Special Supplement 2
Exotic Atmospheres

TRAVELLER®

Science-Fiction Adventure in the Far Future

Game Designers' Workshop

ROLE-PLAYING FFE GAMES

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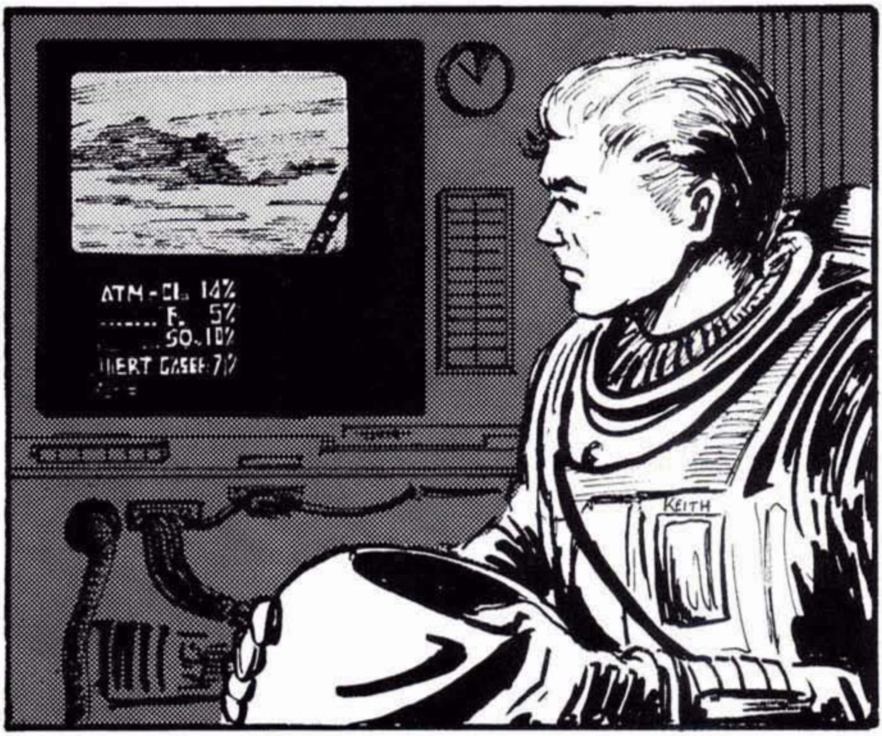


This Special Supplement for **Traveller**, *Exotic Atmospheres,* is a brief overview of the various types of atmospheres found on alien worlds which have been classified as exotic, corrosive, or insidious. Where the basic rules for **Traveller** issue a blanket statement to generally cover each type of atmosphere, this examination will discuss some specific atmospheric compositions, the special hazards they pose, and the picture they give us of the worlds on which each is found.

Referees are encouraged to use this information to paint a more vivid image of the sort of environment in which **Traveller** characters are adventuring. The term insidious atmosphere is quite sufficient in game terms, but it is far more descriptive if the referee reports that the players are about to debark on a hydrogen-atmosphere world where subtle hydrogen seepage could cause a dangerously explosive air mix inside a character's vacc suit, which could be ignited by a spark from the suit's electrical system. With the introduction of this type of detail, there is much more room for the development of interesting problems, and far more science fiction flavor to the resulting game.

ATMOSPHERES

Few worlds will be found where a single chemical makes up the entire atmosphere. Most atmospheres have a complex gas mix which will include a variety of specific elements, some in great amounts, others barely detectable. Atmospheric mixes include active and inert gases. On Earth, oxygen (O_2) is active, but forms less than 25% of the total atmosphere around us. Three times as much is nitrogen (N_2), plus a few trace elements such as argon. These inert gases are not usually required by animal or plant life, and take no part in the chemical reactions essential for life (except for nitrogen, a special case). They are, nonetheless, part of the atmosphere.

In this booklet, when we refer to a specific gas such as methane making up an atmosphere, we are referring to the active element, which may make up only a fraction of the total atmospheric mix.

EXOTIC ATMOSPHERES

The *Traveller Book* defines exotic atmospheres as requiring the use of oxygen tanks, but not protective suits. In actual fact, some additional protective gear may be required in some instances, as noted in the specific descriptions below.

The basic definition indicates that exotic atmospheres will be found on worlds which have a fairly normal pressure and temperature range. Thus the worlds in question will be more or less Earth-like in everything but atmosphere.

