4.7	10.3	1.0	F0 VII	13	2800.1
Proxima Centauri M5 5E	A	-1.6	-1.2	-3.8	M5 V	15.45	5510.0
Psi Capricorni F4 V	A	22.3	-26.0	-16.3	F4 V	3.7	8050.0
Psi5 Aurigae G0 V	A	-6.6	34.5	33.5	G0 V	4.37	2450.0
Qinyuan M5.5 5	A	7.6	3.4	-2.8	M5 V	15.27	650.0
Queen Alice's Star K4 V	A	-13.7	-2.1	14.3	K4 V	8.2	4771.0
Red Speck M3 5	A	-3.2	-16.4	15.0	M3 V	10.91	6610.0
Rho Eridani K2 V	A	10.7	4.8	-17.8	K2 V	6.67	660.0
Ross 28 M5	A	11.6	22.2	32.7	M5 V	12.7	1640.0
Ross 41 M5	A	4.2	27.6	4.7	M5 V	12.78	2030.0
Ross 42 M4 5E+	A	6.0	45.4	7.9	M4 V	10.73	2060.0
Ross 42 SB	B	6.0	45.4	7.9	M0 V	13	2060.1
Ross 52 M5	A	-22.8	-21.2	13.6	M5 VI	11.5	5680.0
Ross 52 M5	B	-22.8	-21.2	13.6	M5 V	12.1	5680.1
Ross 64 M6	A	-2.4	24.4	10.6	M6 V	13.6	2320.0
Ross 92 M6	A	-26.8	19.0	13.4	M6 V	15.5	3590.0
Ross 119 M	A	-33.8	1.2	6.0	M0 V	14.1	4521.0
Ross 128 M5 5	A	-10.9	0.7	0.2	M5 V	13.5	4470.0
Ross 165	B	12.5	-25.9	14.6	M0 V	13.6	7660.1
Ross 165 M4.5 5	A	12.5	-25.9	14.6	M4 V	12.6	7660.0
Ross 188 M6	A	23.5	-30.8	30.6	M6 V	14.4	7920.0
Ross 193 M4 5E	A	33.8	-35.7	-4.4	M4 V	11	8120.0
Ross 226 M4	A	21.1	-6.5	39.4	M4 V	13.5	8780.0
Ross 248 M6 5E	A	7.3	-0.7	7.1	M6 V	14.8	9050.0
Ross 249 M1	A	27.8	-1.8	31.8	M1 V	11.5	9070.0
Ross 417 M5	A	-3.5	46.7	-5.5	M5 V	13.2	2313.0
Ross 486 M4 5	A	-36.2	-14.2	-1.3	M4 V	10.9	5120.0
Ross 486 M6 5	B	-36.2	-14.2	-1.3	M6 V	13.8	5120.1
Ross 508 M6	A	-21.8	-26.3	10.8	M6 V	14.8	5850.0
Ross 555 M4	A	32.2	16.6	-7.1	M4 VI	10.9	780.0
Ross 594 M7	A	9.9	23.2	21.0	M7 V	13.7	1700.0
Ross 614	B	-1.6	12.8	-0.7	M0 V	16.58	2340.1
Ross 614 M7 5E	A	-1.6	12.8	-0.7	M7 V	13.08	2340.0
Ross 619 M5 5	A	-11.4	18.0	3.3	M5 V	13.66	2990.0
Ross 627 F 7	A	-35.6	6.0	14.3	F0 VII	13.9	4270.0
Ross 695 M4 5	A	-28.1	-2.8	-9.2	M4 V	11.9	4650.0
Ross 802 M5	A	-20.9	-28.3	-8.8	M5 V	13.6	5920.0
Ross 845 M5.5 5E	A	-37.4	-23.9	-9.3	M5 V	12.8	5402.0
Ross 848 M5	A	-28.9	-19.8	-5.8	M5 V	12.8	5450.0
Ross 863 M3	A	-7.1	-28.9	11.7	M3 V	11.6	6550.0
Ross 867 M5 5E	B	-6.2	-33.0	16.7	M5 V	12.6	6690.1
Ross 868 M4 5E	A	-5.7	-30.6	15.4	M4 V	11.2	6690.0
Ross 974 K 6	A	-39.9	-10.6	-1.4	K0 VI	12.3	4950.0

Star Name		X	Y	Z	Spectra	Magn	No.
