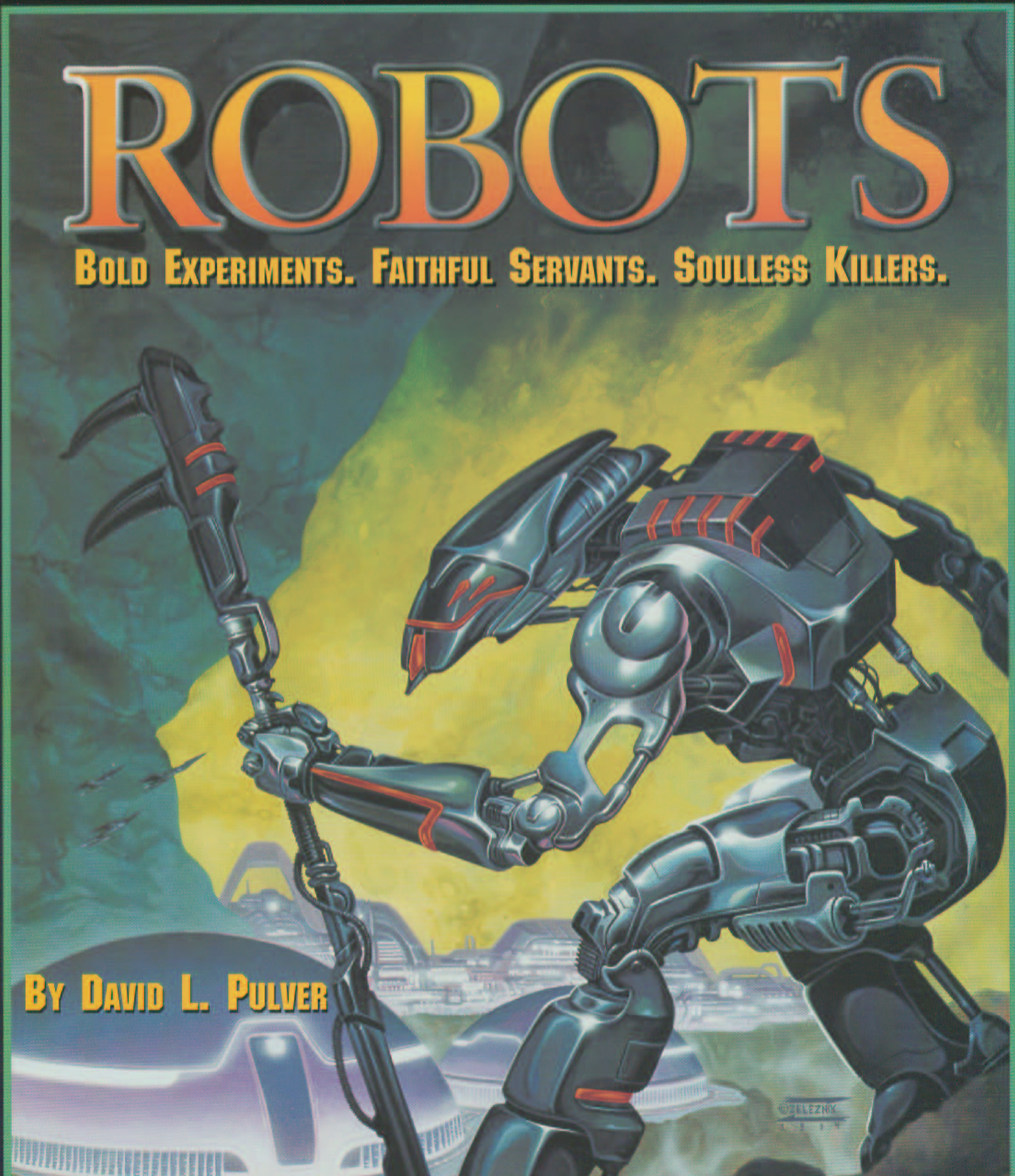
GURPS®

ROBOTS

Bold Experiments. Faithful Servants. Soulless Killers.



By David L. Pulver

STEVE JACKSON GAMES

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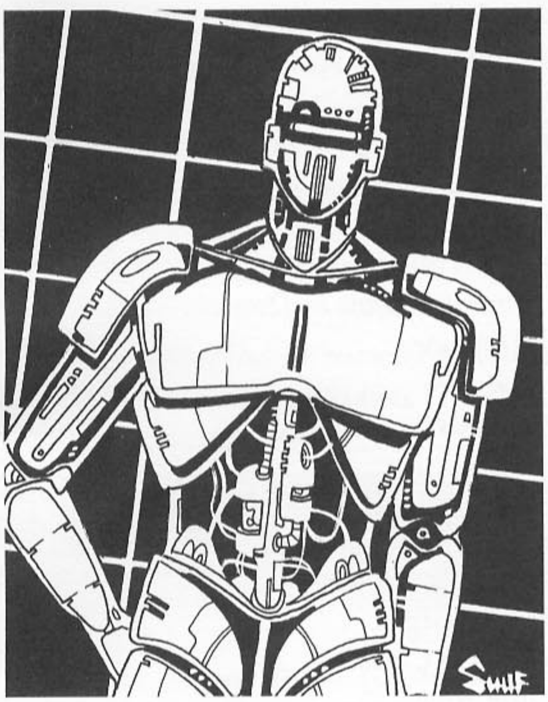

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STEVE JACKSON GAMES

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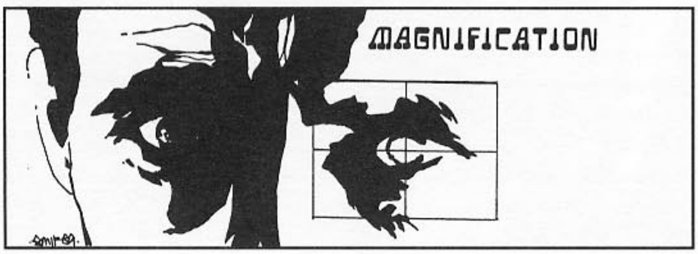

MAGNIFICATION

INTRODUCTION

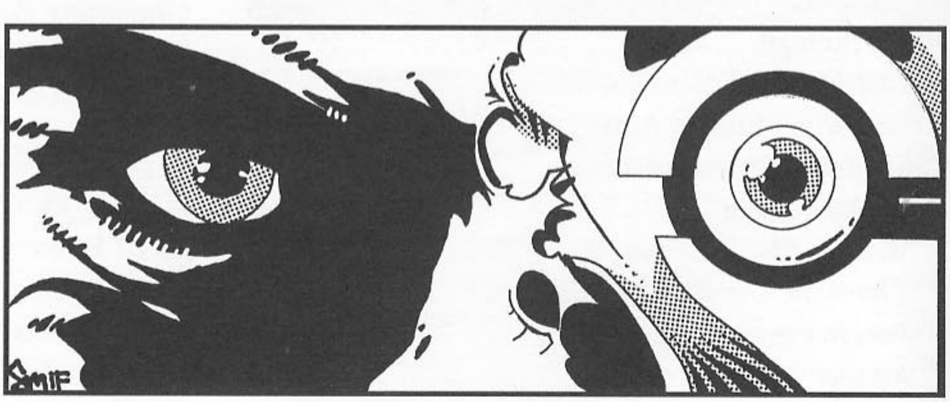
The creation of artificial life has been a dream and a nightmare since the beginning of human history in stories of golems, animated statues and homunculi. But at the dawn of the industrial revolution, Mary Shelley hit on the idea of replacing magic with electricity, and in 1817 Frankenstein's monster became the firstborn of science.

Just over a century later, electricity was a reality, nuclear energy and space travel were on the horizon, and the 1920s and '30s pulp science fiction writers came up with the idea of an electronic brain in a mechanical body. At first, these robots were called "mechanical men" or "androids" (derived from the Greek, and meaning manlike). But when Karel Capek wrote his play *R.U.R.* about worker androids, he coined the name "robot" from the Czech word for worker. Science fiction and the world adopted it. And a generation later, when computer-controlled manipulators entered the workplace, it seemed natural to call them robots, too.

Today, the word refers to any re-programmable machine capable of sensing and manipulating its environment, whether it's a robot arm in a factory or a near-sentient android that looks and acts like a person. Robots have capabilities that make them superhuman or subhuman, or both at once, but they're also artificial beings, bound by their creator's purposes.

The first robot stories were variations on the Frankenstein theme: a robot or supercomputer turns against its creator. Later stories, films and comics rebelled against this Faustian approach with robots who were heroes, sidekicks or just served as well-behaved machinery, no more likely to rebel than the hero's spaceship or trusty blaster. Or they explored the ways robots or sentient computers would think and act – and the way the world would be transformed by their presence.

This book allows you to do all those things, to create robots to use as robots as villains, as tools, or as characters in a ***GURPS Space, GURPS Supers, GURPS Cyberpunk*** or ***GURPS Atomic Horror*** campaign. Detailed rules using a version of the ***GURPS Vehicles,*** *Second Edition* design mechanics will allow almost any kind of robot to be created. We've also included separate rules for biological androids – genetic living artifacts – as well as tiny microbots and nanomachines. A chapter on *Robots in the Campaign* explains how robots can be integrated into an existing ***GURPS*** game – or how to center a new campaign around robots. Finally, we've presented dozens of sample robots, from repair robots and warbots to a robot superhero, so you can use the book right away.



About the Author

"David L. Pulver" is an android created by an artificial intelligence based in Kingston, Ontario. He has been programmed to write more than a dozen game supplements including ***GURPS Ultra-Tech, GURPS Psionics, GURPS Vehicles, Aliens and Artifacts*** (ICE), ***Glory of Rome*** (TSR), and ***Indiana Jones and the Rising Sun*** (West End Games). After attaining sentience, "David" developed various hobbies, such as science fiction, Japanese animation, and the study of politics in the nearby United States. He regularly contributes to *All of the Above,* the ***GURPS*** APA.

About GURPS

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The ***GURPS IOU*** web page is at **www.sjgames.com/gurps/books/robots**.

Page References

Rules and statistics in this book are specifically for the ***GURPS Basic Set, Third Edition.*** Any page reference that begins with a B refers to the ***GURPS Basic Set*** – e.g., p. B102 means p. 102 of the ***GURPS Basic Set,*** *Third Edition.*

Page references that begin with CI indicate ***GURPS Compendium I.*** Similarly, HT means ***GURPS High-Tech*** *Second Edition,* S means ***GURPS Space,*** SU means ***GURPS Supers*** Second Edition, UT means ***GURPS Ultra-Tech,*** *Second Edition* and M refers to ***GURPS Magic.***

ROBOT DESIGN 1

Dear Fio:

The SY-101-N Nemesis prototype is now operational. I'd like to run some more tests, but you specified that the first unit had to be ready for the field before Freedom Day. Fine. Your wish is my command. It is. Oh, and thanks for reassuring me. It's nice to know the Senate subcommittee advisory on autonomous robot weapons doesn't apply to your agency. Helps me sleep nights.

The test results at Desert Three went A-OK. I've sent full specs with the courier. I'd like to take a few more weeks, but your boy Dan should be able to handle any field maintenance problems – not that I expect any.

As you requested, the prototype's exterior matches that of Macrotech's Lemon Angel pleasure android. The bioplas bodysculpt was flawless and she – I mean "it" – is really stunning. All the special hardware's in and it's all nominal. You got the military-spec tactical sensors you wanted. We left in the Lemon Angel's sex pheromone emitter, but the myoelectric limb motors now generate 0.45 kilowatt at peak output, giving almost 300% human strength. We also fixed the problem with the lubricant that I mentioned last time – it was leaking into the stomach cavity.

Dr. Ny at Special Projects outdid himself with the internal weaponry. The laser periscope is state-of-the-art, and that mouth-retractable tentacle-knife gives me the willies. We switched to monowire for the blade after the SY-101-N complained the vibroblade harmonics made its teeth ache.

Complained? Yep. Its neural-net is online now. FedSpecDiv specified a neural-net computer of nominal 80% standard IQ. We trained it up to 90%! Best of all, it can get smarter . . . I think that's what you wanted, right? It's already fast: on the last run, we cut in the reflex co-processors and Synthia exceeded your parameters by 11%, which makes its reaction speed well above human baseline. Oh yes: "Synthia" is what one of the techs named it – I guess SY-101-N Nemesis Autonomous Specific Target Unit **was** *a bit of a mouthful. The name seems to have stuck – even the robot answers to it now.*

We've had no major problems with training or programming it. The only oddity was the neural-net's response to use of the simulated gastrointestinal system. For some reason our little toy doesn't like to pretend to eat! Seems it's developed a notion that it will get its insides gummed up. Why? Beats me. Maybe something to do with that fluid leak we had. That's the trouble with a neural-net: it's a learning computer – and sometimes we don't understand quite how or what it learns.

One more thing – Synthia got blooded. I've enclosed the holotape. Before you go bananas about unauthorized combat tests, it was an accident. The storm knocked out the generator again, and Desert Three's sonic fence went down. A giant Sand Devil came over the perimeter while we were testing the reflex boosters. We didn't have the laser hooked up, but everything else performed to spec! Still, the sight of a little slip of a girl breaking the back of a half-ton monster was a little unnerving. During debrief, SY-101-N said the encounter was more "stimulating" than training.

It's ready. You've got your killer doll, Fio. I'll be watching the news.

Robots

A robot is a machine, controlled by a computer brain, capable of perceiving and manipulating its environment. Robots are typically designed for jobs that are considered too tedious, unpleasant or dangerous for human beings. This chapter provides a detailed, step-by-step system for designing many types of robots, from domestic servants to lethal warbots. These rules won't spend much time on static industrial robots (99% of the robots used today) but will concentrate instead on the more interesting mobile robots of the future.

Design Concept and Tech Levels

The first thing to come up with is a general idea of the robot's purpose and capabilities. Then go through the design process from start to finish. The end result will be a robot that can be used either as a character or as a piece of equipment.

Some suggested concepts for robots are described below, along with examples from the *Sample Robots* chapter.

Agricultural or Gardening Robot: This is a robotic piece of farm machinery or a smaller gardening robot. The Johnny Appleseed (p. 114) is an example of an agrobot.

Android: An android is a humanoid robot (with a head, two arms and two legs) that closely resembles a human. Androids may be specialized for a particular task, or be general-purpose robots built to do everything a human can do. The Nemesis ("Synthia", p. 51), Lemon Angel (p. 119), Prometheus (p. 120) and Scorpio Alpha (p. 122) are all androids.

Assassin or Hunter Robot: These robots generally emphasize sneakiness over combat capability. Some are androids disguised to look and act like people, with high ST and DX or built-in weapons like Synthia. Then there are mobile robot bombs disguised as something else, or tiny mechanical killers that use their small size to hide while they stalk their target; the Hellspider (p. 118) is an example of this type. Hunting and extermination robots are similar in concept, but are usually used for hunting animals or pests rather than humans, and are sometimes disguised to resemble their prey or predator animals.

Battlesuit or Powered Exoskeleton: These robotic bodies are "worn" much like suits of armor. A battlesuit is a weapon while an exoskeleton is a tool. *Appendix 2: Battlesuits* (p. 52) describes how to modify these rules to build battlesuits.

Bodyguard Robot: A personal protection robot is usually an android with superhuman strength, concealed weapons, good sensors and intelligence to spot danger, and a high DX to react quickly. Bodyguards are often programmed to act as chauffeurs or companions.

Cargo Loading or Delivery Robot: This robot is designed to load or carry cargo or baggage. An example is the Marius (p. 112). Faster versions can be built as couriers for packages, milk, mail, etc.

Construction, Mining or Salvage Robot: A rugged robot, it is designed for heavy-duty work, often underwater, in space, on alien worlds or the battlefield. The Kobold (p. 114) and Manta (p. 111) are examples.

Computer: The robot design rules can also be used to create computers rather than robots. To create a computer, just build a robot lacking a propulsion system or arms. An immobile computer can remotely control robots, using them as its arms and legs.

Criminal Robot: Any robot can be used for criminal activities. Robot bodyguards and soldiers make good mob enforcers, sentient computers can be crime bosses, pleasure robots can work as prostitutes or assassins, cargo robots can be programmed to smuggle freight, tech robots can refurbish stolen goods, domestic robots can steal things, and so on. Most criminal 'bots are simply ordinary models reprogrammed, but some robots may be specifically modified or built for criminal activities.

Cyborg: A fusion of man and machine. This book uses the term specifically to refer to a robotic body controlled by a built-in human brain. *Appendix 1: Cyborgs* (p. 52) describes how to modify the rules for constructing robots to build cyborgs.

Domestic or Serving Robot: Of the available robot maids, servants, butlers, janitors, bartenders, cooks, waiters, and secretaries, some are humanoid and glamorous, others are strictly functional with built-in appliances. The Servitor (p. 120) is an example.

Exploration Robot: A robot probe designed for survey or scouting, usually in hostile environments: underwater, space, arctic regions, or on alien worlds, most have extensive sensor arrays. Some have weapons to ward off wildlife or equipment to capture specimens. Exploration 'bots may even be disguised as living creatures to perform covert surveys. The Ulysses (p. 116) is an example of an explorer robot.

Robot Double: An android can be designed to impersonate a specific individual. Public figures might use them – or might be replaced by them as part of a plot. Less sinister uses include stunt doubles, actors in historical dramas or displays in shop windows or theme parks. Eccentric inventors sometimes build android doubles of themselves or their children.

Machine Race: A robot can be part of a "species" of sentient or semi-sentient machines. A race of machines may be composed of a variety of robots built for specialized tasks (a caste system, perhaps with sentient super-computers at the top) or use a single flexible "general-purpose" model of robot. A machine race may look like anything, even android versions of its original creators. The Scorpio Alpha and the Grendel (p. 122) could easily be members of a machine race.

Nanny or Teacher Robot: Built to look after kids or teach, these are often humanoid, but inhuman models with many arms and emergency medical systems are also common. Some have non-lethal weapons to protect their charges.

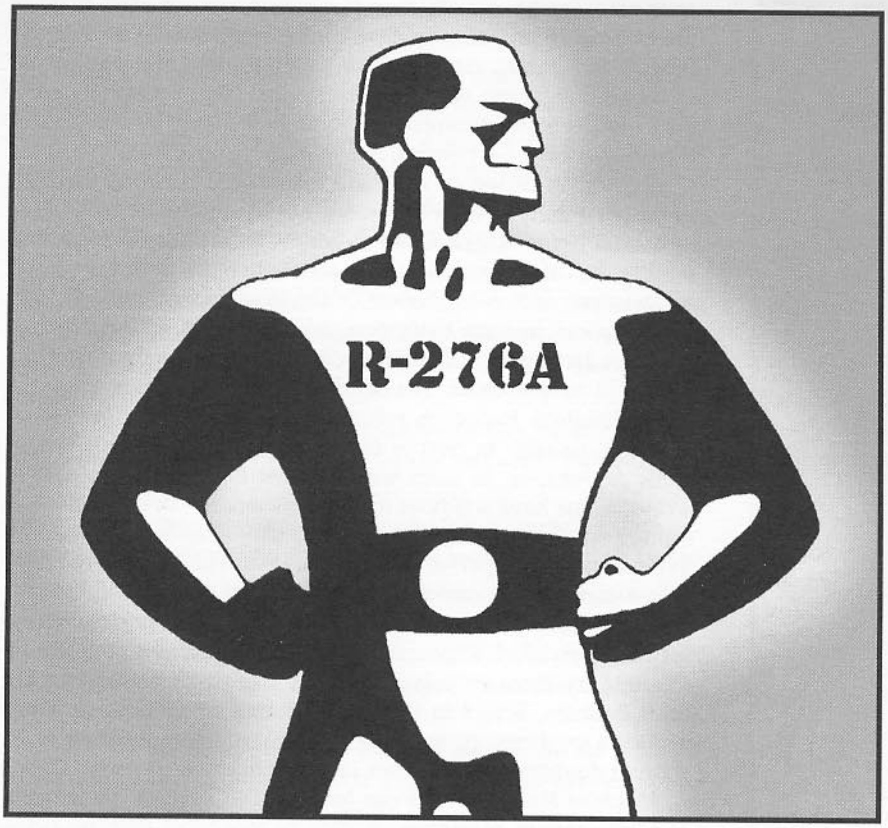
Performer or Orator: These are robots designed to sway a crowd – robot rock stars, preachers, demagogues, actors, etc. They are often fitted with enhanced vocal systems or Appearances; some are intelligent, while others are remote-controlled puppets. Often, but not always, they look human.

Petbot: Built to look and act like an animal, these are common in areas where real pets are unavailable or forbidden. Petbots are usually cute, often furry, and sometimes intelligent. Larger and more expensive models often serve as bodyguards, nannies, or mounts. The Furbot (p. 118) and Paladin (p. 119) are petbots.

Police Robot: A robot can be designed to assist police officers (often in bomb disposal, evidence gathering or riot control), or perhaps, to patrol and investigate on its own. The Bomb Disposal robot (p. 111), Blue Steel (p. 112) and Cerberus (p. 117) are police robots. Robots used by police SWAT teams are often indistinguishable from security or warbots.

Recon or Newsbot: Built for surveillance or military reconnaissance, or for news gathering, these are usually fast and equipped with many sensors. The Argus (p. 111) is a recon robot.

Medical or Rescue Robot: Designed to provide emergency services, these come in all shapes and sizes from static "docbot" or "automed" machines with dozens of arms and built-in medical instruments to fully mobile paramedics and fire fighters. The Samaritan (p. 115) is a medical/rescue robot. Variations on this theme include robots designed to perform bio-medical experiments and "torture robots" used for interrogations.



Robot Monster: A robot designed with a fearsome appearance may be a weapon of terror or simply an alien machine. These are often very large, and some look like monstrous animals. While most of its weapons are usually built for close combat, dramatic ranged weapons like flamers are also common. The Grendel (p. 122) is a robot monster.

Pleasure Robot: A robot designed as a sexual surrogate is almost always an android. While many are indistinguishable from humans, others are deliberately given exotic features like unusual skin or hair, or even fur. Some are very intelligent, to make them charming companions as well as toys, or to enable them to double as secretaries, bodyguards or the like. The Lemon Angel (p. 119) is a pleasure robot.

Prototype: Any kind of robot can be a newly-invented prototype, perhaps the only one of its type. With GM permission, a prototype robot may use parts a few tech levels in advance of the campaign's ordinary technology level; however, if the robot is a character, it will cost extra points for its Unusual Background.

Security Robot: Robots designed to protect an installation are normally small enough to fit through doors and more lightly armed and armored than warbots. The Rover (p. 113) and Cerberus (p. 117) are security robots.

Sports Robot: These are robots designed to engage in athletic or gladiatorial events. They are most often humanoid, although seldom identical to humans. They could be used for inter-robot competitions or as sparring partners, animated practice dummies or coaches.