Exotic atmospheres may be further broken down by the referee in much the same way as breathable atmospheres are. If this is desired, use the table below.

The table yields some data which is useful mostly for color — that which deals with the relative pressure of the atmosphere — plus information which is important to the classification of the atmospheric contents. Terms such as thin, standard, etc., refer strictly to atmospheric pressure, not to its composition. Atmospheres indicated as being irritant are borderline cases somewhere between exotic and corrosive atmospheres, and might require more than just an oxygen supply to keep characters alive and healthy.

Exotic Atmosphere Table (2D)

Die Roll	*Atmosphere*
2	Very Thin, Irritant
3	Very Thin
4	Thin, Irritant
5	Thin
6	Standard
7	Standard, Irritant
8	Dense
9	Dense, Irritant
10	Very Dense
11	Very Dense, Irritant
12	Occasional Corrosive

A roll of 12 Occasional corrosive, indicates an atmosphere which is normally exotic, but under the right conditions is far more dangerous. An example might be a nitrogen atmosphere which occasionally precipitates nitric acid. The atmosphere itself might be perfectly safe (with an oxygen supply), or only mildly irritant . . . a different matter entirely.

Some of the more common exotic atmospheres are discussed below.

Carbon Dioxide (CO_2): A non-irritant component of exotic atmospheres, CO_2 will be commonly occurring, either by itself or in various combinations. Earth itself once had an atmosphere which was mostly carbon dioxide, before certain organisms learned to use photosynthesis to break down CO_2 and release oxygen into the air.

Planets with carbon dioxide in the atmosphere may be worlds in the very early stages of developing Earth-like life (though within a mere few hundreds of millions of years the atmosphere will have changed completely), or they may have evolved life in a completely alien direction — with life forms which draw their energy from sunlight (without using photosynthetic reactions), or from thermal, radioactive, chemical, or even more unusual sources. Worlds with CO_2 in the atmosphere may not have developed life at all.

Carbon dioxide atmospheres have the property of trapping heat, causing a process known as the greenhouse effect, which can cause planetary temperatures to rise far over the ranges in which humans could flourish without complete protective equipment. In order for an atmosphere of this kind to exist at a point defined as exotic (rather than some more extreme condition), the world will probably be rather distant from its star, and will probably have a fairly low pressure (very thin or thin). The hydrographic percentage of such a world would probably also be rather low — say in the region of 30% or less. All these factors would allow heat to radiate back from the planet despite the heat-retentive properties of CO_2. This information can help us visualize the planet quite effectively.

An exotic CO_2 atmosphere on a planet with more tropical conditions — warmer temperatures, greater hydrosphere, etc. — would be poised right on the brink of a runaway greenhouse effect which, within a few centuries at most, would turn the world into a hostile inferno. This might be put to good use by a referee, who could set an adventure on such a world against the backdrop of scientific research into the greenhouse effect — which will surely interest planetologists as much in the 50th century as it would today.

Nitrogen (N_2): A (usually) non-irritant component of exotic atmospheres, nitrogen is probably typical of the classic exotic type. Because nitrogen is relatively inert, atmospheres containing nitrogen in standard temperature and pressure ranges are rarely a problem.

If nitrogen and oxygen are present in an atmosphere in certain combinations, the atmosphere becomes somewhat more hostile. Nitric acid (HNO_3) can form under certain conditions, as can other interesting compounds which can be irritants in low concentrations, or can make the atmosphere corrosive in higher doses.

An atmosphere containing nitrogen can be imagined on almost any type of world.

Methane (CH_4): A non-irritant component of exotic atmospheres, methane is found in terrestrial swamps as "marsh gas." It is also known as "natural gas," and the properties it exhibits on Earth are typical of the chief special danger methane poses to adventurers.

When methane is mixed with a normal oxygen-nitrogen atmosphere, the resultant combination can be quite dangerous. At a critical concentration of between 7% and 14% methane in the air, a spark can cause the methane to explode and burn fiercely. Though it is highly unlikely that free oxygen will be found in an atmosphere containing a high percentage of methane, there is a great danger that adventurers visiting a methane world could themselves create the proper conditions for an explosion. Airlocks which fail to cycle properly, or small leaks in ships, habitats, or space suits, could lead to a concentration of methane; electrical equipment (or static electricity) could cause a spark which will lead to a potentially devastating explosion and fire. Though associated with a foul smell in terrestrial swamps, methane is normally an

odorless, colorless gas which could easily pass unnoticed until it is too late.