Ross 989 M4.5 5E	C	-11.3	27.6	21.9	M4 V	11.48	2770.2
Serurier M4.5 5E	A	1.7	-8.5	-3.9	M4 V	13.3	7290.0
Sigma Draconis K0 V	A	2.5	-6.0	17.3	K0 V	5.92	7640.0
Sirius A A1 V	A	-1.6	8.1	-2.5	A1 V	1.42	2440.0
Sirius B A 7	B	-1.6	8.1	-2.5	A0 VII	11.56	2440.1
Sol G2 V	A	0.0	0.0	0.0	G2 V	4.67	0.0
Tau Ceti G8 VP	A	10.1	4.8	-3.3	G8 V	5.72	710.0
Tau1 Eridani F6 V	A	33.9	29.1	-15.3	F6 V	3.7	1110.0
Theta Bootis F7 V	A	-23.9	-17.3	37.8	F7 V	3.22	5490.0
Theta Bootis M3.5	B	-23.9	-17.3	37.8	M3 VI	10.3	5490.1
Theta Centauri K0 III	A	-33.3	-20.0	-28.3	K0 III	0.9	5390.0
Theta Persei F7 V	A	20.6	17.4	31.1	F7 V	3.62	1070.0
Theta Persei M2 5E	B	20.6	17.4	31.1	M2 V	9.36	1070.1
UV Ceti M5.5 5F	B	7.6	3.4	-2.8	M5 V	15.8	650.1
V 371 Orionis M3 5	A	6.1	48.9	1.6	M3 V	10.8	2071.0
VB 1 M VII	C	1.7	24.4	-10.1	M0 V	13	2160.2
VB 4	B	-26.0	3.1	-16.8	M0 V	15	4320.1
VB 5	B	-25.4	1.7	-21.5	M0 V	15	4420.1
VB 8	C	-5.8	-19.2	-3.0	M0 V	17.69	6440.2
VB 9 M	B	4.0	-27.5	28.4	M0 V	14.5	7200.1
VB 10 M5 5E	B	5.9	-17.8	1.6	M5 V	19.3	7520.1
VB 11 C 7	B	33.8	-35.7	-4.4	M0 V	15.8	8120.1
Van Maanen's Star G1 7	A	13.3	2.7	1.2	G1 VII	14.26	350.0
Vega A0 V	A	3.1	-20.3	16.4	A0 V	0.5	7210.0
Vogelheim K3 V	A	-29.6	-5.9	19.4	K3 V	8	4841.0
WX Ursae Majoris M8 5E	B	-12.3	3.1	12.1	M8 V	15.88	4120.1
Wolf 47 M7 5EF	A	13.7	3.6	26.9	M7 V	13.81	510.0
Wolf 219 A 7	A	24.3	35.3	14.2	A0 VII	14.5	1510.0
Wolf 358 M5 5	A	-21.7	7.0	2.8	M5 V	12.42	4020.0
Wolf 414 M5	A	-41.1	-4.8	6.3	M5 VI	11.5	4690.0
Wolf 424	B	-13.8	-1.9	2.2	M0 V	15.2	4730.1
Wolf 424 M5.5 5E	A	-13.8	-1.9	2.2	M5 V	14.98	4730.0
Wolf 433 M4 5	A	-38.4	-6.2	8.2	M4 V	10.9	4800.0
Wolf 437 M4 5	A	-27.7	-5.6	4.9	M4 V	11.68	4860.0
Wolf 457 C 7	A	-38.5	-9.9	2.6	G2 VII	15.5	4920.0
Wolf 461 M5 5E	A	-34.9	-9.1	3.7	M5 V	13	4931.0
Wolf 461 SB	B	-34.9	-9.1	3.7	M0 V	13	4931.1
Wolf 489 K 7	A	-22.6	-9.9	1.7	K0 VII	15.36	5180.0
Wolf 534 M4	A	-35.7	-24.3	-5.4	M4 V	13.9	5430.0
Wolf 629 M4 6	A	-5.8	-19.2	-2.9	M4 VI	12.73	6430.0
Wolf 629 SB	B	-5.8	-19.2	-2.9	M0 V	13	6430.1
Wolf 906 M3	A	27.8	-28.1	-4.6	M3 VI	10.6	8160.0
Wolf 918 M3	A	24.7	-23.5	-8.2	M3 VI	10.5	8210.0
Wolf 922 M4.5 5E	A	18.9	-14.7	-4.3	M4 V	12.59	8310.0
Wolf 1039 M4	A	40.4	-5.1	0.0	M4 VI	10.6	8990.0
Wolf 1056 M4 5	A	34.7	5.5	20.5	M4 V	10.54	260.0
Wolf 1084 M5 5E	A	16.5	-19.5	36.6	M5 V	14.4	8020.0