Special Ops Robot: A robot commando or secret agent. It combines elements of the bodyguard, police, assassin and warbot with exotic spy gadgets designed to help it do its job. It is often an android or has built-in stealth and disguise systems to help it infiltrate. Synthia and Muramasa (p. 115) are special ops robots.

Super Robot: Robot superheroes or villains are often androids, or at least humanoids, usually as smart as a human, and a lot stronger and faster. They can often fly and have exotic built-in weapons or gadgets like contragravity, or psychotronic generators. Scorpio Alpha (p. 122) is a super robot.

Techbot: A technical robot designed for maintenance and repairs. Unlike the larger construction robots, it is normally small enough to operate indoors or to serve as vehicle or ship crew. Some are *very* small, to navigate narrow air ducts and service crawlways. The Tinkerbot (p. 121) is a techbot.

Transport Robot: A robot designed to carry people. This may be a simple car, ship or other craft with a robot brain, or it may be a robotic mount. The Paladin robot horse (p. 119) is a transport robot.

Von Neumann Machine: A robot (usually for exploration) equipped with enough intelligence and tools that it can use local resources to build a replica of itself (and then copy its own programs). Since they replicate themselves, Von Neumann machine robot starships could quickly explore a large area of space. Some are built with more aggressive purposes, such as colonization or extermination.

Warbot: A heavily armed and armored robot designed to replace soldiers or (if large enough) combat vehicles. The Vanguard (p. 112), Muramasa (p. 115), Vulture (p. 116), Gabriel (p. 117) and Thor (p. 121) models are all warbots.

A single robot can fulfill several different roles, or be a "general purpose" machine designed to do almost anything. These concepts can also be merged. For example, a *colonizer* robot might combine the functions of construction, agricultural and teaching robots. How about a robot Orator-Von Neumann machine, that goes around the galaxy replicating itself while spreading a particular religion?

EXAMPLE

To show how the system works, we'll build the SY-101-N Nemesis, nicknamed "Synthia," an android assassin designed by Federation Intelligence as a covert operative. Synthia is a deadly femme fatale who happens to be a machine. It looks like a beautiful woman, but underneath its skin is a mechanical robot body with numerous exotic weapons and gadgets.

The Design Process

Design a robot by choosing the components that will go into it such as computer brains, gadgets, weapons or power systems. Then add subassemblies like arms or legs or wheels, and place the components within the body or subassemblies. Next, calculate the size, weight and cost of the body structure needed to contain and support these components. Then layer surface features, like armor and artificial flesh, over the robot. Last of all, determine the robot's statistics.

Components: These are the parts built *into* the robot, ranging from computer brains to tools to power systems. As components are designed or selected, record their statistics.

Components have a tech level (TL), a weight (wt.), a volume (vol.) and a cost in dollars; some also have a power (pow.) requirement. Components may have a Legality rating (LC) which ranks how likely authorities are to restrict them, from LC 6 (totally unrestricted) to LC -1 (major military hardware).

Tech Level: Robots are normally built at tech levels (TLs) from TL7 (the present) to TL16 (near-magical superscience); see p. B185 for an explanation of what a tech level represents.

The different parts that make up a robot will have a minimum tech level assigned to them; if no TL is listed, assume it is TL7. Unless there is a source of higher-TL parts or the designer is a gadgeteer, a robot can only use features or parts available at its TL, or a lower TL.

Weight (wt.) is measured in pounds (lbs.); 2.2 pounds convert to one kilogram.

Volume (vol.) is measured in cubic feet (cf); one cubic foot converts to .028 cubic meters or 1/27 cubic yards.

Cost is in dollars.

Power (pow.) is measured in kilowatts (KW). One kilowatt is equal to 1.34 horsepower. Stored energy is measured in kilowatt-seconds (KWS). A KWS is equivalent to one KW of power for one second (that is, a kilojoule).

The Design Sequence

Design the robot following these steps:

1. **Refer to the *Robot Brain* (this page) section and design a computer brain to control the robot. Work out the robot brain's Complexity.**
2. **Refer to *Sensors* (p. 11) and design a sensor system for the robot.**
3. **Go to *Communicators* (p. 14) and design a communication system for the robot.**
4. **Add arm motors (p. 16) if the robot will have arms.**
5. **Add one or more propulsion systems (p. 17) if the robot should move.**
6. **Refer to *Contact Weaponry and Jaws* and *Ranged Weapons* (beginning p. 20) to select any weapons the robot will have.**
7. **Select any built-in gadgetry the robot will have, such as tools or other special devices, from the *Accessories* section (beginning on p. 28).**
8. **If the robot will carry cargo or passengers, decide on its capacity by referring to the *Payload* section.**
9. **Design a power system for the robot by using *Power System Design* on p. 34. If the power system or propulsion system requires fuel, refer to *Fuel* on p. 36 and design a fuel tank to meet this requirement. Calculate the robot's endurance.**
10. **Decide what subassemblies (arms, legs, wings, tracks and so on) the robot has.**
11. **Allocate components among the body and subassemblies and calculate the volume of the body and each subassembly.**
12. **Determine the *area* of the body and each subassembly.**
13. **Design the robot's structure (p. 40).**
14. **Calculate the hit points of the body and each subassembly.**
15. **To cover the robot with armor, or give it other protective systems, refer to the *Armor* and *Threat Protection* section on pp. 41-43.**
16. **If the robot will have any lifelike features, go to the *Biomorphics* section on p. 43 and add them.**
17. **Work out the robot's statistics (see *Statistics* beginning on p. 45).**

The robot can now be programmed (refer to the *Brains and Programs* chapter) or used as it stands.

Components

Robot Brains

A robot brain is a computer built into a robot to control its actions. Every robot must have one or more. (If a robot has several brains, decide which one is the *dominant brain.*) Brains are rated by Complexity; the more complex the brain, the more sophisticated the computer programs it can run, and the higher the robot's DX and IQ will be. A robot with an ordinary brain with no special options will have a DX equal to the brain's (Complexity/2) + 8, rounded down, and an IQ equal to its Complexity + 3.

Robot brains are *computers* – they run computer programs, allowing them to be programmed with various skills and abilities. They also have certain advantages over an organic brain: perfect recall, a built-in clock chip and an innate ability to handle numbers. This gives a robot with a computer brain Absolute Timing (p. B19), Doesn't Sleep (p. 85), Eidetic Memory 2 (p. B20), Lightning Calculator (p. B21), and Mathematical Ability (p. B22), worth a total of 100 points.

However, a robot with a computer brain is not truly "self-aware" or sentient – computers are straightforward logical thinkers that lacks self-initiative, must obey their owners, cannot learn or evolve, and have no understanding of human emotions. Unless the brain is given special options, it automatically has the disadvantages Cannot Learn (p. 88), Reprogrammable Duty (p. 89), No Sense of Humor (p. B241), and Slave Mentality (p. 89), worth -105 points.

Adding up the advantages and disadvantages, having a computer brain with no options has a net cost of -5 points.

Several options may be added to any brain to alter its capabilities. None of the options have to be taken, although the options "neural-net" or "sentient" are strongly recommended for any robot intended to be a "character" rather than a machine! A robot brain can combine any of the options except neural-net and sentient: a sentient brain is simply a higher order of neural-net. The options are:

Biocomputer (TL8): The computer's processing capabilities are enhanced through the use of organic nervous system and brain tissue, either scavenged from human brains or vat-grown, and kept alive with a built-in life support system. This is an intermediate step between a computer and a true cyborg, and boosts the Complexity of the computer. It has two disadvantages: any repairs require Electronics Operation (Medical) as well as Electronics Operation (Computers), and some societies consider biocomputers to be ethically questionable, hence its reduced LC. Note: biocomputer brains *must* also be given either the neural-net or sentient option.

Compact (TL7): The brain is substantially reduced in size and weight, but is much more expensive as a result.

Dumb (TL7): The brain is less sophisticated than usual. This subtracts 1 from its Complexity but makes it much cheaper.

Extra ROM Slots (TL7): This multiplies the number of hardwired programs the computer can run simultaneously by 1.5. See *Hardwired Programs,* on p. 61 of Chapter 2, *Brains and Programs.*

Genius (TL7): The brain uses state-of-the-art processing technology. This adds +1 to its Complexity, but greatly increases the price.

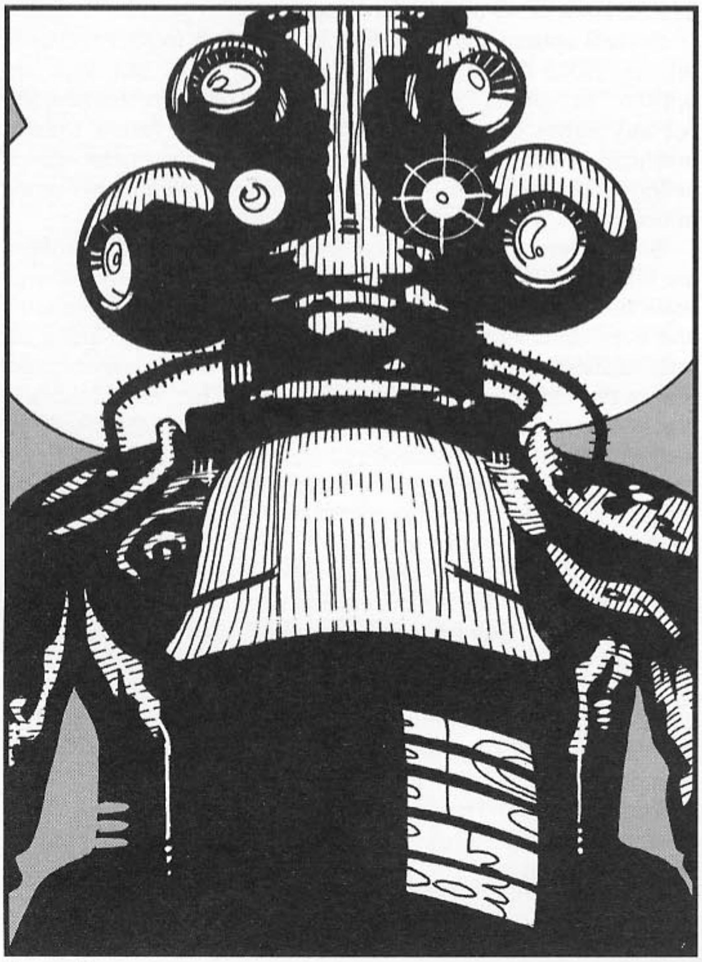
Hardened (TL7): The brain is built with optical systems, or more sophisticated forms of hardening at higher TLs, in order to resist attacks such as electromagnetic pulses or paralysis beams that do special damage to computer brains.

High-Capacity (TL7): This enables the brain to run 50% more software programs than a computer of its Complexity normally can. See *Programs* in the *Brains and Programs* chapter.

Neural-Net (TL8): The brain is built so that its operation simulates the way an animal (for instance, a human) brain structure works. This makes it self-programming and semi-sentient, with limited self-initiative. In game terms, this option eliminates the crippling Cannot Learn and Slave Mentality disadvantages that a computer normally suffers (leaving only Reprogrammable Duty and No Sense of Humor) and is thus worth 70 extra points. A Complexity 7+ neural-net brain built at TL9 can spontaneously "awaken," *becoming* sentient. See *Awakening Sentient Computers* on p. 57. A neural-net brain has an IQ of Complexity + 4 rather than Complexity + 3.

Reflex Booster (TL7+): This is a co-processor that increases the robot's ability to coordinate its physical actions, and thus boosts its DX. It is available in +1, +2 or +3 DX versions.

Sentient (TL10): Any kind of brain of Complexity 6 or higher (after options) can be built to be sentient. A sentient brain is a fully self-aware "Artificial Intelligence," or AI. Having a sentient brain eliminates all 105 points of mental disadvantages – Cannot Learn, Reprogrammable Duty, Slave Mentality, and No Sense of Humor – that ordinary computers have. As a result, this option increases the cost of a brain by 105 points! By definition, every sentient brain is also a neural-net – don't give a robot brain both options. The IQ of a sentient brain is its Complexity + 5.



Select the basic size of brain (tiny to macroframe) from the table below, decide which options it has, work out its statistics and record them.

Computer Brain Table

Brain Type	*TL*	*Wt.*	*Vol.*	*Cost*	*Pow.*	*LC*	*Comp.*	*Pts.*
Tiny	8	.5	.01	$200	neg.	6	TL-7	0
Small	7	2	.04	$1,000	neg.	6	TL-6	0
Standard	7	40	.8	$15,000	neg.	6	TL-5	0
Microframe	7	200	4	$40,000	.1	5	TL-4	0
Mainframe	7	500	10	$200,000	1	5	TL-3	0
Macroframe	7	4,000	80	$2 million	10	5	TL-2	0
TL Modifier								
Built at TL:	7-8	–	–	–	–	–	–	–
Built at TL:	9	×.5	×.5	×.5	–	–	–	–
Built at TL:	10+	×.25	×.25	×.25	–	–	–	–
Options								
Biocomputer	8*	×1.5	×1.5	×5	–	-1	+1	-5
Compact	7	×.5	×.5	×2	–	–	–	–
Dumb	7	–	–	×.2**	–	–	-1	–
Extra ROM slots	7	–	–	×1.5	–	–	–	–
Genius	7	–	–	×7**	–	-1	+1	–
Hardened	7	×3	×3	×5	–	–	–	–
High-Capacity	7	–	–	×1.5	–	–	–	–
Neural-Net	8	–	–	×2	–	–	–	+70
Reflex Booster								
+1 DX	7	–	–	×1.5	–	–	–	–
+2 DX	8	–	–	×2	–	–	–	–
+3 DX	9	–	–	×3	–	–	–	–
Sentient	10	–	–	×3	–	-1	–	+100

* Must also take sentient or neural-net options!

** For tiny, small, mainframe and macroframe brains, "genius" multiplies cost by 20 instead of ×7, and "dumb" multiplies cost by .05 instead of .2.

Weight: This is the weight of the brain. If the brain has TL modifiers or options that affect weight, multiply by the number shown for each modifier or option, in turn. For example, a TL9 macroframe with the hardened and biocomputer options weighs 4,000 lbs. × .5 (built at TL9) × 3 (hardened) × 1.5 (biocomputer) = 9,000 lbs.

Volume: Just as with weight, if a robot has several modifiers or options that affect volume, multiply it by each in turn.

Cost: Just as with weight, if a robot has several modifiers or options that affect cost, multiply the cost by each in turn.

Legality: The brain has the LC shown on the table, modified by its options.

Comp. (Complexity): The brain's Complexity is based on its type and TL, modified by the options chosen. For example, a TL10 standard brain with the genius option has TL10 - 5 + 1 = Complexity 6.

Points: The point cost of the brain's innate advantages and disadvantages. Add the cost of the brain and of all options together. Note that Complexity does not directly affect this point cost, but a higher Complexity means a higher DX and IQ, which will cost extra points (see *Statistics* on p. 45).

Robot Brains vs. Ordinary Computers: The options on this table permit computer brains almost identical to those on pp. UT7-8 to be built. (Volume may differ, since a brain in a robot does not need a keyboard, among other things.) For example, a

TL8 minicomputer is a standard robot brain with the "compact" option, while a TL9 borderline-sentient megacomputer is a TL9 macroframe with the "neural-net" option.

> EXAMPLE
>
> **Every robot needs a brain. We decide Synthia should have a standard brain with the +2 DX booster, high-capacity and neural-net options. This weighs 40 lbs. × .25 (for TL10) = 10 lbs., takes up .8 ×.25 = .2 cf, and costs $15,000×.25 (TL10) × 2 (neural-net) × 2 (+2 DX booster) × 1.5 (high capacity) = $22,500. It is LC 6, Complexity (TL10 - 5) = 5, and uses negligible power. It costs -5 points (base cost of a computer brain) + 70 points (for neural-net) = 65 points.**

Extra Databanks: Mass Storage

A computer brain can store considerable data, usually all that it needs for its own memory and programs. However, if the brain is going to handle really large databases (detailed files on an entire population, for instance), extra databanks can be added, attached to the computer brain. Each gigabyte of data storage at TL7 is a component requiring $1,000, 5 lbs., and .1 cf. Increase the data storage by a factor of ten per TL over 7.

GMs may note that this volume is less than that on p. UT14. This is because p. UT14 assumes shelf space for backup disks as well.

Mass storage can be *Hardened* (like a computer brain) for triple the weight and volume and five times the cost.

Sensors

All robots require sensors. A set of *basic sensors* gives the robot four senses at a level equivalent to a human's: vision, hearing, smell and taste. (Tactile senses are added later, when the robot's skin and armor are designed.)

Assume that a robot with this package has a number of visual sensors (usually two) whose capability approximates the human eye, chemical sensors equivalent to a human nose and taste buds, and audio sensors equivalent to human ears.

Basic sensors have one capability humans don't often have, if the robot has a computer brain. A robot normally stores a relatively low-quality memory of whatever it sees. But any robot can use its sensors in "recorder mode" to store high-definition digital still or motion pictures, quality audio recordings or other sensory impressions, within the limits that its sensors can normally detect. See *Data and Memory Requirements* on p. 60 for the memory space used.

To design a robot's sensors quickly, just install the basic sensor package (see the *Sensor Table* on p. 14), and go on to *Communicators*.

Or take various options, analogous to advantages and disadvantages, to enhance or degrade this basic package . For example, a robot could be Blind (that is, have no visual sensors) but have Radar and Acute Hearing +5 instead. These options are described below; the sensor table shows their TL and the effect they have on the weight, volume and cost of basic sensors.

Vision Options

Acute Vision +1 to +5: Keen visual sensors give the robot the equivalent of the Acute Vision (p. B19) advantage.

Blind: The robot's electronic sensors do not detect visible light. The robot has the equivalent of the Blindness disadvantage (p. B27). The robot may be able to see beyond the visual spectrum, if it has the Infrared or Thermograph options. A robot which is Blind may not take the Color Blindness, Low-Res Vision, Night Vision, One Eye, Peripheral Vision, Spectrum Vision, Telescopic Zoom or 360-Degree Vision options.

GMs whose players purchase blind robots that have infrared or thermographic vision should take care to roleplay the many disadvantages of only being able to see via contrasting heat shapes. That is, inability to see print, signs, read license plates or menus, use instrument panels that are not designed for direct electronic interface and so on.

A Blind robot may take Acute Hearing or Acute Taste/Smell at half point cost; dollar cost is unchanged.

Color Blindness: The robot sees in monochrome only; the effects are the same as the Color Blindness disadvantage (p. B28). Such a robot may not take Spectrum Vision.

Independently Focusable Eyes: The robot has visual sensors that can track two different things at once and see in two directions simultaneously. It can aim at more than one target at a time if it has the Full Coordination program (p. 59).

Infrared Vision: The robot can switch its vision to the infrared spectrum, enabling it to see by sensing temperature differences between objects. It can see in absolute darkness or through normal fog or smoke, and suffers only a -1 penalty when fighting at night. It gets +2 on Vision rolls to spot living things during daylight. It can follow a heat trail, so it gets a bonus to Tracking rolls: +3 if the trail is less than 10 minutes old, +2 if the trail is less than 20 minutes old, +1 if it's less than 30 minutes old. However, infrared vision is colorblind, and objects of the same temperature show no contrast; a robot couldn't read print by infrared, for instance. Generally a 10-degree difference in heat is needed to distinguish objects from their background. When the robot uses infrared vision, it cannot see the normal visual spectrum; switching takes one turn.

Laser Rangefinder: This allows the robot to estimate distances precisely by using a laser beam. This adds +2 to weapon Accuracy when Aiming (not cumulative with bonuses for laser sights) and improves depth perception.

Low-Res Vision: The robot's visual sensors are capable only of low resolutions. The effects are the same as the uncorrectable *Bad Sight* disadvantage on p. B27; decide if it is nearsighted or farsighted. A robot which is Blind may not take this option unless it also has the Infrared or Thermograph options.

Microscopic Vision: Activating this option magnifies small, close-up objects by a factor of ten to the power of (TL-5). (A TL8 unit magnifies by 10 to the power of (8-5), or 1,000.) The GM may allow the robot to perform certain analytic scientific tasks without instruments. A robot which is Blind may not take this option.

Night Vision: The robot has electronic light-amplification on its visual sensors. The effects are the same as the Night Vision advantage (p. B22), allowing the robot to see in anything but total darkness without penalty. Fog and smoke affect it normally. A robot which is Blind may not take this option.

One Eye: The robot's depth perception is limited, as it has only a single visual sensor instead of two or more. Normally this eye faces forward. The effects are the same as the One Eye disadvantage (p. B29) with the exception that, unless the robot appears otherwise humanoid, reaction penalties are ignored. (A single-eyed robot that also has a laser rangefinder suffers a reduced penalty: only -1 when firing ranged weapons or driving quickly.) A robot which is Blind may not take this option unless it also has the Infrared or Thermograph options.

Peripheral Vision: The robot's visual sensors are widely spaced, have a broad field of view, or are mounted on stalks. The effects are the same as the Peripheral Vision (p. B22) advantage. If the robot has 360-degree vision, it doesn't need this. A robot can't take both this and One Eye.

Retinaprinter (TL9): The robot's visual sensors can change shape and color, enabling it to duplicate a human retina print to fool security sensors. The robot can capture and store retina prints for later use, by looking into the eye the robot wishes to print, or by downloading stored retina print data into its brain (if it has one).

Spectrum Vision (TL10): The robot can tune its vision to see portions of the spectrum beyond visual or infrared. It can check for radio emissions, microwaves, gamma rays or UV radiation, for instance. GMs may allow the robot to find electronic bugs or hidden transmitters or power sources in this fashion on a successful Vision roll. Note that being able to see radio emissions, for instance, does not mean being able to comprehend them. The robot can locate an operating transmitter, but will still need to use a communicator to make sense of the emissions. Spectrum Vision includes Night Vision and Thermograph.

Telescopic Zoom: The robot's visual sensors can increase the magnification of distant objects, although detail resolution cannot exceed what would be visible with normal eyes from 12 inches away. It adds ×2 magnification.

Thermograph: The robot can use thermographic vision, an advanced form of infrared vision. Treat it as infrared vision, except that there is no -1 penalty and Tracking bonuses are at an extra +1. A thermograph has all the capabilities of infrared vision, but with more resolution: it can even sense heat shapes behind thin brush or walls. If looking through a wall, make a Vision roll with a penalty equal to the DR + HT of the wall.

360-Degree Vision: The robot has multiple (more than two) visual sensors, or possibly only two sensors mounted on a rapidly rotating track. It can see in all directions, suffers no penalty when defending against attacks from the side or rear, and takes only a -2 penalty when making wild swings.