Methane generally occurs as an active part of an atmosphere on large, cold worlds. The hydrogen which makes up part of the gas is usually lost early in the planet's history when the world is as small and warm as Earth. Thus, most worlds with methane in the atmosphere will tend to be larger (size 8 and up) and colder than generally habitable worlds. A dense or very dense atmosphere is most common. There are, however, exceptions – in the Solar System, Titan (size 4) has methane in its atmosphere, though it is quite a bit colder than a habitable world – requiring the need for protective clothing.

Ammonia (NH_3): Ammonia is an irritant found in some forms of exotic atmosphere, requiring some type of protection over and above the usual source of air to allow adventurers to survive. As an absolute minimum, ammonia in an atmosphere requires protection for the characters' eyes, nose, and mouth, and a form of gas mask would be one choice for protection. Another would be a transparent "goldfish bowl" helmet, sealed at the neck, into which an air supply is pumped.

Unlike methane, ammonia has a sharp and pungent odor, and leaks will be quickly noticed. An ammonia leak, even in a weakly concentrated ammonia atmosphere, will cause some damage to the character by burning eyes or mucous membranes. One point of damage is scored for every minute (four combat rounds) a character is exposed to ammonia.

Atmospheres containing ammonia will have to be extremely mild to classify as exotic rather than corrosive, for in any kind of concentration ammonia will cause serious damage even to exposed skin.

Worlds on which ammonia is found in the atmosphere will be much like those described for methane – large, cold and with atmospheres falling in the standard – very dense pressure range.

Chlorine (Cl_2): An irritant found in exotic atmospheres, chlorine is often postulated as a likely alternative to oxygen as a life-supporting gas. Chlorine is in many ways similar to oxygen, reacting readily in the same ways as oxygen in various chemical processes. This makes it a prime candidate as an atmosphere which would support life, though such life would be quite alien as compared with our own.

Greenish-yellow in color, chlorine is a deadly poison even in relatively small concentrations, though it can be detected by its odor long before it reaches a lethal level. It is also far more dangerous to exposed tissues than ammonia, and requires head-to-toe protective clothing. Lack of such protection causes the character to take 2 points of damage every minute (1 every 2 combat rounds). In this respect, such atmospheres are more corrosive in nature, but a human could operate without protection for a short time and survive.

A planet with chlorine in its atmosphere would be a mysterious and eerie environment, with the shifting yellow-green haze causing the landscape to waver in a murky green half-light, hiding and distorting objects and shapes. Life forms evolving under such conditions would be quite alien in appearance, and might be expected to be more active and energetic than their terrestrial counterparts. This is because the superior reactive properties of chlorine could make the biological power plants to these chlorine breathers more efficient than those which run on oxygen.

Sulfur Compounds: A variety of sulfur compounds can be found in various types of atmospheres, ranging from non-irritant and even up to corrosive in nature. These compounds can be found in the atmospheres of otherwise perfectly Earth-like worlds, and indeed are one of the prime components of smog.

In exotic atmospheres, sulfur compounds might represent the result of an extreme atmospheric taint resulting from prolonged heavy industrialization. Other components of the atmosphere could include oxygen, nitrogen, and other perfectly normal gases, but the air would be completely unbreathable. In other cases, sulfur compounds can be encountered as part of the natural atmosphere of a world, and probably go hand-in-hand with a great deal of volcanic activity.

Sulfur compounds would be a good alternative to the usual carbon-based organic chemistry. These would lead to a totally alien group of life forms.

CORROSIVE ATMOSPHERES

Corrosive atmospheres require the use of protective suits or vacc suits to insulate the wearer from harm. Several of the exotic atmospheres classified as irritant are, in fact, mild forms of corrosive atmospheres. The chief difference between the two lies in the degree of danger posed by the atmosphere — irritants cause only minor damage, while true corrosive atmospheres kill unprotected humans in a short time.

When creating a world with a corrosive atmosphere, the referee may wish to fill in additional details as to the nature of the specific environment. The corrosive atmosphere table, on the next page, is one way of supplying such background. The table gives results which can define the nature of an atmosphere.