Wolf 1421 M2 5	A	-18.3	36.9	15.4	M2 V	10.7	2890.0
Wolf 1466 M0.5	A	7.9	-48.0	-9.1	M0 V	10.5	7230.0
Wolf 1539 M4 5E	A	11.9	37.6	4.4	M4 V	11.6	1790.0
Wolf 1561 M4.5 5E	A	28.0	-13.9	-5.0	M4 V	13.6	8520.0
Wolf 1561 M5 5E	B	28.0	-13.9	-5.0	M5 V	14.6	8520.1
Xi Bootis G8 VE	A	-15.4	-14.0	7.2	G8 V	5.53	5660.0
Xi Bootis K4 VE	C	-15.4	-14.0	7.2	K4 V	7.69	5660.2
Xi Bootis SB	B	-15.4	-14.0	7.2	M0 V	15.0	5660.1
Xi Ursae Majoris G0 VE	A	-25.0	4.9	15.7	G0 V	4.9	4230.0
Xi Ursae Majoris G0 VE	C	-25.0	4.9	15.7	G0 V	5.38	4230.2
Xi Ursae Majoris SB	B	-25.0	4.9	15.7	M0 V	13.0	4230.1
Xi Ursae Majoris SB	D	-25.0	4.9	15.7	M0 V	13.0	4230.3
Xiuning M1 V	A	7.8	-6.1	-11.6	M1 V	10.32	8320.0
YY Geminorum K6 V	E	-15.6	36.9	25.0	K6 V	8.26	2780.4
YY Geminorum SB K6 V	F	-15.6	36.9	25.0	K6 V	9.8	2780.5
YZ Canis Minoris M4.5 5	A	-8.5	17.7	1.2	M4 V	12.29	2850.0
Zeta Doradus F8 V	A	6.1	24.9	-40.5	F8 V	4.1	1890.0
Zeta Draconis G0 V	A	-5.0	-11.0	-33.0	G0 V	4.7	6240.0
Zeta Draconis SB	B	-5.0	-11.0	-33.0	M0 V	13.0	6240.1
Zeta Herculis G0 IV	A	-9.2	-25.1	16.4	G0 IV	2.97	6350.0
Zeta Herculis K0 5	B	-9.2	-25.1	16.4	K0 V	5.57	6350.1
Zeta Tucanae G2 V	A	9.7	0.7	-21.2	G2 V	4.96	170.0
Zeta1 Reticuli G2 V	A	10.9	12.6	-32.6	G2 V	5.28	1360.0
Zeta2 Reticuli G1 V	A	10.9	12.7	-32.6	G1 V	4.98	1380.0

COMPANIONS

Many of the systems in the *Near Star List* contain binary or multiple stars. This companion list shows each multiple star in the *Near Star List* and indicates the names of all companion stars for it.

Name: Companions
26 Draconis G1 V A: 26 Draconis B
26 Draconis M0.5 5 B: 26 Draconis A
44 I Bootis G1 5 A: 44 I Bootis B, C
44 I Bootis G2 5 B: 44 I Bootis A, C
44 I Bootis SB G2 5 C: 44 I Bootis A, B
61 Cygni A K5 VE A: 61 Cygni A B, 61 Cygni B C
61 Cygni A UC B: 61 Cygni A A, 61 Cygni B C
61 Cygni B K7 VE C: 61 Cygni A A, 61 Cygni A B
70 Ophiuchi K0 VE A: 70 Ophiuchi B, DM+ 2 3482 C
70 Ophiuchi UC B: 70 Ophiuchi A, DM+ 2 3482 C
85 Pegasi G3 V A: DM+26 4734 B, C
AC+18 1890-112 M4 A: L1272-21 B
AC+20 1463-148 M2 6 A: AC+20 1463-154 B
AC+20 1463-154 M2 6 B: AC+20 1463-148 A
AC+32 54804 M5 5 A: AC+32 54804 B
AC+32 54804 M5 5 B: AC+32 54804 A
AC+32 86401 A 7 B: AC+32 86422 A
AC+32 86422 M5 5 A: AC+32 86401 B
AC+38 23616 M5 5E A: AC+38 23616 B
AC+38 23616 SB B: AC+38 23616 A
AC+39 57322 C: AC+39 57322 A, B