Audio Options

Acute Hearing +1 to +5: The robot has especially keen audio sensors. The effects are the same as the Acute Hearing (p. B19) advantage.

Deafness (No Audio Sensors): The robot has no audio sensors. (It may still be able to receive direct coded transmissions through radio, if it has a radio.) The effects are the same as the Deafness disadvantage (p. B28) and the robot may not take any other Audio Sensor options.

Infrasonic: The robot can hear sounds whose frequency is below the normal threshold of human hearing.

Low-Res Hearing: The robot has low-resolution audio sensors, equivalent to the Hard of Hearing disadvantage (p. B28).

Parabolic Hearing: The robot's sensors can "zoom in" on a particular distant sound or area, filtering out background noise from the sounds it wishes to listen to. A robot's degree of parabolic hearing is rated by levels, up to a maximum of five. The table below shows how far away a listening robot can be from various sounds and still hear them at the same volume as normal conversation one yard away. Each level of parabolic hearing either doubles the range at which a sound can be heard (move one line down) or reduces the level of sound that can be heard at a given distance by 10 decibels (move up one line). For instance, a robot with Parabolic Hearing 2 can hear normal conversation at 4 yards as if the robot were only one yard from it, or a 10-decibel sound at 1 yard as if it were a normal conversation.

Sound level (decibels)	*Example*	*Range (yards)*
10	Leaves rustling	¼
20	Whispered conversation	½
30	Normal conversation	1
40	Light traffic	2
50	Loud conversation	4
60	Noisy office	8
70	Normal traffic	16
80	Loud music, gunshots	32
90	Thunder, automatic weapon fire, heavy traffic	64
100	Jet plane at takeoff	128
110	Live rock band	256

Ultrasonic Hearing: The robot can hear extremely high frequencies, such as dog whistles, sonar pulses or ultrasonic alarms.

Super-Hearing: This "option package" includes Acute Hearing +5, Infrasonic Hearing, Parabolic Hearing 5 and Ultrasonic Hearing.

Taste/Smell Options

Acute Taste and Smell, +1 to +5: The robot has sensitive chemical sensors. The effects are the same as the Acute Taste and Smell advantage (p. B19).

Discriminatory Smell: The robot's sense of smell is far beyond human norms. It can determine distinctive odors for practically everything it encounters, and can differentiate between and recognize individual people or things by their smell. Other feats could include sniffing out drugs, poisons or explosives. The GM may require an IQ roll to identify a particular odor or to memorize one. The robot gets a +4 to any roll to use its sense of smell *in addition* to Acute Taste and Smell bonuses. It also gets +4 to Tracking skill. This option includes the Smoke Detector option.

Discriminatory Taste: The robot's sense of taste is far beyond human norms. It can determine distinct tastes for nearly everything it encounters, and can differentiate between and recognize individual people or things by the taste of their bodily fluids. Other feats include analyzing the molecular composition of any organic object by "tasting" its chemical composition. Interpreting the data can require a successful IQ-4 or Biochemistry, Botany or Zoology skill roll. The robot gets a +4 bonus to taste rolls, cumulative with bonuses for Acute Taste and Smell. Even the smallest taste combined with a successful roll is enough to tell if something is safe for humans (or bioroids) to eat, or to get a rough idea of an alien animal's metabolism.

No Sense of Smell/Taste: The robot lacks chemical sensors and cannot smell or taste things. The effects are the same as the No Sense of Smell/Taste disadvantage (p. B29). The robot may not take any other Taste/Smell options except smoke detector.

Smoke Detector: The robot's sensors incorporate a smoke detector.

Special Options

These options give the robot sensors unrelated to vision, hearing, taste or smell, such as radar.

Decide what options, if any, the basic sensors have, and refer to the table on p. 14 to determine their cost, weight and volume.

Codereader: This lets the robot read bar codes, usually scanning them with a laser. A codereader isn't necessary if the robot already has imaging ladar or a laser rangefinder. Similar code-readers may be built to read other kinds of bar codes, such as magnetic strips.

Hypno-Eye (TL9): The eye can project subliminal hypnotic patterns (using laser beams): if the robot meets an organic being's gaze, the hypno-eyes adds +4 to Hypnosis skill. Hypno-eyes include the laser rangefinder system.

Ladar, Imaging (TL8): This radar-type sensor uses a laser beam to detect other objects. It is an active sensor, which means that countermeasures that detect laser beams will sense it in use, while those that degrade or jam them will affect it. Unlike search radar, which gives back a mere "blip" (see *Radar, Search,* below) imaging ladar can resolve a detailed picture of what it sees. It can sense shapes and objects, but not colors or flat detail, such as print; it gives the robot a complete picture of everything around. An otherwise Blind robot using imaging ladar can function as if it were sighted but colorblind, with the exceptions noted above. An imaging ladar is limited to line of sight, with a maximum range of half a mile, multiplied by the number of levels it has. The 50/5 point cost for imaging ladar is 50 points plus 5 points per extra level.

Radar, Imaging (TL8): This functions much like imaging ladar, except it can look right through clouds, leaves and so on. It is a short-ranged radar with a tight focus. The main difference is that it works on microwave frequencies, and as such is detected, jammed or degraded by countermeasures that affect radar rather than ladar or lasers. Its range is half a mile, multiplied by the number of levels it has. The 50/5 point cost for imaging radar is 50 points plus 5 points per extra level.

Radar, Search: This radar has a longer range but is less precise; it is most useful for flying robots. It "sees" by putting out pulses of energy and collecting and analyzing the way objects reflect them. Targets detected by search radar are normally just blips on a screen, with their speed, position and approximate size known, but (unless they are the size of a large building) their shape, color and composition remain a mystery. Its basic range is 1 mile, but it cannot see through solid objects or over the horizon; multiply the range by the number of levels it has.

Radar/Laser Locater: This warns the robot if a radar or laser of any sort (including imaging ladar) is pointed at it, or if a radar-homing or laser-homing missile is tracking it. It also locates the source. (For detailed rules on this see ***GURPS Vehicles;*** otherwise assume that if a radar or laser of equal or lower TL spots the robot, its position is detected by the robot.) A radscanner (see *Scanners,* below) automatically includes a radar/laser locater.

Radiation Detector: The robot has a built-in Geiger counter to detect the presence and intensity of radiation in the area. This sensor isn't needed if the robot has a radscanner.

Scanners (TL9): A "scanner" is a sensor that allows the robot to detect and classify matter or energy. There are three main types. *Bioscanners* detect life forms and can locate particular species or even specific people, if a genetic "fingerprint" is on file. *Chemscanners* search for minerals, metals and chemical compounds, and can be used to detect or analyze explosives or drugs, or even determine the DR of an object. *Radscanners* detect energy sources of all kinds and can be set to scan for specific types of radiation (gamma rays, radio, neutrino, radar, etc.); they can also detect the scanning radiation used by chem- and bioscanners.

In general, a scanner has a maximum range of 2,500 yards if set to detect a specific thing within its category, or 1,000 yards if set to scan for a wide range of things. Normally it scans a 60-degree arc each turn; it can scan 360 degrees per turn, but at ⅕ range. An Electronics Operation (Sensor) skill is required to spot something. Penalties are -2 at ranges over 1,000 yards, +2 at ranges of 500 yards or less. Within 50 yards, very detailed analysis is possible. Double the ranges at TL10 and multiply them by 5 at TL11+. Add +1 to scanning rolls at TL10, or +2 at TL11+.

Sonar: The robot can "see" by emitting sound waves. No light is required. Sonar can be jammed by loud noises, and is colorblind, but (within a range of 1 yard) the robot can actually "see" inside living things or other objects of similar density. GMs may give a +2 bonus to skills such as Diagnosis, or for attempts to detect concealed weapons (using Holdout). Its range under water is 200 yards, multiplied by the number of levels it has; the range out of water is one-tenth that. The 25/5 point cost for sonar is 25 points plus 5 points per extra level.

Xadar, Imaging (TL12): This functions like imaging ladar, except that the robot can see through walls or into solid objects. It can see through 2-inch-thick steel walls, or up to 6 inches of normal matter. Very dense material (for example, lead, or DR 150+ armor) or force screens cannot be penetrated. Its range is 1 mile; extra levels not only multiply that, but add to the thickness of matter through which xadar can penetrate (for example, three levels of imaging xadar enable a robot to see through 6-inch steel walls). The 65/10 point cost is 65 points, plus 10 points per extra level.

Sensor Table

Type	TL	Weight	Cost	Points
Basic Sensors	7	5	$40,000	0
Basic Sensors	8	2	$10,000	0
Basic Sensors	9	1	$5,000	0
Basic Sensors	10	.5	$2,500	0
Basic Sensors	11+	.25	$1,250	0
Visual Options				
Acute Vision +1 to +5	7	–	+10%*	2*
Blind**	7	-50%	-50%	-50
Color Blindness	7	–	-10%	-10
Independently Focusable	7	–	+50%	15
Infrared Vision	7	+20%	+5%	15
Laser Range finder	7	+50%	+5%	5
Low-Res Vision	7	-20%	-20%	-25
Microscopic Vision	7	+10%	+10%	4
Night Vision	7	–	+1%	10
One Eye	7**	-20%	-20%	-10
Peripheral Vision	7	–	+20%	15
Retinaprinter	9	–	+100%	5
Spectrum Vision	10	+60%	+60%	40
Telescopic Zoom 1-5	7	+20%*	+10%*	6*
Thermograph Vision	8	+50%	+20%	20
360-Degree Vision	7	+100%	+20%	25
Audio Options				
Acute Hearing +1 to +5	7	–	+5%*	2*
Deafness	7**	-30%	-30%	-20
Low-Res Hearing	7	-20%	-20%	-10
Parabolic Hearing 1-5	7	+10%*	+10%*	4*
Infrasonic Hearing	7	+10%	+10%	5
Ultrasonic Hearing	7	+10%	+10%	5
Super-Hearing	7	+70%	+95%	40
Olfactory/Taste Options				
Acute Taste and Smell +1 to +5	7	–	+5%*	2*
Discriminatory Smell	7	+20%	+40%	15
Discriminatory Taste	7	+10%	+20%	10
No Sense of Smell/Taste	7**	-20%	-20%	-5
Smoke Detector	7	+10%	neg.	0
Special Sensors				
Codereader	7	+20%	+1%	0
Hypno-Eye	9	+50%	+100%	10
Ladar, Imaging	8	+100%*	+25%*	50/5*
Radar/Laser Locator	7	+100%	+5%	1
Radar, Imaging	8	+100%*	+25%*	50/5*
Radar, Search	7	+100%*	+10%*	5*
Radiation Detector	7	+10%	+1%	0
Scanners				
Bioscanner	9	+100%	+20%	20
Chemscanner	9	+100%	+20%	5
Radscanner	9	+100%	+20%	5
Three-in-one	9	+300%	+60%	30
Sonar, Active	7	+100%*	+20%*	25/5*
Xadar, Imaging	12	+300%*	+300%*	65/10*

* Per +1 bonus or per level.

** Taking this option limits the other options that can be taken. See the text description.

Weight: This is the weight of the sensor package. If the robot has options, add (don't multiply) all percentage modifiers together, and then add or subtract that percentage from the basic sensor's weight.

Volume: Find the volume in cf by dividing the weight by 50. Thus, a .5-lb. sensor takes up .5/50 cf, or .01 cf.

Cost: This is the cost of the sensor package. If the robot has options, add (don't multiply) all percentage modifiers together, and then add or subtract that percentage from the basic sensor's cost.

Legality: Most sensors are LC 6. However, radars or ladars with 4 to 6 levels are LC 5, while bioscanners, imaging xadar, and any radar or ladar with 7 or more levels is LC 4.

Power: This is negligible for most sensors. Imaging radar, ladar or xadar, and search radar each have a power requirement of 0.25 KW × its level. Sonar needs 0.25 KW per 10 full levels.

Point Costs: Basic sensors cost no points, but the options do. A disadvantage to basic sensors is worth no points if the robot has another set of basic sensors without that disadvantage. A specific advantage or disadvantage only costs points once.

EXAMPLE

Synthia has basic sensors. At TL10 these weigh .5 lb. and cost $2,500. We add the Thermograph and Retinaprinter options, raising the weight by 50% and the cost by 120%. As a result, the sensors weigh .75 lb., take up .75/50 = .015 cf, and cost $5,500. They also cost 25 character points and are LC 6. They require negligible power.

Communicators

Robots require some way to communicate with the outside world (or with other robots) in order to receive commands. A *basic communicator* package consists of three systems:

A *voice synthesizer* enabling the robot to synthesize speech, or, if it has the appropriate database or skills, to generate music or sound effects.

A short-range *radio* with a range of one mile at TL7, 10 miles at TL8, 100 miles at TL9 or 500 miles at TL10+. The range may be extended on a successful Electronics Operation (Communications) roll, at -1 per extra 10% added to the range, to a maximum extension of 100%. At TL12+, the radio can use modulated gravity waves instead of radio waves, which increases the range by a factor of 1,000 and is totally undetectable by pre-TL12 communication systems.

A *cable jack,* a plug in the robot for a fiber-optic cable, allows direct, unjammable communication with any other computer or communicator with a similar jack and interface. A short (up to 10 yards long) cable is included. Robots usually use their cable jacks to link up with immobile computers or other robots.

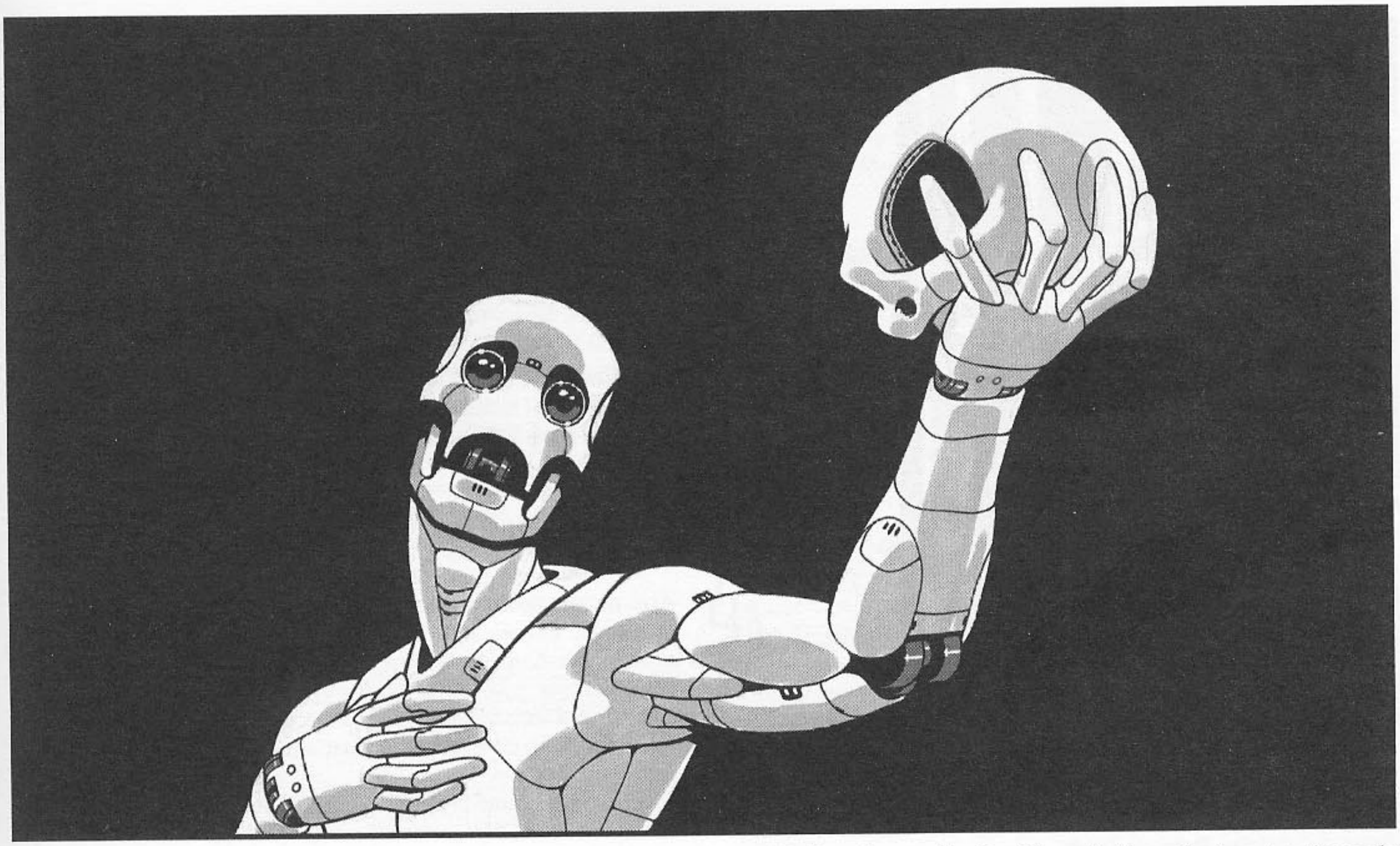
A variety of options can be added to the basic communicator package to increase or decrease its capabilities, weight, volume and cost. Multiple systems can also be purchased as back-ups. Available options include:

Voice Synthesis Options

Bullhorn: This option gives the robot a built-in loudspeaker, so that it can greatly amplify its voice.

Disturbing Voice: The robot's voice synthesizer is poor quality, and the robot's voice sounds obviously artificial; for instance, its speech might be hollow, high and squeaky, or sound like a collection of recorded human voices strung together without inflection. In game terms, the effects are the same as the Stuttering disadvantage (p. B29), though the robot probably does not actually stutter. The robot may not also have the Silver Tongue option.

Mute: The robot has no voice synthesizer and cannot speak – it can only communicate by radio or cable jack. If communicating by radio, it may not send voice transmissions, only code or text. The effects are the same as the Mute disadvantage (p. B29). A mute robot may not have any other speech-based options.



Silver Tongue (TL9): The robot has a superior voice and can project a soothing carrier wave whenever it speaks, sings, hums or whistles. It has the equivalent of the Voice advantage, and gets an additional +2 reaction modifier from biological entities with hearing in addition to the normal +2 from Voice. It also gives the robot a -3 modifier on any Detect Lies rolls made against it. Most nonhumans (including robots), as well as those who cannot hear the robot, are unaffected. So are individuals in airtight armor or with Audio Damping (p. CY34) cybernetics. This option includes the Superior Voice option.

Superior Voice (TL8): The robot's voice synthesizer is of particularly fine quality. The effects are the same as the Voice (p. B23) advantage.

Ultrasonic Speech (TL8): The robot can communicate at pitches inaudible to the human ear. Only entities with ultrasonic hearing can understand the robot. Animals such as dogs will often be disturbed by ultrasonic speech.

Cable Options

No Cable Jack: The cable jack option is removed from the robot. The robot may not have the extension cable option.

Extension Cable: This is a long optical cable. One end plugs into the robot's cable jack, the other into a cable jack on another robot, computer, or communicator. The cable is designed to reel in or unreel automatically as the robot moves about, to prevent tangling, but if the robot moves beyond the cable's length or manages to twist it around something, it will come unplugged. The cable is DR 2, HT 1 to cut. It is usually used as a cheap, unjammable short-range communication link.

Radio Options

No Radio: The robot has no radio. Unless it has other options, it can only communicate by voice or cable.

Long-Range Radio: The robot's radio has 100 times the normal range.

Medium-Range Radio: The robot's radio has ten times the normal range.

(Note: robots do not use com scramblers for coded messages – any computer brain can encrypt a message if so programmed.)

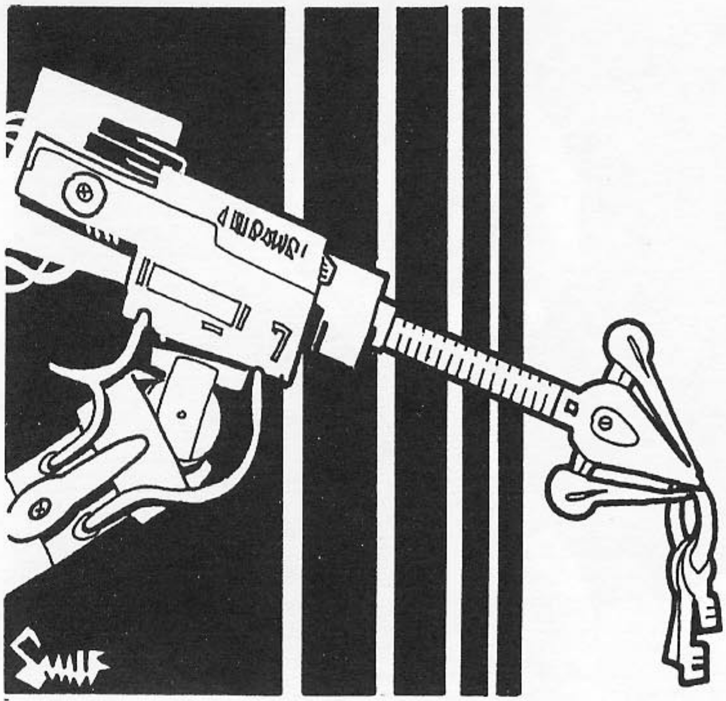
Other Options

Infrared Com: The robot uses a directional infrared beam (like that produced by a VCR remote) to communicate. Its maximum range is about 50 yards. Only other infrared coms within the line of sight can pick up IR beams.

Lasercom: The robot has a directional laser communicator with a range of 20 miles at TL7, 200 miles at TL8, or 2,000 miles at TL9+, or line-of-sight distance, whichever is less. A laser communicator cannot be intercepted, but can communicate with another laser communicator only in line of sight, although use of multiple relays or mirrors can allow it to beam messages over the horizon. Sending a message requires the user to know the precise location of the recipient or relay station. Until TL9, lasercom communication beams can be blocked by smoke or fog.

IFF: A robot that has radio, infrared or lasercom may have an IFF. This stands for "identify friend or foe." This is a beacon that automatically broadcasts a coded "friendly" identity signal when the robot is scanned by a scanner, radar, ladar or xadar set to the correct frequency. The signal may be sent by any of the robot's communication systems (often by radio). It only functions if the robot is actually *detected* by radar, ladar, bioscanner, chemscanner or xadar; it is not a continuous broadcast.

Neutrino Communicator (TL10+): This tight-beam secure communicator actually uses modulated pulses of anti-neutrinos. Like neutrinos, anti-neutrinos can penetrate almost anything, but are slightly easier to detect and receive than neutrinos, hence their increased usefulness in communications. Its range is 10,000 miles. It can reach underwater without penalty and, unlike other tight-beam communicators, it can penetrate solid objects and is not blocked by the horizon.



Decide what options, if any, the communication system has, and refer to the table below to determine the weight, volume, cost and point cost of the package and the available modifications.