Corrosive Atmosphere Table (2D)

2	Extreme Low Temperature
3	Very Thin, Low Temperature
4	Very Thin, Moderate Temperature
5	Very Thin, High Temperature
6	Thin/Standard/Dense, Low Temperature
7	Thin/Standard/Dense, Moderate Temperature
8	Thin/Standard/Dense, High Temperature
9	Very Dense, Low Temperature
10	Very Dense, Moderate Temperature
11	Very Dense, High Temperature
12	Extreme High Temperature

A designation of pressure (primarily of use to add color to a world's statistics) is given, as is a description of the temperature. A low temperature is one which averages between −25° and −200° C. Moderate temperatures are those which allow life (as we know it) to survive. High temperatures run over 50° C. Extreme temperatures are at the upper and lower ends of the temperature scale, and require extra equipment to compensate for the difficulties encountered.

In general, there are two major reasons for a designation of corrosive to be applied to an atmosphere. These are covered below.

Some corrosive atmospheres are the result of concentrates of corrosive chemicals in the air. Several of these have actually been covered previously, in the exotic atmospheres section, but are considered corrosive when they occur in higher concentrations. They are discussed again, in brief, in this section.

Nitrogen (N_2): A world in which free oxygen and nitrogen exist together in the correct proportions will have a corrosive atmosphere. In this case, seas of nitric acid and the presence of nitrides (nitrogen-oxygen compounds) in the atmosphere cause it to become most dangerous for unprotected humans.

Ammonia (NH_3): An irritant at best, atmospheres containing high concentrations of ammonia become corrosive. Usually characteristic of low temperatures.

Chlorine (Cl_2): More active, more poisonous, and more irritating to exposed skin than ammonia, chlorine in the atmosphere will be corrosive in any but the mildest concentrations.

Sulphur Compounds: The presence of sulfur compounds in sufficient concentrations will be corrosive, and can cause damage to unprotected individuals.

Fluorine (F_2): Similar in nature to chlorine, fluorine in an atmosphere is even more irritating, even in small quantities. Atmospheres containing fluorine are always considered corrosive at best. Fluorine shares many properties with chlorine, including the possibility of supporting completely alien forms of life. It is easily detected by smell and by color, but quickly lethal if a major leak occurs.

Corrosive effects, requiring the use of a protective outfit, can be the result of factors other than the mix of gases in the atmosphere. Temperature is the most important of these. No matter what gases comprise the atmosphere, a very low or very high temperature will kill an unprotected human in a matter of minutes.

The actual gas mixes which go with worlds with hostile temperature ranges will vary. For worlds with high or extremely high temperatures, atmospheres can include our own familiar oxygen-nitrogen mix, carbon dioxide, nitrogen, chlorine, or fluorine, possibly with interesting sulfur compounds mixed in. Low-temperature worlds tend to have combinations of methane and ammonia in their atmosphere.

To combat problems of temperature, protective suits and vacc suits must be equipped with suitable heating or cooling equipment. Such equipment (normally built into vacc suits and is available for installation and use with protective suits) will combat the effects of temperatures designated as low or high. Extreme temperatures cause further problems, and can put the atmosphere over the edge into an insidious classification without heavy-duty equipment and multiple backup systems. See the section on equipment for some specific items designed to combat these problems.

INSIDIOUS ATMOSPHERES

The most dangerous of all atmospheric types encountered by **Traveller** adventurers is the insidious atmosphere, defined as an atmosphere similar in nature to corrosive, but capable of defeating any personal protective measures in 2 to 12 hours.

Most of the atmospheres discussed as being corrosive in nature can, in sufficient concentrations or under the proper circumstances, be considered insidious. For example, a planet with high percentages of chlorine in its atmosphere at an Earth-like pressure and temperature could be expected to have large amounts of hydrogen chloride gas in the air and seas of liquid hydrochloric acid. Hydrogen chloride droplets would condense on exposed portions of a vacc suit, work their way into joints and crevices, and might eventually cause the suit integrity to give way entirely in dozens of small but lethal leaks.

One specific type of insidious atmosphere that might be encountered would be made up of a surprisingly harmless gas mix — simple hydrogen (H_2). The smallest and lightest of all atoms, hydrogen poses a special problem that makes its classification as a component of an insidious atmosphere necessary. The atoms are so small that they can seep right through fabrics, plastics, and even solid metal in a process known as diffusion. An air-tight seal is not necessarily hydrogen-tight.

Hydrogen is not poisonous. However, like methane, hydrogen and oxygen which

come together combine explosively. A spark can cause an explosion, followed by the precipitation of drops of water — the product of the combination of these two elements.

Starship hulls and the walls of buildings can be sealed against hydrogen leakage. Vacc suits, however, cannot be built with sufficient resistance to hydrogen diffusion; to do so would cause the suit to be far too bulky and massive to allow the wearer to move freely.