AC+39 57322 M3 5 B: AC+39 57322 A, C
AC+39 57322 M3 5E A: AC+39 57322 B, C
AC+39 60670 B: AC+39 60670 A
AC+39 60670 M0 5 A: AC+39 60670 B
AC+58 25001 M4 5 A: AC+58 25002 B
AC+58 25002 A D B: AC+58 25001 A
AC+65 6955 M3 5 A: AC+65 6955 B
AC+65 6955 SB B: AC+65 6955 A
AC- 7 342-397 M5 5 B: AC- 7 342-402 A
AC- 7 342-402 A 7WK A: AC- 7 342-397 B
Alpha Centauri G2 V A: Alpha Centauri B
Alpha Centauri K0 V B: Alpha Centauri A
Alpha Fornacis B: Alpha Fornacis A
Alpha Fornacis F8 IV A: Alpha Fornacis B
Augereau M2 VE A: WX Ursae Majoris B
Bessieres M2 VE A: Bessieres B
Bessieres UC B: Bessieres A
Beta Aquilae G8 IV A: Beta Aquilae B
Beta Aquilae M3 5 B: Beta Aquilae A
Beta Cassiopei F2 IV A: Beta Cassiopei B
Beta Cassiopei SB B: Beta Cassiopei A
Broward M5 5 A: DM-12 4523 B
Capella A G8 III A: Capella B B
Capella B F5 III B: Capella A A
Capella H A M2 5 A: Capella H B B
Capella H B M5 5 B: Capella H A A
Castor A A1 V A: Castor B, C, D, YY Geminorum E, F
Castor A SB A1 V B: Castor A, C, D, YY Geminorum E, F
Castor B A5 V C: Castor A, B, D, YY Geminorum E, F
Castor B SB A5 V D: Castor A, Castor B, C, YY Geminorum E, F
Catherine's Star B: Henry's Star A
Chi Draconis F7 V A: Chi Draconis B
Chi Draconis SB B: Chi Draconis A
Clarkesstar M4.5 5E A: DM- 8 4352 B, VB 8 C
DM+ 2 3482 K6 VE C: 70 Ophiuchi A, 70 Ophiuchi B
DM+ 4 4048 M3.5 VE A: VB 10 B
DM+ 5 1668 M5 5 A: DM+ 5 1668 B

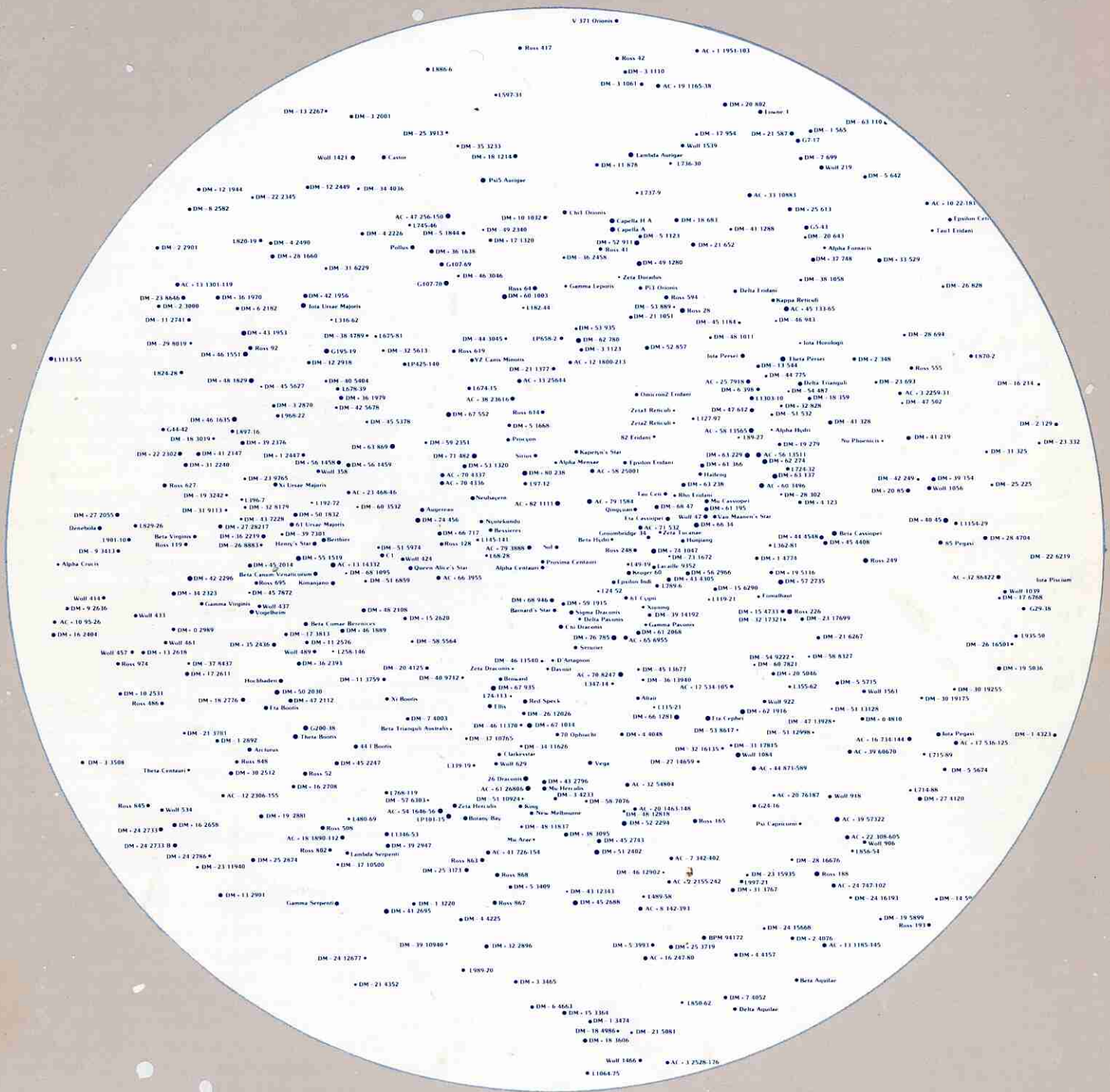
DM+ 5 1668 UC B: DM+ 5 1668 A
DM+ 5 3409 B: DM+ 5 3409 A
DM+ 5 3409 M1 V A: DM+ 5 3409 B
DM+ 6 398 K3 V+ A: DM+ 6 398 B, C
DM+ 6 398 M4 5 C: DM+ 6 398 A, DM+ 6 398 B
DM+ 6 398 UC B: DM+ 6 398 A, C
DM+10 1032 B: DM+10 1032 A
DM+10 1032 M3 5 A: DM+10 1032 B
DM+11 2576 M1 V A: DM+11 2576 B
DM+11 2576 SB B: DM+11 2576 A
DM+15 4733 M2 5E A: DM+15 4733 B
DM+15 4733 SB B: DM+15 4733 A
DM+17 2611 K2 V A: DM+17 2611 B
DM+17 2611 M2 5E B: DM+17 2611 A
DM+19 2881 K1 V A: DM+19 2881 B
DM+19 2881 SB B: DM+19 2881 A
DM+19 5116 M4 5E A: DM+19 5116 B
DM+19 5116 M6 5E B: DM+19 5116 A
DM+24 2733 M1 5 A: DM+24 2733 B
DM+24 2733 M2 5 B: DM+24 2733 A
DM+24 2786 G2 5 A: DM+24 2786 B
DM+24 2786 SB B: DM+24 2786 A
DM+26 4734 M5 V B: 85 Pegasi A, DM+26 4734 C
DM+26 4734 SB M3 V C: 85 Pegasi A, DM+26 4734 B
DM+27 2296 K6 5 B: Hochbaden A