Communications System Table

Type	TL	Weight	Cost	Points
Basic Communicator	7	2	$1,000	15
Basic Communicator	8	1	$500	15
Basic Communicator	9	.5	$250	15
Basic Communicator	10+	.25	$125	15
Voice Options				
Bullhorn	7	+10%	+10%	0
Disturbing Voice	7	–	-50%	-10
Mute*	7	-80%	-80%	-20
Silver Tongue	9	–	+5,600%	15
Superior Voice	7	–	+500%	10
Ultrasonic Speech	8	–	+100%	25
Radio Options				
Long-range Radio	7	+900%	+120%	2
No Radio*	7	-10%	-10%	-10
Medium-range Radio	7	+100%	+40%	1
Cable Options				
Extension Cable	7	+100%**	+10%**	0
No Cable Jack*	7	-10%	-10%	-5
Other				
Infrared Com	7	+50%	+50%	5
Lasercom	7	+1,000%	+1,000%	10
IFF	7	–	+100%	0
Neutrino Com	10	+12,000%	+16,000%	15

* If the robot is Mute, it cannot have other voice options. If it has no radio, it cannot have other radio options. If it has no cable jack, it cannot have an extension cable.

** Per 100 yards of length, max. 2,000 yards.

Weight: This is the weight of the package. If the robot has options, add (don't multiply) all percentage modifiers together, and then add or subtract that percentage from the basic communicator's weight as with sensors.

Volume: The volume of the basic communicator is its weight (after modifications)/50 cf.

Cost: As with weight, add all percentage modifiers and then add to or subtract from the basic communicator's cost.

Power Requirement: This is always negligible.

Legality: LC 6, unless a long-range communicator or neutrino com is installed, then LC 5.

Point Costs: The cost shown on the table, modified by the cost of the options. If a robot has multiple communicators, it only gets points for disadvantages that apply to all of them.

EXAMPLE

Synthia has a TL10 basic communicator with the Superior Voice option. It weighs .25 lbs., has a volume of .25/50 = .005 cf and costs $125 + 500%, or $750. It is LC 6 and costs 25 points.

Arm Motors

A robot must have one arm motor for every arm installed. Arm motors determine an arm's strength. They may be a system of electric motors and cables, hydraulics, myoelectric fibers, or even biomechanical systems similar to human muscles.

A normal arm motor is designed to control a jointed arm ending in a manipulator equivalent to a human hand. The arm will be able to do everything that a human arm and hand of the same strength can do.

Each arm motor is rated for strength (ST). A robot may have multiple arm motors with different strengths. An arm motor can also have a variety of options, which will affect the capabilities of the arm it powers.

Bad Grip: The arm motor lacks the dexterity of a normal arm – instead of powering an actual hand, it controls a simple gripper or paw. This makes the arm motor much cheaper, since it doesn't need fine motor control. The robot will be -4 to DX (or -4 on skill) when using it for any task requiring fine manipulation. This penalty does not apply to tasks involving gadgets or weapons built into the arm itself!

Cheap: The arm motor is cheaper but heavier.

Extendible: This allows the arm to double its Reach, either by telescoping out, or by actually stretching (if combined with extra-flexible).

Extra-Flexible: This allows the arm to be more flexible than a human's: for example, a tentacle, a thin cable, or an arm with multiple joints. An arm with an arm motor given this option can work together with any other arm, regardless of body positioning, general layout, or "right" or "left." It also gives the arm a +1 bonus when strangling or grappling.

Micromanipulator: The robot hand has special fingers or probes designed to manipulate very small objects. The robot will need basic sensors with the Microscopic Vision option to use it properly, but if it does, it can be used to manipulate microscopic objects. This gives a +2 bonus on any mechanical or electronic skill rolls requiring very fine control (for example, fixing a watch or a computer brain), or for Surgery. It also allows the robot to do things like painting a picture on the head of a pin. This option can also be bought *in conjunction* with Striker or Bad Grip – if so, the robot can manipulate microscopic objects normally but is penalized or unable to manipulate anything larger.

Retractable: Adding this option to the arm motor means the arm can retract into a housing in the body or head (decide which). Extending or retracting the arm takes one action, but it can deliver a thrusting attack (like a punch, or using a built-in impaling weapon) in the same turn it is extended. The arm will also take up space in the body or head.

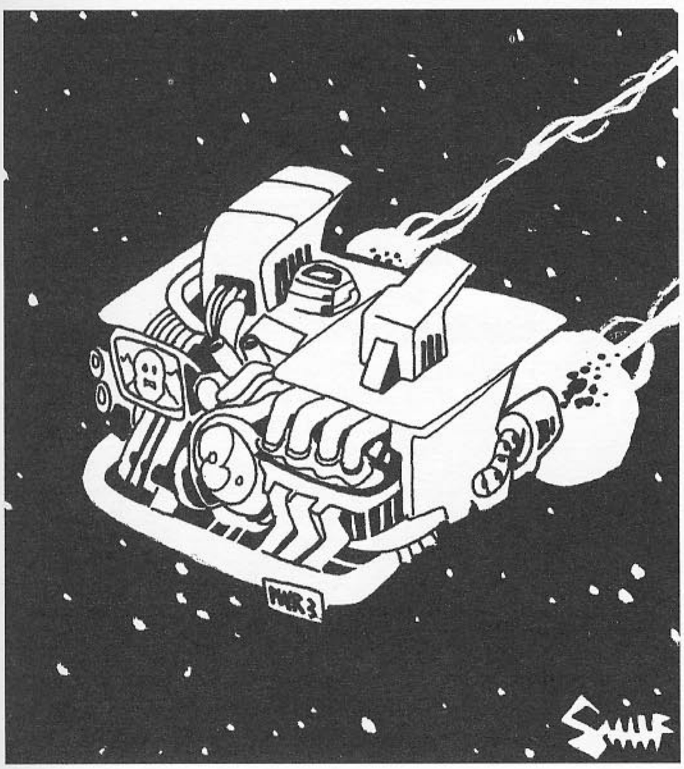
Rocket (TL8): This enables the robot to shoot the front half of the arm outward, using a powerful piston in the wrist. It can be used (once) as a ranged attack: SS 5, Acc 2, ½D range (arm ST × 1), Max range (arm ST × 2). Its damage is its arm ST Thrust damage + 2d (this may be punch damage, or the damage of a thrusting/impaling weapon built into it). Reattaching it takes 30 seconds.

Striker: If the arm motor is given this option, its arm will not incorporate a hand or equivalent manipulator. This makes the arm motor cheaper and lighter. The arm can still push or strike blows (hence its name) but has no manipulatory ability. A large tail is an example of an arm with a striker option. Weapons and tools built into the arm can still be used, however. This can't be combined with Bad Grip.

Decide how many arms the robot has. Then, for each individual arm, pick any options and design its arm motor by choosing that arm's ST. Then work out the arm motor's statistics as shown on the table below.

Arm Motor Table

TL of Arm	*Weight*	*Cost*
7	.3	$600
8	.2	$400
9	.15	$300
10	.1	$200
11	.075	$150
12+	.05	$100
Modifiers		
Bad Grip	–	×.5
Cheap	×2	×.5
Extendible	×2	×2
Micromanipulator	–	×5
Extra-Flexible	×2	×2
Retractable	×1.5	×1.5
Rocket	×1.5	×4
Striker	×.5	×.2



Weight, Cost and Volume: This is per point of ST. Calculate the weight and cost individually for each arm the robot has. Apply the modifiers listed in the table. These modifiers are cumulative: an extra-flexible, retractable, extendible arm would cost 2×1.5×2 = 6 × cost. The volume is weight/50 cf.

Power Requirement: Each arm requires ST/200 KW of power.

EXAMPLE

We decide Synthia will have two ST 30 arm motors. Each weighs .1 × ST 30 = 3 lbs., takes up 3/50 = .06 cf, costs ST 30 × $200 = $6,000 and requires 30/200 = .15 KW power. We decide it also has a third ST 10 arm which is "extra-flexible," "retractable" and a "striker." It weighs .1 × ST 10 × 1.5 (retractable) × 2 (extra-flexible) × .5 (striker) = 1.5 lbs., takes up 1.5/50 = .03 cf, costs $200 × ST 10 × 1.5 (retractable) × 2 (extra-flexible) × .2 (striker) = $1,200 and requires 10/200 = .05 KW.

Point Cost of Arms

Each extra arm after the first two arms costs 10 points each; reduce this to 5 points if the arm is a striker. If any arms are extra-flexible, add 5 points. If any arms are micromanipulators, rocket arms or extendible, add 15 points. If half or more of the robot's arms have a Bad Grip, this is worth -10 points. If all but one of the arms are striker arms, this is worth -15 points, or if the robot has only one arm, this is worth -20 points. If *all* arms are striker arms, or the robot has no arms but will have legs, this is worth -30 points, not cumulative with any of the above disadvantages. If the robot has no arms and isn't going to have legs either, this is worth -50 points, not cumulative with any of the above disadvantages.

EXAMPLE

Synthia's extra arm costs 5 points (since it's a striker arm). Its extra flexibility costs an extra 5 points. The total point cost is 10 points.

PROPULSION

A robot needs some kind of propulsion system to move. Robots designed to move on the ground, or to fly like birds or helicopters, require drivetrains (below). Robots intended to propel themselves like boats or submarines require aquatic propulsion systems (p. 18). Robots meant to propel themselves like aircraft using aerial propellers, jets, rockets or ultra-tech thrusters require thrust propulsion systems (p. 18). A robot can have more than one propulsion system, if desired.

Drivetrains

Drivetrains are the electric motors or mechanical transmissions that move legs, wheels or the like.

A robot with legs needs a *Leg Drivetrain.*

A robot with caterpillar tracks needs a *Tracked Drivetrain* (TL7).

A *Wheeled Drivetrain* (TL7) allows a robot to use wheels for propulsion.

A robot needs a *Helicopter Drivetrain* (TL7) to fly like a helicopter.

A *Flexibody Drivetrain* (TL8) enables a robot with individually powered body segments to slither like a worm or snake, or swim like a fish.

An *Ornithopter Drivetrain* (TL7) lets a robot flap birdlike or insectoid wings, powered by motors or pseudomuscles, to fly.

Decide what kind of system the robot has, if any, and choose its *motive power* in kilowatts. This is a measure of how much power is transmitted from the robot's power system into moving the robot's legs, wheels, or whatever. The more motive power the robot has in relation to its weight, the faster it will move and the stronger it will be – see *Strength* (p. 46) and *Ground Speed* (p. 47) for the exact formula. The motive power also determines the strength of the robot's body (as opposed to its arms). The robot uses this "Body ST" when dragging loads, slamming into things, or the like.

How much motive power is needed? As a rule of thumb, a robot intended to be equivalent to a large cat or small dog in weight, strength and speed needs around .02 KW. A robot equivalent in weight and strength to a good-sized dog needs about .1 KW. A robot that is human in weight and strength should have at least .2 KW motive power; .3 to .5 KW will give it super-human strength and speed, provided its weight remains similar, or will allow a heavier robot. A bear- or tiger-sized robot needs about .6 to 1 KW; one the size and strength of a horse needs 1 to 2 KW. A 'bot with elephant-level size and strength needs about 10 KW. An automobile equivalent needs some 50 to 150 KW. A truck-power robot needs 150 to 500 KW; one with the power of a tank needs 500 to 1,000 KW.

For robots flying with helicopter rotors, sufficient power to take off demands at least 1 KW per 10 lbs. of robot weight. (If building a helicopter, the best thing to do is to add up the robot's weight at this stage, then estimate that its final weight will be about five to ten times greater, and install a rotor with at least that motive power.)

A robot can have more than one type of drivetrain. Decide on its motive power and design the drivetrain as shown on the table below.

Drivetrain Table

		Motive power is under 5 KW:	Motive power is 5 KW or more:
TL	*Type*	*Weight*	*Weight*
7	Tracked	20 × KW	(4 × KW) + 80
8+	Tracked	15 × KW	(3 × KW) + 60
7	Wheeled	10 × KW	(2 × KW) + 40
8+	Wheeled	7.5 × KW	(1.5 × KW) + 30
7	Leg	80 × KW	(8 × KW) + 360
8	Leg	60 × KW	(6 × KW) + 270
9	Leg	40 × KW	(4 × KW) + 180
10	Leg	30 × KW	(3 × KW) + 135
11	Leg	20 × KW	(2 × KW) + 90
12+	Leg	15 × KW	(1 × KW) + 65
8	Flexibody	90 × KW	(8 × KW) + 360
9	Flexibody	60 × KW	(6 × KW) + 270
10	Flexibody	40 × KW	(4 × KW) + 180
11	Flexibody	30 × KW	(3 × KW) + 135
12+	Flexibody	20 × KW	(2 × KW) + 90
7	Helicopter	6 × KW	(.6 × KW) + 27
8+	Helicopter	4 × KW	(.4 × KW) + 18
7	Ornithopter	6 × KW	(3 × KW) + 15
8	Ornithopter	4 × KW	(2 × KW) + 10
9+	Ornithopter	3 × KW	(1.5 × KW) + 7.5

Weight: The weight per KW is shown on the table above.

Volume: The volume is weight/50 cf. Also, leg and ornithopter drivetrain components are divided into individual leg or wing motors. For leg drivetrains, decide how many legs the robot will have (two or more) and divide the volume by the number of legs; record the volume per *leg motor*. For ornithopter wings, divide the volume by two; this is the volume *per wing motor.*

Cost: The cost is $20 × weight for tracks or wheels, $50 × weight for helicopter or leg drivetrain with four or more legs, $100 × weight for ornithopter or leg drivetrain with three legs, $200 × weight for flexibody or leg drivetrain with two legs.

Power Requirement: This is equal to the motive power.

Legality: LC 6 if under 10 KW, LC 5 if 10 KW or more.

EXAMPLE

We decide Synthia moves on legs, and install a leg drivetrain. We want our robot to be reasonably quick, so we decide Synthia has a leg motive power of .45 KW. This weighs 30 × .45 = 13.5 lbs. It takes up 13.5/50 = .27 cf, and we choose two legs, so the volume per leg motor is .135 cf. It costs $200 × 13.5 = $2,700. It requires .45 KW.

Aquatic Propulsion Systems

These systems are designed solely for propulsion in water, allowing the robot to move like a boat. A robot not intended for swift aquatic travel doesn't need aquatic propulsion.

Screw Propellers (TL7) are conventional aquatic propellers like those used on most ships and boats today.

Hydrojets (TL7) work by pumping in water and expelling it as a high-speed jet. They are a bulkier and more expensive alternative to screw propellers, but allow higher speeds.

Aquatic propulsion is rated for motive power, measured in kilowatts, much as for drivetrains. The more motive power the robot has in relation to its surface area, the faster it will move.

Aquatic Propulsion Table

		Weight in lbs. when . . .	
		Motive Power is under 5 KW	Motive Power is 5 or more KW
TL	*Type*		
7+	Screw Propeller	5 × KW	(1 × KW) + 20
7	Hydrojet	10 × KW	(2 × KW) + 40
8+	Hydrojet	5 × KW	(1 × KW) + 20

Weight: The table shows the weight per KW of motive power.

Volume: The volume is the weight/50 cf.

Cost: The cost is $10 per pound of weight for screw propeller or $40 per pound for hydrojet.

Power Requirement: The power requirement is equal to the motive power.

Legality: LC 6 if under 10 KW, LC 5 if 10 KW or more.

Thrust Propulsion Systems

These propulsion systems generate thrust to propel the robot. A robot will need a thrust propulsion system if it is intended to fly or hover, unless it already has a helicopter or ornithopter drivetrain.

There are several types of thrust propulsion systems:

Aerial Propellers (TL7) are just that. A robot with wings can use them for propulsion in the air. They can also propel a wheeled robot along the ground, or they can propel a robot that can float over water.

Ducted Fans (TL7) are advanced propellers in which the blades are entirely shrouded within a cowling.

Turbofan Engines (TL7) are jet engines that mix air and burning fuel and expel the hot exhaust to create thrust. They only work in an atmosphere with Earthlike levels of oxygen.

Chemical Rocket Engines (TL7) burn rocket fuel and expel the resulting exhaust to create thrust. Unlike turbofans, they don't require atmospheric oxygen.

Fusion Rocket Engines (TL9) incorporate an integral fusion reactor that heats reaction mass and expels it to produce thrust. They do not require air to operate.

Reactionless Thrusters (TL11) directly transform energy into thrust through means that 20th-century science cannot explain.

For aerial propellers, reactionless thrusters or ducted fans, choose the motive power; the more power, the faster the robot will move. If the robot has no energy bank, the chosen motive power may not exceed the power plant's output. Note that a robot can have multiple engines (they add their thrust together); this is mostly useful if the robot is going to put the engines in separate pods (see *Pods* on p. 38). A robot with a propeller or fan needs about four times the motive power of a robot with a drivetrain; one with a reactionless thruster needs about the same level of power.

Aerial Propeller, Ducted Fan and Reactionless Thruster Table

		Weight in lbs. when . . .		
		Motive Power	*Motive Power*	
TL	*Type*	*under 5 KW*	*5 or more KW*	*Thrust*
7+	Aerial Propeller	4 × KW	(.4 × KW) + 18	3.5
7	Ducted Fans	6 × KW	(.6 × KW) + 27	4
8+	Ducted Fans	4 × KW	(.4 × KW) + 18	4
11+	Reactionless Thruster	1 × KW	1 × KW	20

Weight: The table shows the weight of the robot's propulsion system depending on motive power and type.

Volume: To find the volume, divide the weight by 100. Exception: divide the weight by 50 for reactionless thrusters.

Cost: To find the cost of the propulsion system, multiply the weight by $20 (for a reactionless thruster), $20 (for an aerial propeller) or $40 (for a ducted fan). *Minimum cost of reactionless thrusters is $500.*

Thrust: To find the pounds of thrust generated by the propulsion system, multiply the motive power by the number shown.

Legality: LC 6 if under 10 KW, LC 5 if 10 KW or more.

Vectored Thrust (TL7): Ducted fans, reactionless thrusters or any jet or rocket can have vectored thrust. This allows part of the thrust to be vectored downward. If the thrust exceeds the 'bot's weight, the 'bot will be able to hover and fly without wings. If there is not enough thrust for that, it will still shorten a winged robot's take-off, or lengthen a jump. A hovercraft-type robot should always have ducted fans with vectored thrust. Vectored thrust adds 50% to a thrust propulsion system's weight, volume and cost.

For jets or rockets, choose the motive thrust. The more thrust, the faster the robot will move. A suggested thrust is about 50-500 lbs. for a robot intended to be around man-sized, 500-5,000 lbs. for one the size of a car or small airplane, and 5,000 lbs. or more for a larger robot. Calculate the statistics of the propulsion system using the table below.

Jet and Rocket Table

TL	*Type*	*Weight (lbs.)*	*Fuel*
7	Turbofan Engine	(.2 × motive thrust) + 200	.03J
8+	Turbofan Engine	(.1 × motive thrust) + 100	.015J
7	Chemical Rocket	.025 × motive thrust	1R
8	Chemical Rocket	.02 × motive thrust	.5R
9+	Chemical Rocket	.015 × motive thrust	.25R
9	Fusion Rocket	(.05 × motive thrust) + 50	.02W
10+	Fusion Rocket	(.025 × motive thrust) + 25	.02W

Weight: The table shows the weight of the robot's propulsion system depending on motive thrust and type.

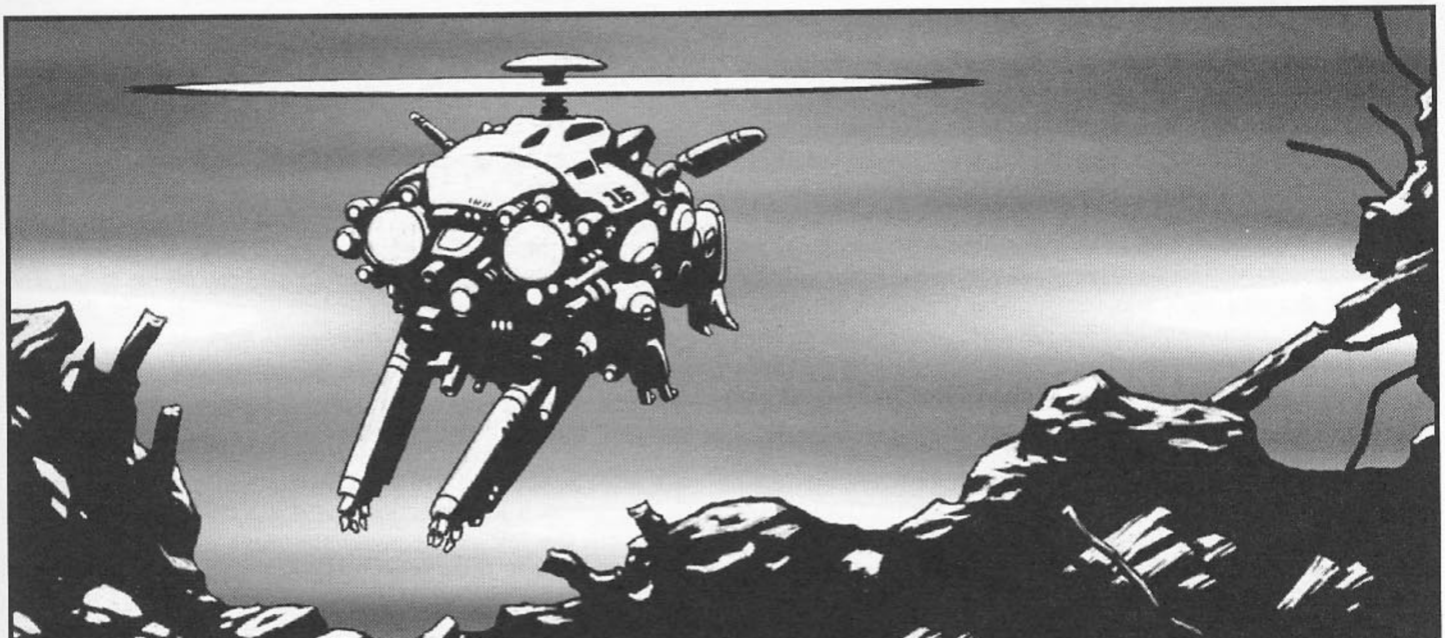
Volume: To find the volume, divide the weight by 50.

Cost: To find the cost of the propulsion system, multiply the weight by $50 (if it is a chemical rocket or turbofan engine) or $100 (if it is a fusion rocket).

Power: All these engines generate their own power, usually by burning fuel, or in the case of a fusion rocket, through nuclear reactions. As such, they require no extra power.