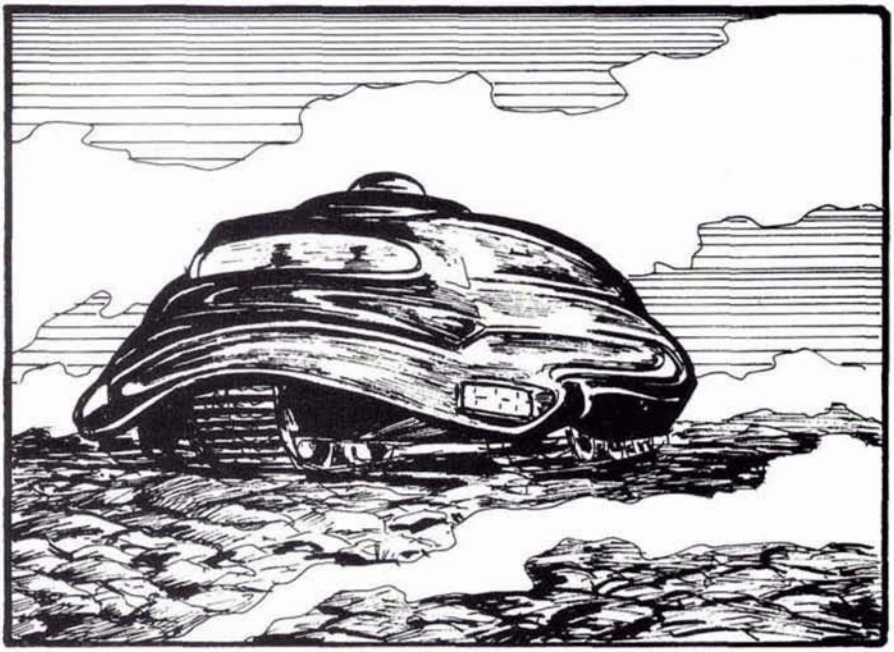
Hydrogen will make up a significant proportion of the atmosphere on large, cold worlds, and is often found in combination with methane and ammonia.

Temperature can also be the element which makes an atmosphere insidious. For example, in our solar system, the planet Venus has an atmosphere composed largely of CO_2, a gas which is not corrosive in nature. However, the temperature on Venus is in the neighborhood of 480° C, and the pressure 90 times that of Earth at sea level. Probes sent into this inferno rarely last more than a few hours.

Though highly efficient heating or cooling systems can compensate for high or low temperatures to a certain extent, it is very difficult to equip a personal protective suit, or even a vehicle, with compensating systems that can offset such enormous temperature problems. A starship or large habitat can be designed to overcome the effects of extreme heat or cold; for lesser equipment, a temporary respite is the best that can be hoped for.

The final agent which can cause an environment to be considered insidious is high radiation. It is very difficult to shield individual suits against the effects of intense radiation, such as might be encountered on a planet very close to a large hot sun, within the radiation zone of a gas giant, or on worlds where recent nuclear wars have devastated the world.

In this context, the time limit given by the protection's duration would not represent the gradual failure of the suit, but would instead indicate the amount of exposure an individual could take. Moreover, exposure would be a cumulative matter



— on a planet where radiation is lethal after 6 hours, a character may spend no more than 6 hours on the surface. If he spends 2 hours outside, and then returns to the ship, he can spend only four more hours on later trips. Exceeding this overall time factor will result in the character's death, or will at least make him extremely sick from radiation poisoning.

Insidious atmospheres of all forms pose a special danger to adventurers. Further details are left to the referee to develop to best fit the adventure situation. For a good example of an insidious atmosphere (of the type caused by chemical reactions), the interested reader should see *Ordeal by Eshaar,* an adventure approved for use with **Traveller** published by FASA Corporation. This adventure shows some special hazards, and even addresses the question of life forms which might exist in an insidious atmosphere environment.

REFEREE'S NOTES

In utilizing these detailed developments of exotic atmospheric types, the referee is encouraged to use imagination and creativity to supplement the bald facts derived from world creation information. Some gas types are noted as occurring most frequently on specific worlds. When a world is created which turns out to have an exotic, irritant atmosphere, at high pressure, with a size of 9, the referee can look through the descriptions and choose *ammonia* as

carbon dioxide
carbon dioxide-sulphur dioxide
methane-ammonia-hydrogen
chlorine-nitrogen
fluorine-carbon dioxide
fluorine-sulphur tetrachloride or other sulphur compounds
hydrogen
carbon dioxide-nitrogen
methane-ammonia
chlorine-carbon dioxide
chlorine-disulphur dichloride
fluorine-nitrogen

a prime ingredient, further noting that the planet will tend to be a cool one. He can go further, indicating a methane-ammonia mix, which will mean that the problems associated with both gases will be found on the world in question.