DM+27 4120 M0 5E A: DM+27 4120 B
DM+27 4120 SB B: DM+27 4120 A
DM+28 1660 G8 V A: G 47-9 B
DM+31 2240 K9 VE A: DM+31 2240 B
DM+31 2240 M2 5 B: DM+31 2240 A
DM+31 3767 M1 5 A: DM+31 3767 B
DM+31 3767 M2 B: DM+31 3767 A
DM+35 2436 M0 5 A: DM+35 2436 B
DM+35 2436 M3 B: DM+35 2436 A
DM+36 1638 M3.5 5E A: DM+36 1638 B, Ross 989 C
DM+36 1638 SB B: DM+36 1638 A, Ross 989 C
DM+36 1979 B: DM+36 1979 A
DM+36 1979 G8 IV A: DM+36 1979 B
DM+39 2376 B: DM+39 2376 A
DM+39 2376 M2 5E A: DM+39 2376 B
DM+42 1956 B: DM+42 1956 A
DM+42 1956 F5 V A: DM+42 1956 B
DM+43 4305 M4.5 5E A: DM+43 4305 B
DM+43 4305 SB B: DM+43 4305 A
DM+45 2505 M3.5 B: Red Speck A
DM+45 2743 M2 5 A: VB 9 B
DM+45 4408 K9 5E A: DM+45 4408 B, C
DM+45 4408 M0 5E C: DM+45 4408 A, B
DM+45 4408 SB B: DM+45 4408 A, C
DM+47 2112 M3 5E A: DM+47 2112 B
DM+47 2112 M3 5E B: DM+47 2112 A
DM+48 2108 B: DM+48 2108 A
DM+48 2108 M2 5E A: DM+48 2108 B
DM+51 2402 K6 VE A: DM+51 2402 B
DM+51 2402 SB B: DM+51 2402 A
DM+53 1320 M0 VE A: DM+53 1321 B
DM+53 1321 M0 VE B: DM+53 1320 A
DM+55 1519 M2 5E A: G197-50 B
DM+59 1915 M4 5 A: DM+59 1915 B
DM+59 1915 M5 5 B: DM+59 1915 A
DM+61 195 M2 5E A: DM+61 195 B
DM+61 195 SB B: DM+61 195 A
DM+66 34 M2.5 5E A: DM+66 34 B
DM+66 34 M4.5 B: DM+66 34 A
DM+67 1014 K0 V A: DM+67 1014 B
DM+67 1014 SB B: DM+67 1014 A
DM+67 552 M1 5 A: DM+67 552 B, DM-22 2345 C
DM+67 552 SB B: DM+67 552 A, DM-22 2345 C
DM+67 935 M0 VE. A: DM+67 935 B
DM+67 935 M3 5 B: DM+67 935 A
DM+68 946 M3.5 V A: DM+68 946 B
DM+68 946 SB B: DM+68 946 A
DM+71 482 K5 V A: DM+71 482 B
DM+71 482 M0 5 B: DM+71 482 A
DM+74 1047 K3 V A: DM+74 1047 B, DM+74 1047 C
DM+74 1047 M2 C: DM+74 1047 A, DM+74 1047 B
DM+74 1047 SB B: DM+74 1047 A, DM+74 1047 C
DM+74 456 K5 5 A: DM+74 456 B
DM+74 456 M2 B: DM+74 456 A
DM- 1 565 K5 5E A: DM- 1 565 B, C
DM- 1 565 M3 5E+ B: DM- 1 565 A, C
DM- 1 565 SB C: DM- 1 565 A, B
DM- 2 2901 F6 V A: DM- 2 2902 B
DM- 2 2902 K0 B: DM- 2 2901 A
DM- 3 1061 K3 V A: DM- 3 1061 B
DM- 3 1061 M2 B: DM- 3 1061 A
DM- 3 2001 K2 VE A: DM- 3 2002 B
DM- 3 2002 K5 5 B: DM- 3 2001 A
DM- 3 2870 M2 5 A: DM- 3 2870 B
DM- 3 2870 SB B: DM- 3 2870 A
DM- 3 3508 K6 5 A: DM- 3 3508 B
DM- 3 3508 SB B: DM- 3 3508 A
DM- 5 1123 K3 V+ A: DM- 5 1123 B
DM- 5 1123 SB B: DM- 5 1123 A
DM- 5 1844 K6 5 A: DM- 5 1844 B
DM- 5 1844 M2 B: DM- 5 1844 A