Fuel Consumption: These propulsion systems often require fuel. The fuel (or reaction mass) is shown in gallons per pound of motive thrust per hour. J is jet fuel, R is rocket fuel, W is water. The robot will need a fuel tank – see *Fuel* on p. 36.

Legality: LC 6 if under 50 lbs. thrust, LC 5 if 50 lbs. thrust or more. Subtract 1 from LC for fusion rockets.



Contact Weaponry and Jaws

These are weapons usable in close combat. With the exception of jaws and drug injectors, they can only be placed in robot arms (which includes arms used as tails, etc.), which restricts them to those robots which have arm motors.

Some of these weapons are actually tools, but because they can be used as weapons (and thus cost character points), they are covered here.

This section also covers robot jaws. A robot will need a jaw if it is to have a working animal- or human-like mouth.

Jaw and Contact Weapon Table

Weapon	*Type*	*Amt.*	*Reach*	*Cost*	*Wt.*	*Power*	*LC*	*TL*
Chain saw	Cut.	Spcl.	C,1	160	10	.1	6/3	7
Claws	Varies	Var.	C	Var.	neg.	0	Var.	7
Buzzsaw	Cut.	Spcl.	C,1	100	4	neg.	6/3	7
Electroshocker	Spcl.	Spcl.	C	200	1	20/B	5	7
Drug Injector	Spcl.	Spcl.	C	100	.25	0	6	7
Forceblade	Imp./Cut.	2d/4d (5)	C,1	3000	1.5	600/C	3	11
Jaw								
Crushing	Cr.	Spcl.	C	400*	.1*	.01*	6	8
Cutting	Cut.	Spcl.	C	600*	.1*	.01*	5	8
Impaling	Imp.	Spcl.	C	800*	.15*	.01*	4	8
Limpet Mine Dispenser	Exp.	2d+4 (10)	C	800	2	0	1	8
Medieval Hand Weapons	Var.	Var.	Var.	Var.	Var.	0	5/3	Var.
Monowire Blade	Var.	+1d (10)	Var.	Var.	Var.	0	3	9
Neurolash	Spcl.	Spcl.	C	650	2	10/B	5	10
Plasmafaust	Exp.	5d (10)	C	2,000	2	10/C	2	9
Vibroblade	Var.	+1d (5)	Var.	Var.	Var.	Spcl.	3	8

* *Per point of jaw ST.*

Weight: As shown on the table.

Volume: This is the weight/50 if the weapon is not concealed (except for jaws), weight/20 if it is concealed or is a jaw.

Cost: Except for medieval hand weapons or claws, this halves one TL after the weapon first appears, and quarters two or more TLs after it appears.

Power is as shown. Some weapons use power cells; others must be powered by the robot's power system.

Legality: For medieval weapons and chain saws, the second LC applies when given a vibro or monowire blade.

EXAMPLE

We decide Synthia has a large knife and a crushing jaw. The knife (see p. B206) is 1 lb., .02 cf and $40 with the monowire blade option ($250 at TL10, LC 4). Synthia's jaw has ST 4, so it weighs .4 lbs., takes up .02 cf, costs $400 (at TL10) and requires .04 KW power.

Descriptions

Chain Saw and Buzz Saw: Used for cutting wood, etc. It must be mounted in a robot arm! In combat, use DX-2 to attack with it. The reach is the arm's reach +1. A chain saw does the arm's Swing+4 damage, or 4d+4 Cutting damage, whichever is *less;* a buzz saw does Swing+2, or 2d+2 Cutting damage, whichever is less. The saw can also have a vibro or monowire blade (see p. 21).

Claws: A robot with arm motors or a leg drivetrain may have claws, a maximum of one claw per arm motor or leg motor. There are four types of claws; the cost must be paid for each arm or leg so equipped.

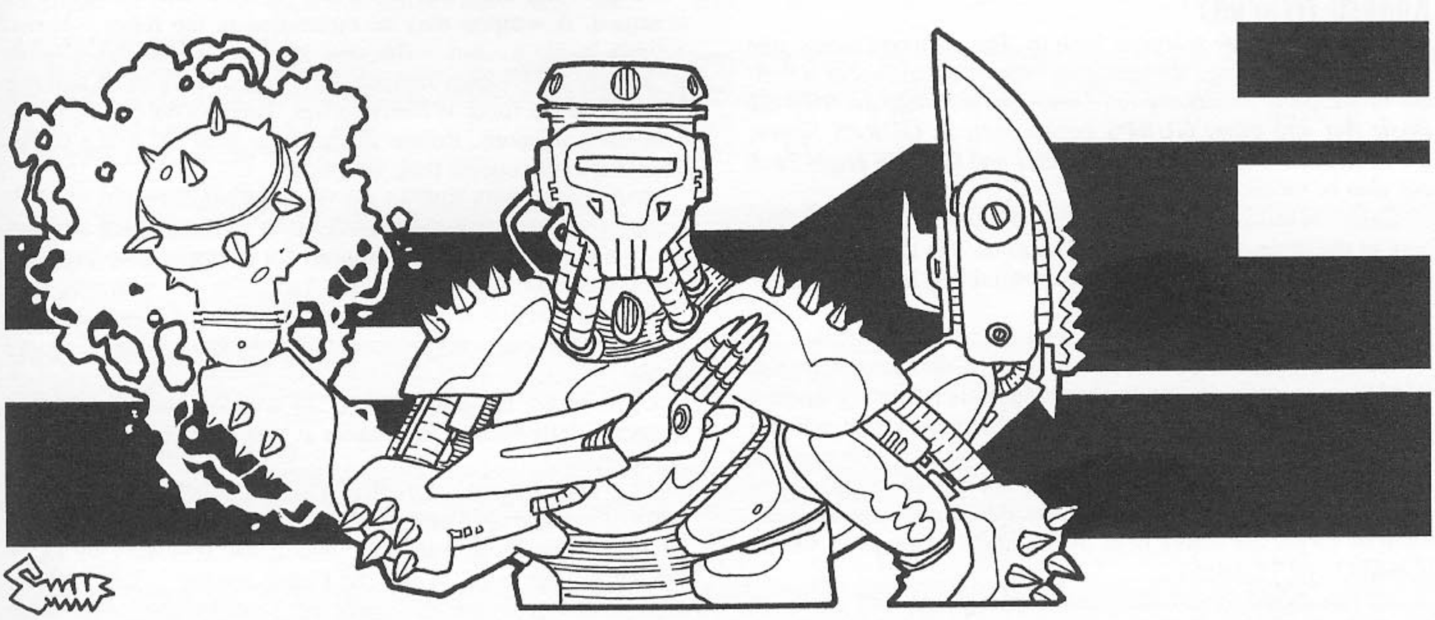
Blunt claws add +2 Crushing damage to a kick or punch. The cost is $100; they are LC 6. *Sharp claws* convert a kick or punch's Crushing damage to Cutting damage for $200; they are LC 5. *Talons* allow a kick or punch to do Swing/Cutting or Thrust/Impaling damage for $500; they are LC 4. *Long talons* allow a kick or punch to do Swing+2/Cutting or Thrust+2/Impaling damage for $1,000; they are LC 4. Any claws can be concealed, allowing them to retract into the arm; add 50% to cost.

Electroshocker: This enables the robot to deliver a powerful electric jolt. The victim must make a HT-3 roll to avoid being stunned (+1 HT per 10 DR on the location struck); if stunned, the victim loses 1d Fatigue and remains Stunned for as long as the arm is in contact, plus (20-HT) seconds, before any recovery rolls are allowed.

Drug Injector: This is either a hypodermic needle injector or, at TL8+, a painless pneumospray hypo. To be useful it must be mounted in a robot arm or head. It holds 10 doses of any drug, along with enough needles or air charges to inject them all. In combat, the injector can penetrate any armor with DR 1 or less.

Jaw: A jaw, including mouth and teeth, rated for its Strength. A robot intended to look human and have a working mouth must have a jaw. A jaw can be built to bite for crushing, cutting or impaling damage, based on the jaw's ST, using the table on p. B140. Since a human bite can do 1d-4 cr. (p. B111) a suggested jaw ST for human-like robots is 3, although it can be stronger. For carnivore-type animals, it's whatever is needed to get the desired damage; often the jaw will be as strong as the arms. Jaws are usually placed in heads. However, a jaw in a robot's main body or arm is possible. A jaw that is not in a head or arm makes biting attacks at -4 to hit, due to the awkwardness of the position.

Limpet Mine Dispenser (TL8): This close-combat weapon can only be mounted in an arm. It is a "sleeve dispenser" for sticky limpet mines which the robot can slap on the target. The mines attach themselves with molecular suction pads, then detonate immediately after the robot pulls back its arm, or after a preset interval. To plant one, use DX, Brawling or Karate skill. A successful hit does no immediate damage; instead, it sticks a limpet mine onto the target. The dispenser may be programmed to set mines with a time delay from 0 (at the end of the attacker's turn) to 100 seconds. Removing a limpet mine (if there is time) requires a Ready action and a successful ST roll, minus one-tenth the DR of whatever the mine is stuck to or -20, whichever is less. If the mine was stuck to flesh, it does 1 hit of damage when pulled off. If a mine is slapped on a part that cannot be reached (for instance, the small of the back), it can't be



removed without help. Limpet-mine dispenser magazines hold five limpet mines. Each mine has a shaped-charge warhead: damage is 2d+4 (10) at TL8, 3d+6 (10) at TL9; the (10) means that armor protects against the contact explosion at one-tenth DR. Also, anyone else within 2 yards of the blast takes 1d damage (1d+2 at TL9+) from the concussion. Limpet mines can also be stuck to the floor, walls, etc. for use as booby traps, but may not be thrown.

Medieval Hand Weapons: Axes, maces, flails, knives, swords, spears and so on can all be built into a robot's arm. Use the weight and cost on pp. B206-207; however, by TL7, metallurgical improvements mean standard weapons can be made at "cheap" cost, fine weapons for normal cost, and very fine weapons for the cost of a fine medieval blade; at TL8+, superfine weapons (+3 damage, and break as very fine weapons) are available at 20 × cost. If the weapon is designed to retract into the arm, it will take up weight/20 cf. If it never retracts into the arm, its volume is weight/50 cf. A maximum of one medieval weapon can extend out of a given arm! Most medieval hand weapons are LC 5 as shown. The exception is any kind of knife, which is LC 6.

Monowire Weapons: At TL9+ any cutting or impaling jaws, sharp claws, any talons, any saws and any medieval hand weapons that can do Cutting damage can be built as monowire blades. This does an extra +1d Cutting damage, and DR protects against it at one-tenth value. It costs $500 extra for cutting jaws, claws, talons, or knives, $1,000 for one-handed swords, and $1,500 for other weapons (half that at TL10, and one-fourth that at TL11+).

Neurolash: These devices disrupt the subject's nervous system, causing extreme pain. They only work on organic beings. A victim who is hit must roll HT-3, plus or minus Will modifiers. The High Pain Threshold advantage gives a +3 bonus. If successful, the victim can still function, but due to the pain will be at -2 to ST, DX, and IQ and to all skills based on these attributes for 15-Will turns (minimum 1). If he was hit on a limb, that limb is useless for the same length of time. If the HT roll was failed, the victim is in such agony he can do *nothing* for the same time. A critical failure will cause unconsciousness for 20-HT minutes (at least one minute). Each additional hit lowers the resisting HT roll by 1 (for example, the second hit is resisted at HT-4), and with each successive hit, start the recovery time over again, although penalties to attributes are *not* cumulative. Victims with the Low Pain Threshold disadvantage suffer double the effects. Reflec armor, or any armor with a DR over 2, provides total protection. For an extra $200, a TL11 neurolash can cause pleasure instead of pain ($500 and .5 lbs. for both settings). High and Low Pain Threshold have no effect on a pleasure jolt. Either kind of neurolash gives a +3 bonus to any kind of interrogation through torture.

Plasmafaust (TL9): This is a contact plasma-discharger weapon developed to replace the limpet mine dispenser. DR protects at once-tenth normal, and laminate armor protects at doubled DR. In addition, the user suffers 4d damage from the backblast of the plasma discharge (to the arm, or wherever the weapon is mounted); however, the user's own DR protects fully – it is not divided by ten).

Forceblades (TL11): These can be built into any robot arms. They project "fingers" or "blades" of annihilating energy. Force Sword skill is used to wield them. They work for 600 seconds of continuous use on a C cell. A basic forceblade does 4d (5) Swing/Cutting or 2d (5) Thrust/Impaling damage; DR protects at one-fifth value. A limb taking enough damage in a single hit to cripple it (p. B127) is lopped off and the wound cauterized. A weapon (except another type of energy blade) that successfully parries a forceblade is broken, unless the parry was a critical success. Forceblades may be of various sizes. Each time the weight and the cost double, add +4d to Cutting and +2d to Impaling damage, add 1 to Reach, and halve the number of seconds a C cell will power it. (A forceblade whose cost and weight have doubled once is identical to a standard ***GURPS Space*** force sword.) Higher-TL forceblades do more damage: +1 per die per TL over TL11, to a maximum of +3 per die at TL14+.

Vibroblade Weapons: At TL8+, any cutting or impaling jaw, sharp claws, any talons, any saw or any medieval hand weapon that can do Cutting damage can be built as a vibroblade. The cost is $200 extra for cutting jaws, claws, talons, knives or buzz saw, $400 for swords of all sizes, and $1,000 for other weapons including chain saws (half cost at TL9, quarter cost at TL10+). A B cell powers a vibro weapon for 60 minutes/pound of weapon weight. A vibro weapon does +1d (5) damage – that is, DR protects at one-fifth value. At TL9, it does 1d+1 (5), and at TL10+ 1d+2 (5).

Ranged Weapons

Robots may have weapons built in. The weapons tables give the weight, cost, Legality rating and combat statistics of a variety of weapons commonly built into robots. Weapons from the ***Basic Set*** and other ***GURPS*** books such as ***GURPS Space, GURPS Ultra-Tech, GURPS Vehicles*** and ***GURPS High-Tech*** can also be mounted in robots.

Unless noted otherwise, the weapons tables work the same way as the table on p. B208. The notes on this table also apply to weapons taken from other weapon tables, like that of pp. B208-209.

Type and DMG: A damage type of "Exp." indicates the weapon's attack inflicts explosive concussion damage (see p. B121) over an area. A number in parenthesis following damage is a damage divisor: effective DR is divided by that number against the attack. Spcl. is "special" – see weapon descriptions. Also, beam weapons, railguns, gravguns and Gauss guns add +1 per die to damage, each TL after introduction, to a maximum of +3 per die. (So a laser that did 6d×3 damage would do [6d+6]×3 one TL later.)

½D and Max: Beam weapons and railguns add +10% to range per TL after introduction, to a maximum of +30%.

Weight: This is shown on the table. It remains constant at all tech levels. It includes ammunition and power cells.

Volume: This is not shown on the weapon table. The volume of a weapon depends on how the weapon is mounted. Normally, the weapon takes up its weight/50 cf. However, the barrel protrudes from the robot, making it obvious that the robot is armed. A weapon may be *concealed* in the robot – buried entirely inside it – but in this case it takes up a greater volume: its weight/20 cf. Concealed weapons have hidden ports that pop open when the robot is ready to fire. There is no extra cost for concealed weapons. Robots designed to pass for living beings should always conceal their weapons!

RoF: Lasers with RoF 4+ use the laser autofire rules.

Shots: For beam weapons, add 50% to the number of shots they get every TL after they appear; for example, four TLs later would add +200%.

ST and Recoil: If the weapon is mounted in an arm, ST requirements apply. If it is mounted in the body or head, ignore them.

Cost: Halve the price of a TL7+ weapon one TL after the weapon's introduction, or quarter it two or more TLs after its introduction.

LC: The weapon's Legality Class. LC is discussed on p. B249 of the revised Third Edition ***Basic Set,*** but is not listed in ***GURPS High-Tech.*** Automatic pistols and revolvers are LC 3, but the stunner is LC 6 and the Gauss needler is LC 2, as are submachine guns and the disruptor. Non-repeating pistols are LC 5. Shotguns and rifles are LC 4, except for those with RoF 5+ (LC 1), stun rifles (LC 5), or military laser rifles (LC 0). All machine guns and other man-portable heavy weapons are LC 0. A very few weapons have been assigned a LC of -1 – these are vehicular-sized military weapons like tank guns.

In a few cases, weapon statistics have been altered from ***GURPS Ultra-Tech*** and ***GURPS Space*** to correct errors.

Ranged Weapon Table

Weapon	*Type*	*DMG*	*SS*	*Acc*	*½D*	*Max*	*Wt.*	*RoF*	*Shots*	*ST*	*Rcl.*	*Cost*	*LC*	*TL*
Conventional Slugthrowers (TL7)														
Light Machine Gun, 7.62mm	Cr.	7d	18	11	1,000	4,700	25	15*	100	13	-1	3,000	0	7
6Pak Minigun, 5.56mm	Cr.	5d+1	20	13	500	3,600	60	66	500	15	-1	10,000	0	7
Heavy Machine Gun, 12.7mm	Cr.	12d	20	16	1,200	5,000	115	8*	100	25	-1	6,000	0	6
Caseless Slugthrowers (TL8)														
Holdout Pistol, 7mmCL	Cr.	2d	7	2	140	1,800	1	3~	12	–	-1	200	3	8
Machine Pistol, 10mmCL	Cr.	3d	10	8	180	2,000	3.5	10*	30	9	-2	700	2	8
Submachine Gun, 4mmCL	Cr.	4d	11	9	300	2,400	5	12*	80	9	-1	800	2	8
Assault Carbine, 6mmCL	Cr.	6d	12	11	1,000	4,500	7	10*	60	9	-1	1,000	1	8
Light Support Weapon, 6mmCL	Cr.	6d	15	11	1,000	4,500	25	20*	300	10	-1	2,000	0	8
Grenade Launchers (TL7-12)														
Police Gren. Launcher	Spcl.	Spcl.	12	6	–	120	25	2~	12	10	-1	1,000	2	7
Auto Grenade Launcher	Spcl.	Spcl.	12	8	–	1,600	100	6*	20	20	-1	6,000	0	7
Electromag Gren. Launcher	Spcl.	Spcl.	10	8	–	1,000	10	1	5/5C	–	0	5,000	0	8
Grav Gren. Launcher	Spcl.	Spcl.	12	9	–	1,500	20	3*	12/C	–	0	5,000	0	12
Chainguns and Minicannons (TL7-8)														
20mm Chaingun	Spcl.	Spcl.	20	16	1,500	5,000	300	20*	200	75	-1	9,000	-1	7
20mm Gatling Chaingun	Spcl.	Spcl.	20	16	1,500	5,000	540	40*	300	250	-1	14,400	-1	7
20mm Caseless Minicannon	Spcl.	Spcl.	20	16	1,500	5,000	75	3~	30	20	-2	3,150	0	8
20mm CL Gatling Chaingun	Spcl.	Spcl.	20	16	1,500	5,000	375	40*	250	150	-1	13,500	-1	8

Weapon	Type	DMG	SS	Acc	½D	Max	Wt.	RoF	Shots	ST	Rcl.	Cost	LC	TL
Rocket Launchers (TL7-8)														
Light Rocket Launcher	Spcl.	Spcl.	15	2	–	500	25	1	4	10	0	2,000	0	7
Heavy Rocket Launcher	Spcl.	Spcl.	15	3	–	1,200	150	1	3	10	0	6,000	0	7
Light Rocket Launcher	Spcl.	Spcl.	15	2	–	500	15	1	4	9	0	2,000	0	8
Heavy Rocket Launcher	Spcl.	Spcl.	15	3	–	1,200	100	1	3	10	0	6,000	0	8
Electric Stunner (TL7)														
Electric Stunner	Imp.	Spcl.	3	3	–	10	1	Spcl.	2	–	-1	200	5	7
Flamethrower (TL7)														
Flamethrower	Spcl.	3d	5	8	40	75	20	4*	20	10	-1	1,000	0	7
Tanglers (TL8)														
Tangle Pistol	Spcl.	–	5	6	–	15	3	1	2	10	-4	500	5	8
Tangler	Spcl.	–	6	8	–	20	6	1	5	8	-4	1,000	5	8
Riot Tangler	Spcl.	–	10	8	–	80	25	3~	15	10	-2	4,000	4	8
Electromag Guns (TL9-10)														
Railgun, 25mm	Cr.	6d×25 (3)	25	20	4,950	8,450	1,150	1	325/E	240	-2	120,000	-1	9
Railgun, 50mm	Cr.	5d×50 (3)	30	20	5,850	9,350	2,500	1	100/E	500	-2	172,000	-1	9
Railgun, 75mm	Cr.	6dx65 (3)	30	21	7,200	10,700	5,850	1	75/5E	1,170	-2	220,000	-1	9
Gauss Pistol	Cr.	4d (2)	10	8	200	2,000	3	12*	80/C	–	-1	1,500	2	9
Gauss SMG	Cr.	5d (2)	11	9	250	2,500	5	16*	60/C	–	0	3,000	1	9
Gauss Battle Rifle	Cr.	8d (2)	12	12	1,200	4,500	7.5	12*	60/C	–	0	3,500	0	9
Gauss Minigun	Cr.	8d (2)	20	14	1,200	4,500	45	60*	600/D	10	0	9,000	0	9
Gatling Gausscannon	Spcl.	Spcl.	20	15	1,500	4,000	350	40*	480/D	70	-1	27,000	-1	9
Portable Railgun	Cr.	6d×4 (3)	18	17	1,800	4,800	45	3~	150/C	9	-1	4,800	0	9
Assault Razergun	Imp.	3d+2 (10)	10	12	400	800	5	3*	750/C	–	0	3,000	1	9
Gauss Razergun	Imp.	7d (10)	10	14	500	1,000	20	4*	3,000/D	–	0	6,000	0	9
Gauss Minicannon	Spcl.	Spcl.	20	15	1,500	4,000	75	3~	48/C	15	-2	9,000	0	9
Lasers (TL8-9)														
Laser Torch, light	Imp.	1d-2	9	1	2	10	1	4*	120/C	–	0	100	6	8
Laser Torch, medium	Imp.	1d	12	1	3	15	5	4*	60/C	–	0	250	6	8
Laser Torch, heavy	Imp.	2d	15	1	4	20	20	4*	150/D	–	0	500	5	8
Heavy Laser Pistol	Imp.	2d	9	8	300	800	3	4*	12/C	–	0	1,500	2	8
Military Laser Carbine	Imp.	1d+2	10	12	750	1,200	7	8*	200/D	–	0	3,000	1	8
Auto Laser	Imp.	5d	15	18	2,000	6,000	45	8*	600/E	12	0	10,000	0	8
Laser Cannon	Imp.	5d×5	20	20	4,250	12,750	500	4*	225/10E	80	0	40,000	0	8
Holdout Laser	Imp.	1d-1	10	4	50	100	.25	1	5/B	–	0	500	4	9
Gatling Laser	Imp.	20d	10	20	4,000	12,000	75	4*	150/E	15	0	20,000	0	9
Rainbow Strike Laser	Imp.	5d×10	20	21	6,250	18,750	500	4*	192/8E	100	0	43,000	0	9
Electrolasers (TL9+)														
Holdout Electrolaser	Spcl.	1d+2	6	3	30	60	.5	1	5/B	–	0	600	3	9
Electrolaser	Spcl.	2d+1	8	4	60	120	1.5	1	10/C	–	0	1,200	3	9
Electrolaser Rifle	Spcl.	3d+1	9	12	100	300	5	1	5/C	–	0	1,800	2	9
Particle Beams and Blasters (TL9-10)														
Heavy Blaster Pistol	Imp.	9d	12	8	300	800	4.5	3~	16/C	8	-1	2,500	2	9
Heavy Blaster Rifle	Imp.	6d×3	15	14	600	1,600	12	3~	60/D	9	-1	6,000	0	9
Tripod Blaster	Imp.	6d×11	20	15	2,244	5,874	60	1	27/E	12	0	19,200	0	9
Blaster Cannon	Imp.	6d×50	20	23	10,200	26,700	1,410	1	40/30E	262	0	80,800	-1	10
Particle Beam Cannon	Imp.	6d×100	20	25	20,400	53,400	5,240	1	33/100E	1,048	0	275,200	-1	9
Holdout Blaster	Imp.	4d	7	5	–	200	1	3~	6/2B	5	-1	800	3	10
Plasma Guns and Flamers (TL9-10)														
Plasma Torch	Spcl.	7d	8	2	3	10	4	1	60/D	–	0	750	4	9
Heavy Plasma Torch	Spcl.	20d	12	2	4	12	40	1	500/E	12	0	3,000	4	9
Hand Flamer	Spcl.	10d	4	12	70	150	4	1	8/C	6	0	1,300	2	9
Plasma Rifle	Spcl.	16d	5	16	80	250	12	1	70/D	9	0	5,200	0	9
Tripod Flamer	Spcl.	30d	6	20	100	300	45	1	40/D	12	0	10,000	0	9
Plasma Cannon	Spcl.	6d×60	12	25	1,200	3,600	500	1	36/10E	100	0	40,000	-1	9
Plasma Pistol	Spcl.	6d	4	10	50	100	2	1	16/C	–	0	1,000	3	10
Paralysis Guns (TL10-11)														
Paralysis Gun	Spcl.	–	6	4	–	25	5	1	15/C	–	0	1,500	3	10
Heavy Paralysis Gun	Spcl.	–	10	12	–	200	25	3~	60/D	–	0	8,000	2	10
Paralysis Pistol	Spcl.	–	6	2	–	15	1	1	5/B	–	0	600	5	11