By and large, gas mixtures will revolve around one or two active ingredients, plus one or more inactive ones. Some fairly common mixes are noted on the previous page.

This list is by no means definitive, but gives an idea of the possibilities. When combining gases, their effects are also combined. An idea of proportions should be kept in mind at all times. An atmosphere composed of chlorine and nitrogen might be considered exotic if the chlorine concentration were relatively small, corrosive if it were somewhat higher, and insidious if it were higher still . . . an important difference from the point of view of the adventurer who must deal with it. Exact percentages are not required — but a feel for the various mixes will help lend color and consistency to the setting.

EQUIPMENT

The equipment described in this section is designed for use in various types of hostile atmospheric conditions.

Protective Mask: For use in irritant atmospheres, the protective mask covers the wearer's mouth, nose, and eyes, and hooks up to an oxygen supply. This is ideal for use in atmospheres containing mild amounts of ammonia, sulfur compounds, and/or minimal amounts of chlorine.

Available at tech level 6, the protective mask weighs 500 grams (plus oxygen tanks), and costs Cr25.

Transparent Helmet: A "goldfish bowl" type of helmet, this protective device has certain advantages over the protective mask. It is lighter, offers more complete protection against irritant atmospheres, and does not hamper the wearer as much as the clumsier mask. The helmet can also be worn with a protective suit or vacc suit in corrosive atmospheres.

The transparent helmet weighs 750 grams (without oxygen tanks), and costs Cr30. It is first available at tech level 8.

Suit Heater: A portable heating unit which is used in protective suits to combat the effects of low-temperature corrosive atmospheres. Without a suit heater, a protective suit is worthless in these conditions.

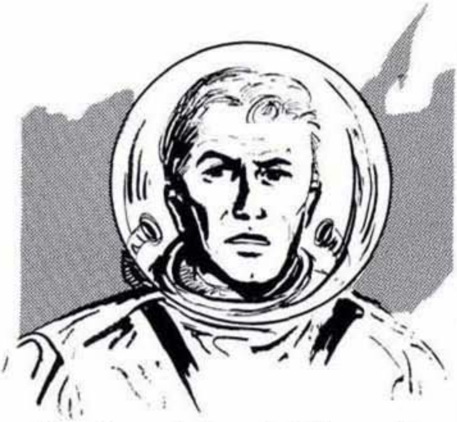
In insidious cold atmospheres, the standard suit heater is good for 2-12 hours before failure. A heavy duty version of the heater will allow a DM+4 to the duration throw (6-16 hours). Weights include additional suit insulation.

The standard suit heater weighs 3 kg, costs Cr250, and is available at tech level 8. The heavy duty heater becomes available at tech level 10, weighs 5 kgs, and costs Cr450.

Suit Air Conditioner: A cooling unit designed to function in hot atmospheres as the suit heater functions in cold. Effects of standard and heavy-duty versions are roughly the same as described for the heaters.

The standard suit air conditioner weighs 3 kilograms, costs Cr200, and is available at tech level 8. The heavy duty version costs Cr375, weighs 6 kilograms, and appears at tech level 9.

Powered Vacc Suit: A heavy-duty vacc suit designed specifically for use in insidious atmospheric conditions. The powered vacc suit contains extra-heavy



shielding, especially around the joints, and is extremely effective at slowing the process of corrosion due to acidic condensation. It also retards hydrogen diffusion, and contains heavy-duty heating and cooling systems. To counteract the excessive weight and bulk of all this protection, the powered vacc suit features the same enhancement effects found in battle dress.

The powered vacc suit gives a DM+4 to duration rolls for insidious atmospheres (except lethal radiation). It does not provide enhanced characteristics, as the weight of the suit itself offsets this aspect of the equipment. Battle dress skill is required to operate the powered vacc suit; if desired, 1/2 vacc suit skill can be applied instead.

The powered vacc suit costs Cr150,000 and is available at tech level 13. It weighs 25 kilograms; this weight is ignored when the suit is worn. Armor is equivalent to combat armor.

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