DM- 6 4663 M2 5 A: DM- 6 4663 B
DM- 6 4663 SB B: DM- 6 4663 A
DM- 7 781 A 7 B: Omicron2 Eridani A, DM- 7 781 C
DM- 7 781 M4.5 5E C: Omicron2 Eridani A, DM- 7 781 B
DM- 8 2582 M0 5 A: DM- 8 2582 B
DM- 8 2582 SB B: DM- 8 2582 A
DM- 8 4352 M4.5 5 B: Clarkesstar A, VB 8 C
DM-12 2918 M4 5 A: DM-12 2918 B
DM-12 2918 M4 5 B: DM-12 2918 A
DM-12 4523 SB B: Broward A
DM-13 2267 B: DM-13 2267 A
DM-13 2267 G1 V A: DM-13 2267 B
DM-14 5936 K1 VE A: DM-14 5936 B
DM-14 5936 M0 B: DM-14 5936 A
DM-17 6768 B: DM-17 6768 A
DM-17 6768 M5 A: DM-17 6768 B
DM-19 3242 M C B: DM-19 3242 A
DM-19 3242 M0 5 A: DM-19 3242 B
DM-19 5899 B: DM-19 5899 A
DM-19 5899 M2 5 A: DM-19 5899 B
DM-20 4123 M2 V B: DM-20 4125 A
DM-20 4125 K5 VE A: DM-20 4123 B
DM-21 1051 B: DM-21 1051 A
DM-21 1051 M1 5 A: DM-21 1051 B
DM-21 6267 M2 5E A: DM-21 6267 B, L 717-22 C
DM-21 6267 SB B: DM-21 6267 A, L 717-22 C
DM-22 1210 K2 V B: Gamma Leporis A, VB 1 C
DM-22 2345 F6 V C: DM+67 552 A, DM+67 552 B
DM-25 225 B: DM-25 225 A
DM-25 225 G5 V A: DM-25 225 B
DM-26 12026 K1 VE A: DM-26 12026 B, DM-26 12036 C
DM-26 12026 K1 VE B: DM-26 12026 A, DM-26 12036 C
DM-26 12036 K5 VE C: DM-26 12026 A, B
DM-27 14659 K1 V A: DM-27 14659 B
DM-27 14659 SB B: DM-27 14659 A
DM-31 325 K3 V+ A: DM-31 325 B
DM-31 325 SB B: DM-31 325 A
DM-32 16135 M4.5 5E A: DM-32 16135 B
DM-32 16135 M4.5 5E B: DM-32 16135 A
DM-32 8179 K0 V A: VB 4 B
DM-34 11626 K3 V A: DM-34 11626 B, C
DM-34 11626 K5 V B: DM-34 11626 A, C
DM-34 11626 M2 C: DM-34 11626 A, B
DM-34 4036 F5 V A: DM-34 4036 B
DM-34 4036 K3 B: DM-34 4036 A
DM-35 3233 B: DM-35 3233 A
DM-35 3233 F8 V A: DM-35 3233 B
DM-36 13940 K3 V A: DM-36 13940 B

DM-36 13940 M5 5 B: DM-36 13940 A
DM-37 10500 A 7S B: DM-37 10500 A
DM-37 10500 G6 V A: DM-37 10500 B
DM-37 10765 M4 A: DM-37 10765 B
DM-37 10765 M7 B: DM-37 10765 A
DM-39 10940 B: DM-39 10940 A
DM-39 10940 K5 V A: DM-39 10940 B
DM-39 7301 G5 V A: VB 5 B
DM-42 249 B: DM-42 249 A
DM-42 249 K5 V A: DM-42 249 B
DM-44 3045 M4.5 A: DM-44 3045 B
DM-44 3045 M4.5 B: DM-44 3045 A
DM-44 775 K6 VE A: DM-44 775 B
DM-44 775 SB B: DM-44 775 A
DM-46 11370 G8 V A: DM-46 11370 B
DM-46 11370 M0 V B: DM-46 11370 A
DM-46 12902 B: DM-46 12902 A
DM-46 12902 K9 V A: DM-46 12902 B
DM-46 3046 B: DM-46 3046 A
DM-46 3046 K2 V A: DM-46 3046 B