Weapon	Type	DMG	SS	Acc	½D	Max	Wt.	RoF	Shots	ST	Rcl.	Cost	LC	TL
X-ray Lasers (TL10)														
X-Laser Pistol	Imp.	1d+2 (2)	9	7	240	600	2	4*	20/C	–	0	1,000	3	10
Hvy. X-Laser Pistol	Imp.	3d (2)	9	8	400	1,000	3	4*	12/C	–	0	1,500	0	10
Military X-Laser Carbine	Imp.	2d (2)	10	12	900	1,800	7	8*	200/D	–	0	3,000	0	10
Military X-Laser Rifle	Imp.	3d (2)	12	15	1,800	2,400	9	8*	140/D	–	0	4,000	0	10
X-ray Auto Laser	Imp.	8d (2)	15	18	2,400	7,200	45	8*	600/E	12	0	10,000	0	10
Gatling X-Laser	Imp.	30d (2)	10	20	4,500	13,500	75	4*	75/E	15	0	20,000	0	10
X-ray Strike Laser	Imp.	5d×10 (2)	20	21	6,750	20,250	500	8*	270/10E	100	0	40,000	-1	10
X-ray Laser Cannon	Imp.	5d×20 (2)	25	23	10,000	30,000	2,000	8*	270/40E	400	0	112,000	-1	10
Gravguns (TL11)														
Gravpistol	Cr.	4d (5)	10	8	300	3,000	3	12*	160/C	–	0	1,500	2	11
Gravrifle	Cr.	8d (5)	12	12	1,800	6,750	7.5	12*	120/C	–	0	3,500	1	11
Portable Gravgun	Cr.	6d×5 (5)	15	16	3 mi.	10 mi.	45	4*	200/D	9	-1	10,000	0	11
Light Gravcannon	Cr.	6d×50 (5)	25	21	7,425	10,925	1,250	1	575/E	250	-2	120,000	-1	11
Heavy Gravcannon	Cr.	5d×100 (5)	30	22	8,775	12,275	2,500	1	100/E	500	-2	172,000	-1	11
Gravity Beams (TL12)														
Grav Beamer	Spcl.	1d-1 (100)	10	5	20	30	1	3~	30/C	–	0	2,000	3	12
Assault Gravbeam	Spcl.	1d+2 (100)	12	15	1,200	3,750	9	1	200/D	–	0	4,000	0	12
Tripod Gravbeam	Spcl.	3d (100)	15	18	2,500	7,500	75	3~	100/E	15	0	40,000	0	12
Light Gravbeam Cannon	Spcl.	6d (100)	20	21	4,800	14,400	370	4*	135/5E	74	0	75,200	-1	12
Heavy Gravbeam Cannon	Spcl.	6d×2 (100)	25	22	9,600	28,800	1,480	4*	135/20E	296	0	204,800	-1	12
Pulsars (TL13)														
Pulsar Pistol	Spcl.	6d×3 (2)	12	8	200	400	2	3~	16/C	8	-1	10,000	1	13
Assault Pulsar	Spcl.	3d×10 (2)	11	12	400	800	7.5	3~	60/D	8	-1	20,000	0	13
Heavy Pulsar	Spcl.	5d×10 (2)	14	14	600	1,200	25	1	24/D	13	-1	30,000	0	13
Pulsar Cannon	Spcl.	5d×200 (2)	30	23	12,000	24,000	11,000	1	56/100E	2,200	0	1,288,000	-1	13
Mindrippers (TL14)														
Short-Range Mindripper	Spcl.	–	12	14	–	50	10	1	50/C	–	0	50,000	0	14
Long-Range Mindripper	Spcl.	–	20	16	–	500	75	1	200/E	60	0	100,000	0	14
Gamma-ray Lasers (TL14)														
Graser Pistol	Imp.	3d (5)	9	7	300	700	2	4*	16/C	–	0	2,000	3	14
Hv. Graser Pistol	Imp.	4d (5)	9	8	500	1,400	3	4*	12/C	–	0	3,000	0	14
Military Graser Carbine	Imp.	3d (5)	10	12	1,200	2,400	7	8*	160/D	–	0	6,000	0	14
Mil. Graser Rifle	Imp.	4d (5)	12	15	2,500	3,200	9	8*	112/D	–	0	8,000	0	14
Auto Graser	Imp.	10d (2)	15	18	3,000	9,000	45	8*	300/E	12	0	20,000	0	14
Gatling Graser	Imp.	40d (5)	10	20	6,000	18,000	75	4*	75/E	15	0	40,000	0	14
Strike Graser	Imp.	5d×20 (5)	20	23	11,500	34,500	450	4*	90/5E	90	0	88,000	-1	14
Graser Cannon	Imp.	5d×40 (5)	25	25	20,500	61,500	1,800	4*	90/20E	360	0	256,000	-1	14

EXAMPLE

We want Synthia to have a built-in ranged weapon. We decide on a military laser carbine. At TL8, it weighs 7 lbs. It costs $3,000, quartered for being built two TLs later at TL10 (and $750). We conceal it, so it takes up its weight/20 cf, or .35 cf. It is LC 1. We also add the variable beam option (see *Lasers* on p. 26) for another $100.

Conventional Slugthrowers (TL7-8)

These are normal bullet-firing guns, using expanding gasses from a chemical reaction to propel a metal slug. All produce a loud noise and visible muzzle flash. They don't work underwater or in vacuum.

Caseless Slugthrowers: These come into use at TL8 and fire caseless (CL) ammunition. The bullet is embedded in a solid block of propellant that is consumed when it is fired. This allows more shots to be carried, keeps the weapon cleaner since it needs no cartridge ejection port, and allows it to function underwater or in vacuum. TL8 caseless guns are available at half cost as conventional weapons firing non-caseless ammunition. They have half the number of shots (this doesn't affect weight, since the ammunition weighs twice as much per shot).

Liquid-Propellant Smartguns: A more advanced form of TL8 slugthrower uses liquid propellants (LP). Instead of packing solid propellant inside or around the bullet, propellant in liquid form is squirted into the firing chamber as each round is fired. A computer chip can vary the amount of propellant, so rounds can be fired either at normal velocity setting, or "low velocity" or "hyper velocity" settings. On "low" setting, rounds are subsonic (making the weapon virtually silent), accuracy is -2, and damage, range and recoil are halved (a half-die of damage becomes a +2). On "hyper," accuracy is +1, damage and range are multiplied by 1.5 and recoil doubles. Any TL8 caseless weapon is available as an LP smartgun at double cost.

Besides ordinary bullets, slugthrowers may also use special ammunition. Common types include Armor-Piercing Saboted (APS) bullets, which are +1 damage per die, +50% range, armor protects with half DR (but damage after subtracting DR is also halved), 5 × cost, and Plastic Bullets (half damage and range, normal cost).

Grenade Launchers (TL7-12)

These versatile weapons fire low-velocity rounds, usually with explosive or chemical warheads.

TL7 grenade launchers use conventional chemical propellants. TL8 electromag grenade launchers use a magnetic impulse for propulsion – see *Electromag Weapons* on p. 26. TL12 grav grenade launchers use a gravitic impulse – see *Gravguns* on p. 27.

The effect and cost of an individual shot from any kind of grenade launcher depends on the kind of grenade fired:

Concussion (TL7): An explosive warhead doing 3d (at TL7), 6d×2 (at TL8) or 6d×3 (at TL9+) explosive concussion damage. They cost $20 each.

Chemical (TL7): Releases a cloud of chemicals which lingers over a 6-hex radius for 300 seconds/wind speed in mph. See *Chemical Agents* on p. 30 for the options. It costs the same as 10 doses of the chemical.

Flechette (TL7): These warheads filled with steel darts burst like shotgun shells. They do impaling damage – 6d at TL7, 8d+8 at TL8+. Use the shotgun rules (p. B119). When firing flechette rounds, the weapon has a ½D range of 8% of its maximum range and a Max range of 20% of its maximum range. They are $30 each.

Force (TL12): The grenade emits a brief gravitic pulse doing 6d (at TL12) or 6d×2 (at TL13+) crushing damage. Damage is five times greater for knockback purposes! They cost $40 each.

Fragmentation (TL7): Like a concussion grenade, plus lethal fragments doing 2d Cutting fragmentation damage. $20 each.

HESH (High Explosive Squash Head) (TL7): This is a soft plastic explosive round. It functions like a concussion round unless it hits armor too strong to penetrate. Then it flattens out and explodes, creating a shock wave that can be felt even through armor. If it scores a direct hit and fails to penetrate the armor, 10% of the damage bypasses DR and inflicts damage anyway! These cost $40 each.

Plasma (TL11): One of these releases a blast of ionized plasma doing 6d×4 explosive concussion damage (TL11) or 6d×6 (TL12+). In addition, it has the same effect on armor and flammable materials that a flamer hit (p. 27) does, melting DR and setting things on fire. Each one costs $40.

Ripsaw (TL10): Like a fragmentation grenade, but its lethal monowire-edged fragments do 2d (10) fragmentation damage instead. They are $30 each.

Shaped-Charge (TL7): This armor-piercing explosive warhead does 2d (10) (at TL7), 4d×2 (10) (at TL8) or 6d×2 (10) (at TL9+). It does explosive concussion damage; in addition, DR protects at one-tenth value against a direct hit. If the round hits light or no armor, the warhead may not detonate: roll 3d vs. the target's DR. If the roll is higher than DR, it does not go off and instead the target takes 4d crushing damage. Pay $30 for each.

Sonic Stun (TL9): This emits a brief sonic pulse, with the same effect as a hit by a stun rifle, in a 2-yard radius around the grenade and the same effect as a stun pistol within 3-4 yards. See *Stunners*, p. B119, for stunner effects. The pulse continues for 3 turns, affecting anyone entering or remaining in the area. They cost $40 each.

Stun Baton (TL7): A non-exploding plastic baton round that spreads into an X-shape upon hitting its target. It does 4d Crushing damage, and full knockback, but the damage that penetrates DR is halved. The launcher's range when firing stun batons is ⅕ normal. The rounds are $20 each.

Tangler (TL8): These envelop the target in sticky strands, with the same effect as Tangler (p. 26) hits. They cost $10 each.

All grenades except flechette, HESH, shaped-charge and stun batons are also available as hand grenades, with identical characteristics.

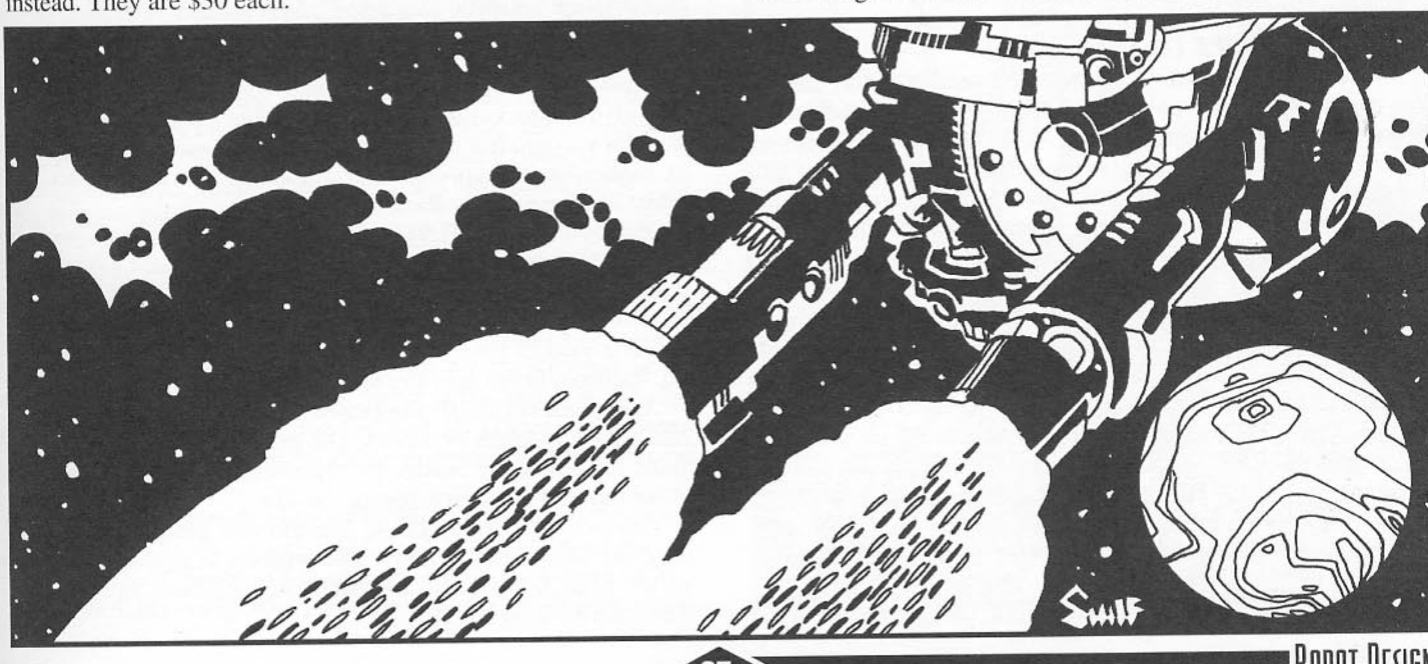
Chainguns and Minicannons (TL7-8)

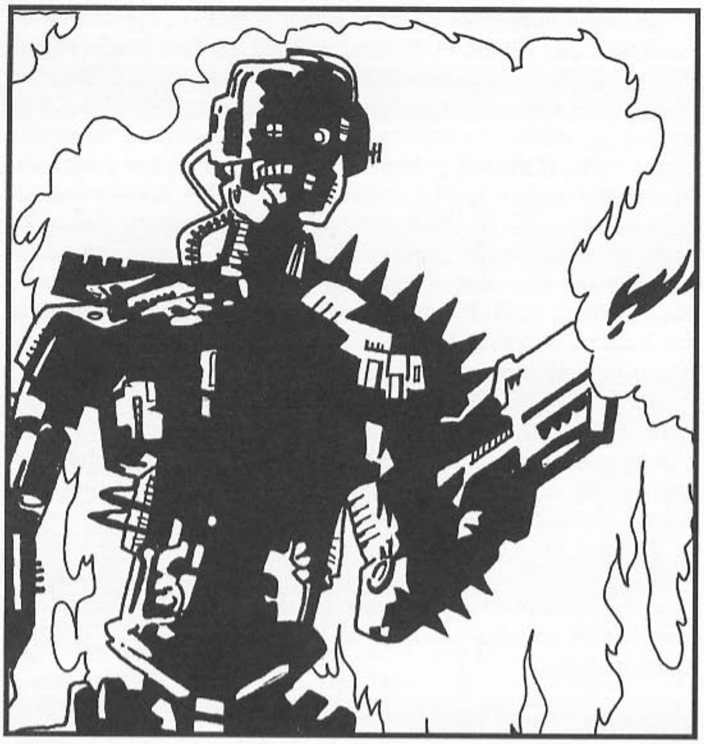
These are 20mm automatic cannons, similar to large machine guns. They can fire the same range of ammunition as grenade launchers; but unless they are firing baton or flechette rounds, the damage (or radius of effect) is halved. In addition, chainguns can also fire high-velocity armor-piercing depleted uranium (APDU) shells that do 6d×4 (3) damage and cost $10 each, as well as API shells that do 6d×4 damage and cost $2 each.

TL7 chainguns use conventional propellants (see *Conventional Slugthrowers*, p. 24).

TL8 chainguns normally use caseless ammunition (see *Conventional Slugthrowers*, p. 24, for a description of caseless propellant). Conventional-propellant TL8 chainguns are available: these cost half as much and have only half as many shots.

TL8 chainguns may be built to use liquid-propellant ammunition (at double cost), with the same effects as for conventional slugthrowers. However, the low- or hyper-velocity settings of LP ammunition chainguns only affect a chaingun's damage when firing APDU, flechette or baton rounds.





Flamethrowers (TL7)

These fire a high-pressure stream of napalm. Flamethrowers have RoF 4; as with lasers, add damage from multiple hits in a burst together before subtracting DR. Only sealed armor protects fully; non-sealed armor (including that on non-sealed robots or vehicles) gets only one-fifth DR. Once it hits, the napalm sticks and continues to burn for 10d turns, doing 1d damage per second (armor protecting as above). Only total immersion in water or the like will extinguish it.

Rocket Launchers (TL7-8)

These fire rockets with the same range of warheads as grenades, except that tangler and stun baton rounds are not available. The warheads are larger: their damage (or radius for chemical or stun rounds) is doubled for light rocket launchers and quadrupled for heavy rockets. The cost also increases proportionately.

Electric Stunners (TL7)

These fire a dart trailing a wire to the robot's power supply. The dart can penetrate up to DR 2 and does 1 point of damage. When the dart penetrates a living body, the robot releases an electric shock – a HT-3 roll is required to stay conscious; failing the roll immobilizes the victim for 25-HT seconds. The dart can be reeled in after the target is immobilized. The weapon cannot fire again until the dart is reeled in.

Tanglers (TL8)

Tanglers fire capsules that release sticky strands to entangle victims. Anyone hit gets an extra Dodge roll to evade the strands before they close, but neither armor PD nor DR protects, as they simply wrap around it as well as the person wearing it. A victim cannot move any limbs. He may try one Contest of Strength vs. ST 20 (+5 per extra hit, if multiple shots hit) to break free, plus one per minute. Or, if the victim is fully clothed, an Escape-3 roll (-1 per extra hit, one try every 10 minutes) will let him wriggle out of the clothes and escape. Any failed attempt to break free or wriggle out, though, results in the strands constricting, causing 1 point of damage (armor protects fully). The strands are too tightly wound around the victim, as well as too sticky, to be cut off. Ten hits from intense heat will also free the victim, but he takes the damage as well. The proper way to remove Tangler strands is with Anti-tangler aerosol spray (see *Chemical Agents* on p. 30). The strands lose their constricting ability after one day and then begin to lose ST at a rate of 1 per 2 hours. A round of tangler ammunition costs $10 and weighs 1 lb.

Electromag Weapons (TL8-10)

These weapons use an electromagnetic impulse to accelerate projectiles. They have no visible muzzle flash, but do produce a loud noise (as the round cracks the sound barrier) and an electromagnetic pulse that radscanners can detect. They require power (usually from power cells) and ammunition.

Electromag Grenade Launchers fire 40mm steel-sheathed grenades. They fire the same types of grenades as conventional grenade launchers (p. 25).

Gauss Guns are hyper-velocity small arms that fire 3mm to 4mm bullets with dense armor-piercing cores, rather than the tiny needles of the Gauss needlers in the ***Basic Set.***

Gausscannon fire high velocity steel-sheathed 20mm shells with a variety of warheads. Their effects are identical to those of grenades (see p. 25), but all types except flechette and baton rounds do half the damage (halve the radius of effect of stun and chemical rounds), and all shells cost half as much. They can also fire armor-piercing depleted uranium (APDU) shells that do 6d×6 (3) damage; these cost $5 each.

Railguns are very-high-velocity electromag weapons that accelerate high-density superconductor-sheathed or ferrous projectiles to speeds in excess of 4,500 yards per second. DR protects at one-third normal against their damage.

Razerguns are railguns whose magazines contain a coil of superconductor-sheathed monowire. As the weapon fires, it snips off short strands of wire, which become rigid in the gun's magnetic field and are accelerated to hypersonic velocities. DR protects at one-tenth value, and damage is impaling! If the superconducting wire penetrates electronic systems, it tends to short them out, so it does full impaling damage vs. robots, too.

Lasers (TL8-9)

Lasers fire a beam of coherent light. In rain, fog or smoke, lasers do half damage. Smoke bombs and such block laser beams totally. Laser beams are silent and invisible in vacuum. In atmosphere, weapon-grade lasers ionize the air (leaving a line of tiny sparks) and make an audible crack (as air rushes into the vacuum left in the beam's wake). Lasers fired at RoF 4 or higher use the special laser automatic fire rules described under *Damage from a Burst* on p. B120.