DM-51 10924 M B: DM-51 10924 A
DM-51 10924 M0 A: DM-51 10924 B
DM-51 13128 M0 A: L 283-7 B
DM-54 9222 B: DM-54 9222 A
DM-54 9222 G1 V A: DM-54 9222 B
DM-56 328 K5 VE B: Rho Eridani A
DM-60 3532 K7 V A: DM-60 3532 B
DM-60 3532 M0 VE B: DM-60 3532 A
Delta Aquilae F0 IV A: Delta Aquilae B
Delta Aquilae SB B: Delta Aquilae A
Delta Trianguli G0 VE A: Delta Trianguli B
Delta Trianguli SB B: Delta Trianguli A
Epsilon Ceti B: Epsilon Ceti A
Epsilon Ceti F8 V A: Epsilon Ceti B
Epsilon Eridani K2 VE A: Epsilon Eridani B
Epsilon Eridani UC B: Epsilon Eridani A
Eta Bootis G0 IV A: Eta Bootis B
Eta Bootis SB B: Eta Bootis A
Eta Cassiopei G0 V A: Eta Cassiopei B
Eta Cassiopei M0 V B: Eta Cassiopei A
G 47-9 M5 B: DM+28 1660 A
G107-69 M6 6 A: G107-69 B, G107-70 C, D
G107-69 SB M5 5 B: G107-69 A, G107-70 C, D
G107-70 A 7 C: G107-69 A, B, G107-70 D
G107-70 SB M5 V D: G107-69 A, B, G107-70 C
G197-50 3 C B: DM+55 1519 A
G200-38 K1 C: Theta Bootis A, B
Gamma Leporis F6 V A: DM-22 1210 B, VB 1 C
Gamma Virginis F0 V A: Gamma Virginis B
Gamma Virginis F0 V B: Gamma Virginis A
Groombridge 34 M1 VE+ A: Groombridge 34 B, C
Groombridge 34 M6 V C: Groombridge 34 A, B
Groombridge 34 SB B: Groombridge 34 A, C
Henry's Star G8 VI A: Catherine's Star B
Hochbaden K6 5 A: DM+27 2296 B
Iota Pegasi F5 V A: Iota Pegasi B
Iota Pegasi SB B: Iota Pegasi A
Iota Ursae Majoris D: Iota Ursae Majoris A, B, C
Iota Ursae Majoris A7 V A: Iota Ursae Majoris B, C, D
Iota Ursae Majoris M1 5 B: Iota Ursae Majoris A, C, D
Iota Ursae Majoris SB C: Iota Ursae Majoris A, B, D
Kruger 60 A M3 5 A: Kruger 60 B B
Kruger 60 B M4.5 5E B: Kruger 60 A A
L 68-27 M B: L 68-28 A
L 68-28 K0 A: L 68-27 B
L 115-21 M A: L 115-21 B
L 115-21 M B: L 115-21 A
L 283-7 A B: DM-51 13128 A
L 489-58 B: L 489-58 A
L 489-58 G0 6 A: L 489-58 B
L 717-22 M4 5E C: DM-21 6267 A, B
L 745-46 F0 7 A: L 745-46 B
L 745-46 M 5 B: L 745-46 A
L 820-19 B: L 820-19
L 820-19 M6 A: L 820-19 B
L 856-54 B: L 856-54 A
L 856-54 M5 A: L 856-54 B
L 989-20 B: L 989-20 A
L 989-20 G A: L 989-20 B
L1272-21 M6 B: AC+18 1890-112 A
LP101-15 M4 5E A: LP101-15 B, LP101-16 C
LP101-15 SB B: LP101-15 A, LP101-16 C
LP101-16 7 C: LP101-15 A, B
Mu Cassiopei G5 VI A: Mu Cassiopei B
Mu Cassiopei M8 5 B: Mu Cassiopei A
Mu Herculis G5 IV A: Mu Herculis B, C