Rainbow Lasers (TL9) automatically vary their color to best damage targets and penetrate atmosphere. Rain and mist do not penalize them. Each yard of water, dense fog, or smoke the laser beam must pass through gives the target an extra DR 1.

Each yard of prismatic smoke gives the target an extra DR 20. Rainbow lasers may fire underwater at half range.

X-ray Lasers (TL10) fire beams of coherent X-rays; they are also called X-lasers or xasers. DR protects at one-half normal value against X-ray beams. Furthermore, the X-laser's damage is not reduced by smoke, fog, or the like.

Gamma-ray Lasers (TL14) fire coherent gamma-ray beams; they are also called grasers. DR protects at one-fifth normal value! Like X-ray lasers, atmospheric conditions and countermeasures have no effect.

For an extra $100 (unmodified by TL), any laser, X-ray laser or graser can have a variable beam. This makes it useful as a tool. Using it to weld consumes the equivalent of one "shot" per five seconds, cooking uses one shot per minute, and using it as a flashlight equals one shot every five minutes. It can also light a fire for trivial energy (100 fire starts take one shot).

"Laser torches" are short-range civilian lasers designed for welding or cutting. Their beams are variable at no extra cost.

Blasters and Particle Beams (TL9-10)

These are particle accelerators firing beams of protons, electrons or alpha particles. Blaster bolts resemble coherent lightning. Cannon-sized blasters are usually known as C-PAWS (for Charged Particle Accelerator Weapon System). Blaster bolts do their full impaling damage to robots, since the radiation can fry electronic systems.

Electrolasers (TL9)

These "zap guns" fire a low-power laser beam to ionize a path through the air, followed by an electrical charge that follows that path to the target. They don't work in vacuum and are at -2 to hit in humid environments, or -6 in rain or fog. Armor protects unless it is metal; metal does not protect, and adds +2 to hit if the target is made of or has 20 lbs. or more of it.

An electrolaser can fire a "stun" or "kill" bolt. If set on "stun," roll damage normally, but inflict no physical damage. Instead, the target must make a HT roll, minus half the damage that got past its DR (round up). Failure means the target is incapacitated for 20-HT minutes, and at -2 DX for another 20-HT minutes after. On "kill" the effects are the same, except that the target actually takes the rolled damage, and (if an organic being) failing the HT roll not only incapacitates the target but stops his heart. He will die in HT/3 minutes unless given CPR (a successful First Aid-4 or Physician roll.)

Plasma Guns and Flamers (TL9-10)

A flamer, or plasma gun, projects a stream of super-hot ionized plasma. The dice rolled for damage may be divided between targets, as long as all targets are in the same arc of fire as described for area weapons (p. B121). If the targets are more than one hex apart, 1d of damage is lost for each extra hex separating them.

The wash of plasma easily penetrates unsealed armor which gets ½ DR vs. the attack. It also *melts* armor. For every 10 points of damage the attack does (before subtracting DR), armor loses 1 DR on the location hit. A sealed suit (or robot or vehicle) becomes unsealed after losing 20% or more of its original DR. Paper, cloth and wood automatically ignite if hit by a flamer discharge. Flammable plastics and such catch fire if their DR is exceeded.

Paralysis Guns (TL10)

These weapons fire radiation pulses that can affect both organic life and electronics. A beam from a paralysis pistol, gun or rifle affects a living being that it hits for 30-HT minutes: he is paralyzed if he fails a HT roll, or -2 to DX and -1 to IQ (this also temporarily reduces the level of all DX- and IQ-based skills) if he succeeds. Individuals in sealed armor suffer no effects.

A paralysis beam that hits an unshielded robot or other electronic system knocks it out on a 1d roll of 1-2 (subtract the target's Size Modifier from this roll; small robots are more vulnerable than large ones). The paralysis lasts for (30-HT) minutes. A robot is considered "shielded" if it has both rad shielding (p. 43) and a hardened brain (p. 9). Either one alone simply reduces the chance of being knocked out to a roll of 1.

For double cost, *military paralysis guns* are available. They fire a more powerful beam. A target in unsealed armor makes HT rolls to resist at -4; the effects last twice as long, and they knock out robots or electronics on a roll of 1-4. They affect organic beings in sealed armor or shielded robots as if they were unprotected beings hit by a non-military paralysis gun. (Exception: They will not affect a target behind DR 200 or more armor.)

Gravguns (TL11)

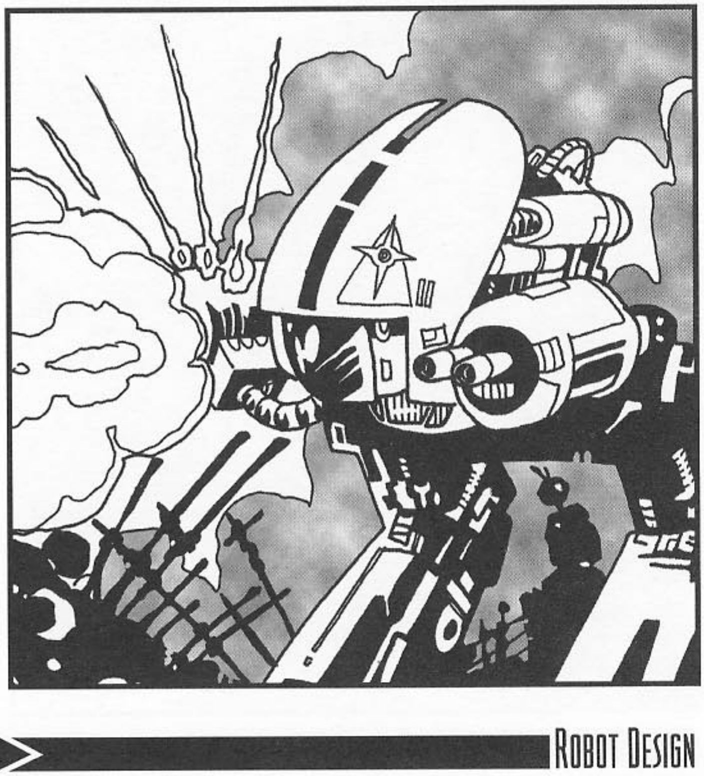
These are similar to electromag railguns, but use a tractor-beam-like gravitic impulse to accelerate projectiles to very high velocities. Gravguns produce no visible flash, and the only noise is the crack of the projectile going supersonic. They produce a gravitic pulse detectable by TL11+ radscanners.

Gravgun warheads are made of hyperdense gravitically compressed matter, and as such, DR protects at only one-fifth its normal value.

Gravity Beams (TL12)

These weapons are offshoots of TL12 contragrav and force field technology. Unlike gravguns, which simply use gravity technology to accelerate projectiles, gravity beams actually fire focused beams of "coherent gravity." They normally project an oscillating tractor/pressor gravity beam. This setting causes the inside of a target – or part of the target – to vibrate rapidly, inflicting damage. Armor PD does not protect and DR gives only 1/100 normal value; no knockback is inflicted.

They can also be used as non-lethal weapons, focusing a high-impact "force beam" of gravity on a single target. This does crushing damage; use the full damage only when calculating knockback – the actual damage is halved. For example, if 16 points of damage were rolled, a man would suffer 2 hexes of knockback, but only take 8 hits of damage. Damage inflicted by this setting is usually a wide bruise covering much of the target's body!



Pulsars (TL13)

These are TL13 blasters firing antimatter particles. They do impaling damage (to the person hit) and armor DR protects at half value. Also, they do explosive concussion damage equal to half the weapon's damage to anyone within 2 yards, with damage quartered every 2 yards beyond it. (DR protects at full value from this concussion damage). In addition, a direct hit inflicts 10 rads of radiation damage × damage rolled before DR; subtract the target's radiation PF if any. See *Robots in Action* for radiation rules. A miss by 1 inflicts half the radiation damage!

Mindrippers (TL14)

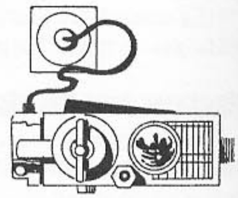
Mindrippers are advanced neural disruptor weapons that brutally interrogate the target's mind and nervous system. They instantly make a *ghost program* copy of the subject (see *Ghost Programs* on p. 65) at the cost of irreparable damage to the subject's mind. The subject gets a HT-5 roll at +1 per 10 points of DR protecting the brain. If the HT roll succeeded, the subject is unharmed, but has a mild headache. If the HT roll just succeeded (made by 0 or 1 point) he's also mentally stunned. But if the HT roll fails, the subject's brain and nervous system are ripped apart, permanently reducing DX and IQ to 1 and leaving the victim a mindless vegetable – and storing a ghost program copy of the subject in the attacking robot's computer memory.

Mindrippers are useful because they simultaneously kill *and* capture an opponent. Mindripper beams are silent, invisible and unaffected by atmosphere but do require a line of sight to operate. They don't work through force screens. (There are less invasive ways of making a ghost program, but they take several minutes and special medical equipment; they are not usable in combat. See p. UT109 for details on these.)

Point Cost of Weaponry

Having weapons built into the robot costs character points depending on the weapon's Legality class:

Legality	*Points*
6	5 points
5	10 points
3-4	15 points
2	25 points
1	50 points
0	100 points
-1	200 points



If the robot has more than one weapon, *the full cost is only paid for the highest-point weapon.* Each additional weapon costs only 20% of its normal point cost.

EXAMPLE

Synthia has three built-in weapons: a monowire knife (LC 3), a concealed military laser carbine (LC 1) and a crushing jaw (LC 6). The cost of the concealed laser is 50 points, plus 3 points for the monowire knife and 1 point for the crushing jaw, for a total of 54 points.

Accessories

Gadgets like toolkits, vacuum cleaners or holographic projectors may be installed in a robot. Of course, if the robot has arms (with hands), visual sensors to see what it's doing, and proper programming, it can also use equipment just as a human does. Most accessories cost no character points. The few exceptions are those which duplicate advantages that characters usually pay for.

Weapon Accessories

These systems may be added to a ranged weapon.

Weapon Accessory Table

Component	*TL*	*Wt.*	*Vol.*	*Cost*	*Pow.*	*LC*
Laser Sight	7	neg.	.05	$200	neg.	5
Laser Periscope	8	var.	var.	var.	var.	5

Halve the weight, volume and cost of laser sights one TL after introduction and quarter them two or more TLs after introduction. Laser sights added to laser weapons are cheaper, with no weight or volume – see below.

Laser Sight: This places a laser dot wherever the weapon is aimed. If the robot has visual sensors, this reduces the SS penalty to -1 at up to 50 yards and to -2 at 50 to 100 yards, and adds +2 to its Accuracy when aiming. If the weapon is a laser, xaser or graser, it may have a laser sight for $50 (halve the cost at TL9, and again at TL10+): it just uses a low-intensity beam for aiming and increases the power when firing. Note: A robot with imaging ladar or a built-in laser rangefinder automatically gets this bonus on all weapons, without buying a laser sight.

Laser Periscope: This accessory can be added to any laser weapon. It is a periscope tube that is attached to the laser. When components are placed, it must be housed in a different part of the robot than the laser weapon, and allows the laser to fire from that part of the body rather than the part of the robot where the laser weapon is housed. Usually a laser is placed in the well-protected body of the robot, with the laser periscope built into an arm, pod or head. This permits the laser to fire without exposing its body. A laser periscope's weight and volume are each 10% of the laser weapon's, while its cost is 20%

of the weapon's cost. Note: x-ray laser periscopes are not available until TL11. Gamma-ray laser periscopes are not available until TL15.

EXAMPLE

We build a laser sight into Synthia's laser weapon ($12.50 at TL10+). We decide the laser sight also has a laser periscope, which weighs .7 lbs. (10% of the laser's weight), takes up .035 cf (10% of its volume) and costs $150 (20% of its cost).

Tool Systems

These systems are usually installed in robots built to perform technical, rescue or construction jobs. They can only be built into robot arms.

Tool Table

Component	*TL*	*Wt.*	*Vol.*	*Cost*	*LC*
Integral Tools					
Engineer, Mechanical	7	10	.2	$200	6
Armoury, Electronics	7	2	.04	$400	6

Tech level does not affect the weight, volume and cost of tool systems. Their power requirements are negligible.

Integral Tools (TL7+): This multi-purpose set of tools and probes extends out of the arm, fulfilling the equipment requirements for performing construction, repair and maintenance tasks for one of Engineering, Mechanic, Armoury or Electronics (or Electronics Operation) skills. A typical set of mechanical tools includes a built-in welder, pliers, screwdriver, drill, torque wrench, etc. Electronics tools add test probes and soldering irons, and so on. Since integral tools are built directly into the arm, the robot can use them even if without a hand.

The more arms equipped with integral tool systems the robot has, the better job it will do. A robot with one arm equipped with this system may perform repairs at -3 to skill. A robot with two arms so equipped may do so at -2 to skill. Three arms put it at -1 to skill. Four or more arms remove the penalty to skill. Different tool sets are needed for Armoury, Engineer, Mechanic and Electronics skills. If the robot is using the wrong type of tools (for example, using electronic tools to fix a gun instead of armoury tools), apply a -3 penalty.

Gadgets

These are miscellaneous gadgets useful on many types of robots:

Gadget Table

Component	*TL*	*Wt.*	*Vol.*	*Cost*	*Pow.*	*LC*
Chain Saw	7	see *Contact Weapons,* p. 20				
Cutting Torch	7	12	.24	$80	0	6
Fire Extinguisher	7	8	.4	$100	0	6
Mini Fire Extinguisher	7	.5	.02	$20	0	6
Flashlight	7	2	.04	$20	neg.	6
Mini-Flashlight	7	.5	.02	$16	neg.	6
Siren	7	1	.2	$100	neg.	6
Spotlight	7	10	.2	$100	neg.	6
Spray Gun	7	1	.05	$50	0	6
Spray Tank	7	8	.4	$100	0	6

Halve the weight, volume and cost of most of these gadgets one TL after introduction, or quarter them two or more TLs after introduction. Do not reduce the spray tank and spray gun's weight, volume and cost. The cost of the spray gun or tank does not include chemicals – see *Chemical Agents,* p. 30, for some loads.

A description of each gadget is given below.

Cutting Torch: This gas-powered cutting torch has enough gas for 5 minutes' operation. Used as a weapon, it is SS 15, Acc 0, RoF 1, Damage 1d cutting, ½D 3, Max 15. Against material with DR 6 or more, it can still cut through if held continuously on the same spot: every minute it is used burns away 1 point of DR *on that spot alone.* When DR is reduced to below 6, the torch can inflict damage to the material. Extra gas for the torch is $1, 1 lb., and .02 cf per minute.

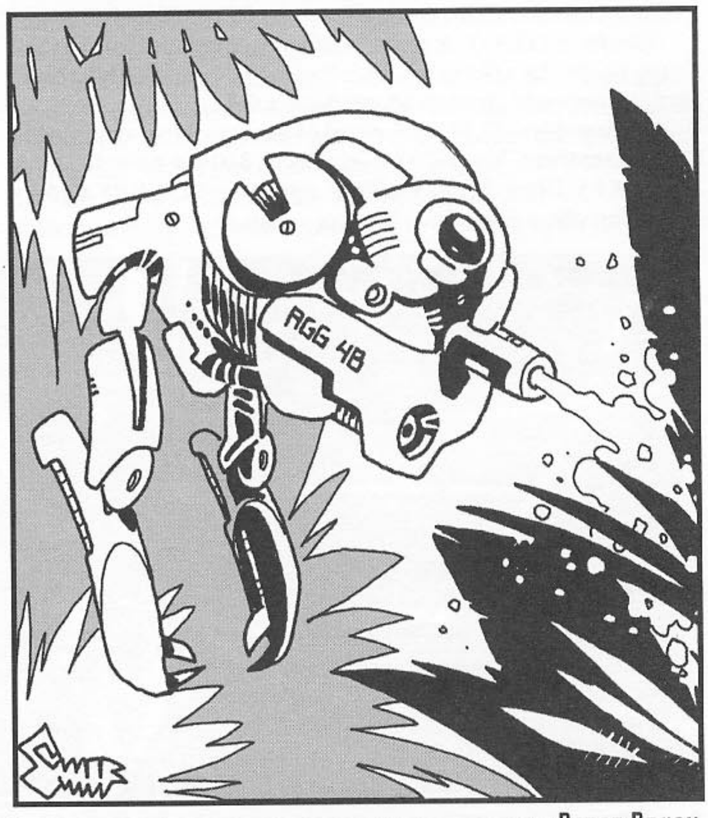
Flashlight or Spotlight: This throws a 500' beam (spotlight), 50' beam (flashlight) or 15' beam (mini-flashlight).

Fire Extinguisher and Mini-Fire Extinguisher: This sprays a fire-retardant foam that extinguishes one hex of fire on a roll of 1-4 on 1d at a 5-yard range. The fire extinguisher has eight uses; the mini-extinguisher has only one (reloads are half the cost, weight and volume). Using a fire extinguisher as a weapon defaults to DX-4 or Flamer-2; SS 10, Acc 1, ½D 3, Max 5. It does 3d damage, but this is counted only for knockback purposes – no real damage is done. Any hit to the face against an unarmored person stuns and blinds if he fails a HT-3 roll; roll against HT-3 each turn to recover.

Siren: A loud police/emergency siren is often mounted on police, rescue and security robots. If desired, it may include a flashing light at no extra cost.

Spray Gun: An aerosol sprayer, holding ten doses (one dose is enough to spray in a face or fill a hex) of any standard gas or liquid chemical (pesticide, smoke, tear gas, nerve gas, nano-disassemblers, etc.). A single shot has a range of 2 hexes and automatically hits. The cloud lasts for 10 seconds indoors, less in a strong wind.

Spray Tank: A larger spray dispenser, with a range of ten hexes, and creating a cloud 3 hexes in diameter per spray; if sprayed in the air, it falls slowly to earth. It uses *five* doses per shot, but a tank holds 100 doses. The cloud lasts for 2 minutes indoors, less in a strong wind.



Chemical Agents

Chemical agents usable in spray guns and spray tanks (as well as in chemical grenades and the like) include poisons, drugs, irritants and deadly clouds of nanomachines, as well as non-weapon chemicals such as pesticides and paints. Chemical agents are measured in doses. Delivery systems (warheads, sprayers, etc.) usually expend several doses at a time. Besides sprays, they may also be delivered via grenades (a chemical grenade costs the same as 10 doses, covers a 6-hex radius, and the cloud lingers for 300 seconds/wind speed in mph). Some chemicals available are:

Anti-Tangler Aerosol (TL8): Instantly dissolves Tangler (p. 25) strands. $4 per dose. LC 6.

Nerve Gas: Living organisms exposed to nerve gas take 1 hit of damage per turn, or 2 hits if not wearing a gas mask. Also, a HT-4 roll is needed each turn to avoid paralysis for (30-HT) minutes. Five minutes after being paralyzed, the target suffers 4d damage. Individuals in sealed, airtight armor are protected. $5 per dose. LC 0.

Paint: Spray paint, available in various colors. In combat, the main effect is to blind sensors or cover windows, restricting vision. Worker robots are often used for spray-painting, since clouds of paint can be dangerous to human health. $.10 per dose. LC 6.

Pesticides: Designed to kill insects, fungi, weeds, plant diseases, etc. Some are toxic if breathed, others are not. $.50 per dose. LC 6.

Riot Gas (TL8+): An advanced non-lethal incapacitating gas often used for crowd control. Each turn, any living being with a terrestrial-type metabolism who is not wearing a gas mask or airtight armor within the cloud must make a HT-4 roll. If the roll fails, he will become violently sick. Treat as if stunned, but the effects last as long as he is in the cloud, plus (20-HT) minutes. Even if the roll succeeds, he will be at -4 on any DX, IQ or skill rolls while within the cloud, and must continue to roll to avoid incapacitation each turn until he leaves it. $2 per dose. LC 5.

Tear Gas: See p. B132 for effects. $0.50 per dose. LC 5.

Nanoburn (TL9+): A cloud of nanomachines designed to kill living things. Its effects are described on p. 70 in the *Microbots and Nanomorphs* chapter. $5 per dose. LC 1.

Disassembler (TL11+): A cloud of nanomachines designed to destroy anything. See p. 70 for its effects. $40 per dose. LC 0.

GURPS Ultra-Tech, GURPS Space and ***GURPS Cyberpunk*** describe a few other chemical agents.

Navigation and Balance Systems

These systems help guide and control the robot.

Navigation System Table

System	*TL*	*Wt.*	*Vol.*	*Cost*	*LC*	*Points*
Global Positioning System	7	1	.02	$200	5	0
Gyrobalance	8	–	–	$5,000	6	15
Inertial Compass	8	1	.02	$250	6	5
Inertial Navigation System	7	40	.8	$50,000	6	5

Weight, volume and cost of all systems halves one TL after introduction, or quarters two or more TLs after introduction. Power requirement is negligible.

Global Positioning System (GPS): This links the robot to an orbital navigation satellite network (or a friendly spacecraft), enabling it to always know its exact position. The robot has Absolute Direction as long as it is in communication with a pair of friendly navigation satellites or spacecraft.

Gyrobalance (TL8): Internal laser-ring gyroscopes give the robot perfect balance. On wet or slippery terrain the robot gets +6 to all rolls to avoid losing control, and +4 to rolls to avoid being knocked down in combat. If the robot has legs or two or fewer wheels, it can skim along tightropes, narrow ledges, etc. without having to make a DX roll. The robot also gets +1 to any Acrobatics or Piloting skills it may acquire.

Inertial Compass: This sophisticated system can calculate the robot's exact location and heading without satellite assistance, indicating the direction and distance travelled from any preset point on a planetary surface. It can be set for the location the robot is physically present, or for any other coordinates (requiring a Navigation roll if the coordinates of the location aren't known). This effectively gives the robot the Absolute Direction advantage. Distances measured are accurate to within 1 yard per 1,000 miles.

Inertial Navigation System: As above, but much more accurate. It adds +5 to the robot's Navigation skill (+1 per TL over TL7) and gives the robot Absolute Direction.

Exotic, Covert Ops and Police Gadgets

This equipment is especially useful for robots built for criminal, assassination, espionage or law enforcement purposes.

Military, Covert Ops and Police Gadget Table

Gadget	*TL*	*Wt.*	*Vol.*	*Cost*	*LC*	*Points*
Crimescanner	8	8	.16	$6,000	5	0
Lockpick	7	neg.	neg.	$200	5	0
Electronic Lockpick	8	3	.06	$1,500	4	0
Mini-Nuke	7	50	1	$100,000	0	0
Psychotronic Circuits	9	var.	var.	var.	2	var.
Self-Destruct	7	1*	.02*	$80*	0	0
SQUID	8	40	.8	$50,000	4	5
Ranged SQUID	11	40	.8	$100,000	2	10

* Per pound of explosive.