Mu Herculis M4 5 C: Mu Herculis A, B
Mu Herculis M4 5E B: Mu Herculis A, C
Omicron2 Eridani K1 VE A: DM- 7 781 B, C
Rho Eridani K2 V A: DM-56 328 B
Procyon A F5 IV A: Procyon B
Procyon B F 7 B: Procyon A
Qinyuan M5.5 5 A: UV Ceti B
Red Speck M3 5 A: DM+45 2505 B
Ross 42 M4 5E A: Ross 42 B
Ross 42 SB B: Ross 42 A
Ross 52 M5 A: Ross 52 B
Ross 52 M5 B: Ross 52 A
Ross 165 B: Ross 165 A
Ross 165 M4.5 5 A: Ross 165 B
Ross 193 M4 5E A: VB 11 B
Ross 486 M4 5 A: Ross 486 B
Ross 486 M6 5 B: Ross 486 A
Ross 614 B: Ross 614 A
Ross 614 M7 5E A: Ross 614 B
Ross 867 M5 5E B: Ross 868 A
Ross 868 M4 5E A: Ross 867 B
Ross 989 M4.5 5E C: DM+36 1638 A, B
Sirius A A1 V A: Sirius B
Sirius B A 7 B: Sirius A
Theta Bootis F7 V A: Theta Bootis B, G200-38 C
Theta Bootis M3.5 B: Theta Bootis A, G200-38 C
Theta Persei F7 V A: Theta Persei B
Theta Persei M2 5E B: Theta Persei A
UV Ceti M5.5 5F B: Qinyuan A
VB 1 M VII C: Gamma Leporis A, DM-22 1210 B
VB 4 B: DM-32 8179 A
VB 5 B: DM-39 7301 A
VB 8 C: Clarkesstar A, DM- 8 4352 B
VB 9 M B: DM+45 2743 A
VB 10 M5 5E B: DM+ 4 4048 A
VB 11 C 7 B: Ross 193 A
WX Ursae Majoris B: Augereau A
Wolf 424 B: Wolf 424 A
Wolf 424 M5.5 5E A: Wolf 424 B
Wolf 461 M5 5E A: Wolf 461 B
Wolf 461 SB B: Wolf 461 A
Wolf 629 M4 6 A: Wolf 629 B
Wolf 629 SB B: Wolf 629 A
Wolf 1561 M4.5 5E A: Wolf 1561 B
Wolf 1561 M5 5E B: Wolf 1561 A
Xi Bootis G8 VE A: Xi Bootis B, C
Xi Bootis K4 VE C: Xi Bootis A, B
Xi Bootis SB B: Xi Bootis A, C
Xi Ursae Majoris G0 VE A: Xi Ursae Majoris B, C, D
Xi Ursae Majoris G0 VE C: Xi Ursae Majoris A, B, D
Xi Ursae Majoris SB B: Xi Ursae Majoris A, C, D
Xi Ursae Majoris SB D: Xi Ursae Majoris A, B, C
YY Geminorum K6 V E: Castor A, B, C, D, YY Geminorum F
YY Geminorum SB K6 V F: Castor B, C, D, YY Geminorum E
Zeta Draconis G0 V A: Zeta Draconis B
Zeta Draconis SB B: Zeta Draconis A
Zeta Herculis G0 IV A: Zeta Herculis B
Zeta Herculis K0 5 B: Zeta Herculis A

The distance between any two stars can be determined using the formula:

$$D = \sqrt{(X_1-X_2)^2 + (Y_1-Y_2)^2 + (Z_1-Z_2)^2}$$

X_1 is the X coordinate of the first star; X_2 is the X coordinate of the second star. By finding the square root of the sum of the differences in X, Y, and Z coordinates, it is possible to determine the distance separating the stars.



NEAR STAR MAP