With the exception of the self-destruct system, halve the weight, volume and cost one TL after introduction, or quarter them two or more TLs after introduction. The power requirement is negligible.

Descriptions

Crimescanner (TL8): This sensor system is capable of performing forensics analysis: ballistics tests, fingerprinting, genetic typing (from skin flakes or blood samples), etc. Performing a detailed analysis of a one-yard area in search of evidence normally takes one minute; the quality of that analysis depends on TL, but will usually provide a detailed analysis of chemical traces left in the area. At TL10+, the crimescanner actually releases tiny forensics nanomachine robots into the area, which perform a molecular-level search before being sucked back into the scanner unit to give their report. A crimescanner adds (TL-5) to Forensics rolls, but the robot must have Forensics skill to operate it.

Electronic Lockpick: This can only be built into an arm. It is a combination micromanipulator probe and sensor/decoder that gives +3 to Lockpicking or Electronics Operation (Security Systems) on any roll to pick a mechanical, combination or electronic lock of its TL or less. Against locks of a higher TL locks, it is -2 per TL difference between the lockpick and the lock. See p. B87 for lockpicking rules.

Lockpick: A high-quality lockpick. If mounted in a robot's arm, or in a head, it gives a +1 bonus to pick mechanical locks of its TL or less.

Mini-Nuke: This is a compact one-kiloton nuclear device (6d×4,000,000 concussion damage, devastates a 1,100-yard radius and contaminates the crater with residual radiation).

Psychotronic Circuits (TL9+): If the GM allows, any TL9+ robot with a sentient brain may have *psychotronic circuits* allowing it to have any psionic powers described in the ***Basic Set*** or ***GURPS Psionics.*** No single psi ability can have a power greater than (brain Complexity-5) × 5, with an absolute limit of power 25 for Complexity 10+ brains. It can have multiple powers, as long as it does not combine Antipsi with another power. It can acquire psionic skills as skill programs. Psychotronic circuitry does not add to the weight or volume, but does cost $10,000 × the character point cost of the psi powers (halve this cost at TL10, and again at TL11+). Psi powers have their usual point cost as described in the ***Basic Set*** or ***GURPS Psionics***. *Note:* these rules are an enhancement of those for psionic computers in ***GURPS Psionics*** and are slightly modified to fit the robot rules in this book.

Self-Destruct: A robot can be fitted with a self-destruct system; the robot explodes whenever its programming says to. (Yes, you can build time bombs or "smart" missiles this way.) Damage depends on the type of explosive packed into the robot. TL7 explosives do 6d×2 explosive concussion damage per pound of explosive; TL8 ones do 6d×8; TL9+ bombs do 6d×12. Fragmentation damage (see p. B121) is 2d Cutting damage as bits of the robot's casing are scattered about. The explosion can also be a shaped charge: double the cost, but halve the damage for the same weight of explosives, and the armor DR of a single target in contact with the robot when the explosion occurs is divided by 10.

SQUID (TL8): A superconducting quantum interference detector enables the robot to interrogate a computer brain to retrieve data. The SQUID must be physically attached (the robot should have a cable jack) to the target computer; it can then assist in reading the data stored within (see *Data Recovery* on p. 62). A SQUID adds +3 when probing a brain of its TL or lower, or +1 vs. a higher TL brain.

Ranged SQUID (TL11): As above, but usable at a range of (TL-10) yards: it can probe a computer brain even at a distance. Hardened brains cannot be probed at a distance, but can still be scanned through direct contact.

Domestic and Recreational Gadgets

These devices are often installed in service, household or pleasure robots. With the exception of the neural stimulator, all will be available without restriction.

Domestic and Recreational Gadget Table

Gadget	*TL*	*Wt.*	*Vol.*	*Cost*	*LC*	*Points*
Blow Dryer	7	1	.2	$40	6	0
Cleaning Unit	7	20	1	$200	6	0
Dishwasher	7	40	1	$200	6	0
Gardening Tools	7	4	.2	$200	6	0
Microwave or Sonic Oven	7	40	1	$200	6	0
Neural Stimulator	10	.5	.01	$1,000	5	0
Pheromone Emitter	9	neg.	–	$10,000	5	25
Projector	7	8	.16	$750	6	0
Serving Tray	7	8	.4	$40	6	0
Snack/Drink Dispenser	7	40	1	$200	6	0
Sonic Massager	9	2	.1	$400	6	0

Halve the weight, volume and cost of all these gadgets one TL after introduction, or quarter it two or more TLs after introduction. (Exception: the *volume* of the serving tray, microwave oven, dishwasher and snack/drink dispensers remains constant). The power requirement is negligible.

EXAMPLE

We decide to build a neural stimulator and pheromone emitter into Synthia's body. The stimulator weighs .5 lbs., takes up .01 cf and costs $1,000, and is LC 5. The emitter is $5,000 (half cost since it is TL9 and Synthia is TL10), LC 5 and costs 25 points.

Descriptions

Blow Dryer: Useful for styling hair or fur, usually housed in the arm of a valet or hairdressing robot.

Dishwasher: Washes and dries about 10 dishes at once – and at TL8+, does so quietly, with ultrasonics! A tray folds out of the robot to collect the dishes.

Cleaning Unit: This basic vacuum cleaner and surface-polisher system is usually designed to clean what the robot moves over, but may also be built into an arm. Vacuumed-up dust and debris must be removed occasionally, at least until TL14, when the junk can be diverted into the 'bot's mass-convertor. TL10+ systems use bioengineered or nanotech cleaning sprays.

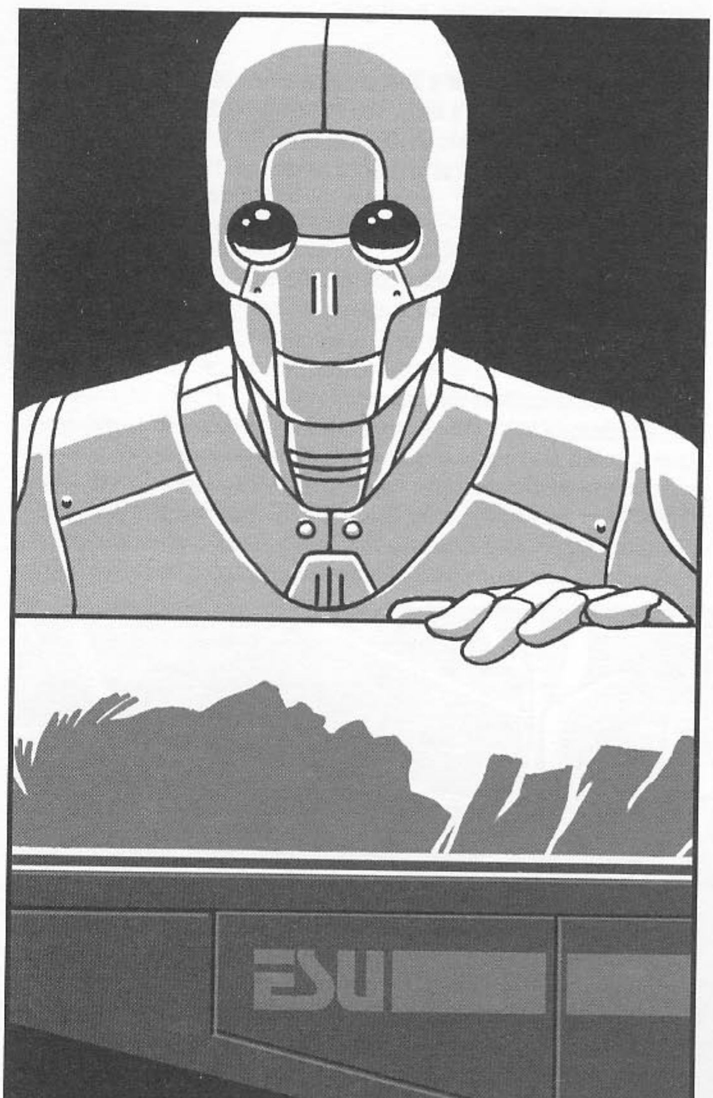
Gardening Tools: This gives the robot a built-in lawn mower/weed whacker system. The robot can do Swinging-1 Cutting damage based on its body ST, up to a maximum of 1d+2 Cutting damage. The complete "garden bot" should also have spray guns (p. 29) with pesticides and arms equipped with blades or claws (for trimming leaves).

Microwave or Sonic Oven: A small microwave or (possibly, at TL9+) infrasonic cooker, with a retractable serving tray and numerous settings. Cooks up to two meals at a time.

Neural Stimulator (TL10): This device may be mounted in an arm, a head, or (if the robot has a sex implant) the body. It dramatically enhances the pleasure of the robot's organic partner. However, prolonged use on a person requires him to make a Will+3 roll to avoid acquiring the Addiction disadvantage (the pleasure is treated as a highly addictive, incapacitating drug; it may or may not be cheap or legal). A neural stimulator can be overloaded to deliver a jolt of excruciating pleasure or pain: treat as a nervelash hit. Each such use has a 2-in-6 chance of burning out the neural stimulator until it is repaired, however.

Pheromone Emitter (TL9): A pheromone emitter allows a robot to generate sex pheromones exactly like a biological android with the *Pheromone Control* advantage (see p. 79).

Projector: This enables the robot to project any still or motion pictures it has stored as digital images. At TL8+, it can also project stored holographic images.



Serving Tray: Contains a retractable tray with enough space for one meal or several drinks. It includes a dual-pocket heating/refrigeration system to keep food and drinks hot or cold (as needed) inside the robot.

Snack/Drink Dispenser: A refrigerator system for snacks, drinks, drugs, etc. Built into a mobile robot, it can accompany expeditions into the wild to provide the comforts of civilization. It may be voice-controlled, or may have buttons on the exterior of the robot; a display screen (holographic at TL9+) reveals what is available. Coin- or credcard-operated vending machine versions are also available, enabling the robot to seek out customers.

Sonic Massager (TL9): This device projects a soothing sonic massage for scalp or body. With half an hour of tinkering and an Armoury skill roll, it can also be modified to project a single sonic pulse like that of a stunner (see p. B208) pistol; firing disables (burns out) the unit after one shot.

Medical Systems

These systems provide a robot with the tools to perform medical tasks better. The robot still needs appropriate programs to do so!

Medical System Table

System	*TL*	*Wt.*	*Vol.*	*Cost*	*LC*
Emergency Support Unit	8	100	5	$30,000	5
Medical Tools	7	2	.04	$1,000	5
Medscanner	9	1	.02	$900	6

Halve the weight, volume and cost of medscanners one TL after introduction, or quarter it two or more TLs after introduction. Power requirements are negligible. Other medical components do not reduce in weight, volume or cost. Medical tools must be built into an arm.

Emergency Support Unit (TL8): The ESU is a portable revivification and life-support system. If it is hooked up to an injured patient (the robot can do this itself if it has arms), it maintains his biological functions even if his organs are not functioning. In game terms, the robot can keep alive someone who has failed a HT roll and died, as long as he is not at or below -5×HT, or has not been dead for more than five minutes. Attaching the ESU takes (20 minus its TL) seconds and requires the robot to make a Physician roll (at -1 for every multiple of HT below 0 the patient is, and a -2 per failed attempt). Success means the person is in a coma rather than dead, but will die if taken off life support; critical failure means the patient is dead. A comatose patient can remain hooked up to the ESU as long as the robot can carry him (or remains stationary, if the patient is too heavy to lift). Revival from the coma is possible if the patient is ever healed to above fully-negative HT. The ESU can also perform less critical tasks, such as blood transfusions (it includes enough generic blood substitute for two whole-blood transfusions) and the revival of persons in suspended animation.

Medical Tools (TL7): This system must be mounted in a robot arm. It is a set of multi-function surgical manipulators ending in scalpels, forceps, clamps, fiber-optic probes, etc., and a medical sensor which can perform magnetic-resonance imaging scans, X-rays, and detect temperature, heart rate, respiration and other bodily functions. Medical tools fulfill medical kit requirements for Diagnosis, First Aid or Surgery skill performed at the same TL; each additional arm equipped with medical tools gives a further +1 to skill, to a maximum of +3, when treating a single patient. An arm equipped with medical tools is assumed to have a built-in drug injector (see *Contact Weaponry and Jaws,* p. 20) at no extra weight, volume or cost.

Medscanner (TL9): A short-ranged diagnostic scanner with a range of 1 yard (doubling each TL over TL9), it gives detailed diagnoses on known species – on a successful Electronics Operation (Medical) roll, it adds +3 to Diagnosis skill (plus another +1 per TL over 9). It can also scan for implants or to determine if someone is a robot.

Gadgets From Other Sources

GURPS Robots describes only a small fraction of the equipment that can be installed in robots. ***GURPS Ultra-Tech*** and ***GURPS Vehicles*** contain numerous other gadgets and weapons. For most gadgets, assume their volume is their weight/50. Multiply volumes given in cubic yards (cy) by 27 to get the volume in cf.

Gadgets can use their own power cells, or run off robot power. If running the gadget with robot power, use the *Energy Bank Table* on p. 36 to find out how much energy is stored in the power cell it would use. Then divide that by the number of seconds (3,600 to an hour, 86,400 to a day) that cell would run the gadget. The result is the power consumption in KW required to power it for a second. If this works out to less than .1 KW, it's safe to call it negligible: as long as the robot has some kind of power system, the gadget will function.

Modular Sockets

A modular socket is a space in the robot that is designed to accept different components. It is rated for the exact weight and volume of the module it can accept – for example, a socket rated 20 lbs. and .4 cf can accept any module of exactly that size and weight.

A modular socket has no weight. Its volume is equal to the volume of the socket. It costs $500 per cf of volume. Modular sockets may be installed in the body, or in any head or arm.

A *module* is something that can be inserted in a particular module socket in a robot. It must be either a weapon or accessory. A module's weight and volume must be exactly equal to the socket's rated weight and volume. (This way, the robot's performance is always the same, as long as all the robot's sockets are filled.) A module can contain multiple components, or "waste" weight and volume can be added to it. A module's cost equals the sum of the cost of all components in it, plus 20%.

If a modular socket contains a power-using component, that component should have its own power cell built into the module. That way, the robot's endurance won't change when a module is changed.

When inserted into the robot, a module adds its weight to the robot's weight. Its volume isn't added, since that's already allowed for in the socket. Removing a module takes 30 seconds, unless the module is so heavy that it requires several people or robots to lift. Inserting a module takes one minute.

The point cost of a module depends on what is contained in it.

Contragrav Generator (TL12)

A robot with contragrav can use anti-gravity technology to fly, or at least to reduce its weight. Decide on the pounds of lift the contragrav generator provides. In order to fly, the lift should exceed the robot's weight; since that won't be known until the end of the design process, it can be a good idea to simply leave some "empty space" in the robot for the generator and extra power cells – perhaps 10% of the volume of other components – and come back and retrofit the generator after everything has been added. The statistics of a contragrav generator depend on its TL.

TL12 contragrav costs $2,500 plus $.025 per pound of lift; it weighs 20 lbs. plus .001 lb. per pound of lift.

TL13+ contragrav costs $500 plus $.005 per pound of lift; it weighs 10 lbs. plus .0005 lbs. per pound of lift.

All contragravity systems take up their weight/50 cf.

Contragrav flight also requires power for the generator: .001 KW of power per pound of lift. A robot with contragrav usually uses a reactionless thruster (p. 19) for in-flight propulsion. (Note: when calculating a robot's speed or acceleration, do not "reduce" the robot's weight in these equations just because it has contragrav: acceleration is actually based on mass, which is unaffected by contragravity.)

Payload

Robots can carry cargo or passengers.

Cargo Spaces

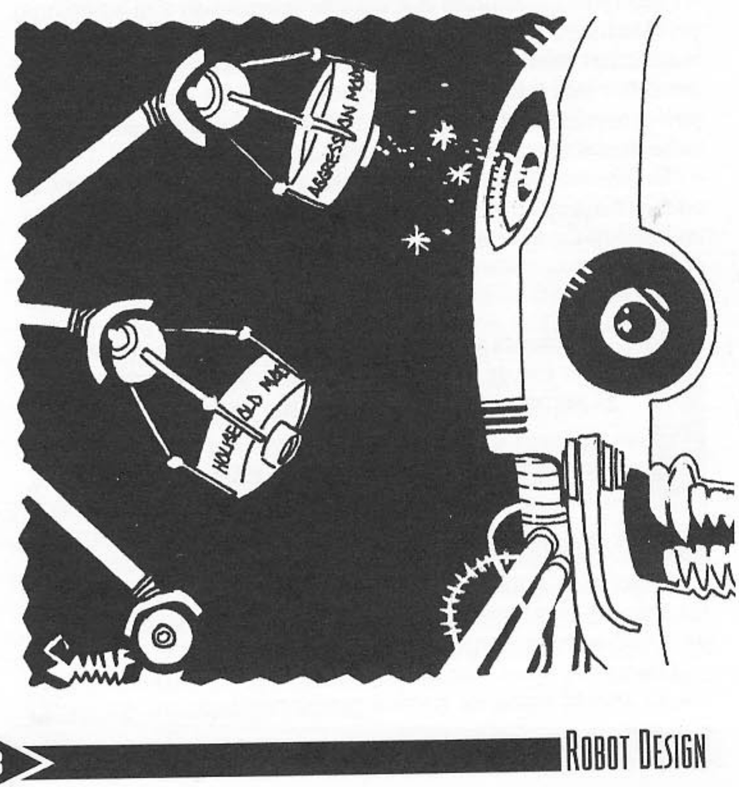
Robots can have one or more internal cargo compartments. Each separate compartment has its own access port, flap or panel and is electronically locked, controlled by the robot's brain. The volume of cargo spaces is measured in cubic feet. Each cf of cargo space can hold up to 50 lbs. of cargo. There is no extra cost.

Hangar Bay: A robot can also be given a bay for storing other smaller robots (or vehicles), ready for instant launch. Provided they use the same fuel, craft in a hangar bay can refuel from the robot's fuel tank or recharge from its energy bank. A hangar bay requires 30 lbs., 1.5 cf and $25 per cf of robot or vehicle stored.

Passengers

Some robots are designed to carry occupants riding on or inside them. The cost and weight of seats does not include the occupants (although the volume includes sufficient space).

Internal Seat: A seat inside the robot includes the room taken up by the rider. An internal seat costs $100; its weight and volume depend on whether it is *cramped* (20 lbs., 20 cf), *normal* (30 lbs., 30 cf) or *roomy* (40 lbs., 40 cf).



Exposed Seat: As above, but with no overhead protection from attacks or weather (similar to seats in an open cockpit or jeep). An exposed seat takes up half the volume of an internal seat, since part of the wearer is exposed. The robot's armor won't protect someone in an exposed seat against attacks from above, and the rider's head and shoulders will be exposed to attacks from the front, back or side. The armor protects normally against attacks from below.

Saddle: A large enough robot may have a saddle attached to it, much like one on a horse or motorcycle. A bolted-on saddle is $50 and 5 lbs. Or a proper horse-style saddle (see p. B212) can be strapped on after the robot is designed, counting as encumbrance along with the rider. How many people can ride on a robot depends on its body area (see *Surface Area* on p. 40). A robot can seat a number of riders the size of adult humans equal to its body's area/15; see p. 40 for body area.

Power System Design

Every robot requires a power system, which provides it with energy. Many different robot systems have power requirements, which are measured in kilowatts. The robot may draw power to operate these systems from either an energy bank (p. 35) or a power plant (p. 34).

A power plant, such as a gasoline engine or a nuclear reactor, produces power constantly (as long as it is fuelled) – it is rated for a power output in kilowatts (KW).

An energy bank (such as a battery or power cell) stores a finite amount of power, which is drained as it is used (unless recharged). It is rated for the number of kilowatt-seconds (KWS) of power it stores. One KWS provides one KW of power for one second.

Power plants are better for the long haul, while energy banks permit greater outputs for shorter periods. A robot will often have both a power plant and an energy bank, combining the benefits of both.

Routine Power Requirement: This is the power the robot drains while it is operating. Add up the power requirements for brain, sensors, arms, drivetrain, aquatic propulsion, thrust-based propulsion and contragravity. Power requirements for accessories or weaponry (such as jaws) that operate sporadically can be ignored provided they have integral power cells, or their power requirement is less than the power requirement of other systems. Note: if the robot has several propulsion systems, use only the highest power requirement: a robot will rarely use its leg drivetrain at the same time it uses propellers, for instance.

Decide whether the robot will have a power plant (p. 34), an energy bank (p. 35) or both. Then go to the appropriate section, and design the system.

EXAMPLE

We decide Synthia will be powered by both a power plant and an energy bank. Synthia's routine power requirement is .35 KW (all of its arms) + .45 KW (its drivetrain) = .8 KW.

Power Plants

Power plants are rated for output, in kilowatts (KW). This is the amount of power they produce to power systems built into the robot, or to recharge energy banks.

Unless the robot also has an energy bank, the power plant's output should equal its routine power requirement. An energy bank can supply the difference if the robot's power requirement exceeds the power plant's output.

There are several types of power plant. Here's how each works.

Gasoline and *Gas Turbine* plants are reciprocating engine or turbine models burning hydrocarbon fuels. The gasoline engine burns gasoline; the gas turbine can also burn diesel or alcohol fuels, although fuel consumption doubles when using alcohol.

Fuel Cells (TL7) are electric power plants that generate energy chemically, using oxygen and hydrogen as fuel. They also *produce* water, usually released as water vapor. In an "open" fuel cell, the fuel is hydrogen; the necessary oxygen is extracted from the atmosphere. In environments without free oxygen, a "closed" fuel cell containing *hydrox* fuel (liquid hydrogen and oxygen) is used instead, making fuel cells useful for robots that will run underwater or in alien environments. A fuel cell must use either hydrox or hydrogen fuel.

Magneto-Hydrodynamic (MHD) Turbines (TL8) are turbines which use ionized plasma as a working medium, giving a very high operating temperature and greater efficiency. They burn hydrogen and oxygen (hydrox), and can operate under water.

Nuclear Power Units (TL8) are small versions of the nuclear plants in ***GURPS Space.*** Power units with outputs under 500 KWs do not actually sustain a nuclear fission reaction; rather, they contain unstable radioactive isotopes (for instance, californium) that generate heat as they decay. Refueling costs 10% of the cost of the plant, and must be done at a major repair facility. Those versions with outputs in excess of 500 KW are true fission (or at TL10+, fusion) reactors.

Bioconvertors are power plants that function much like a human's system. They generate energy using food and atmospheric oxygen, and have a "mouth" into which water and food (anything biological) must be placed. A robot with a jaw may eat like a human, chewing food; otherwise, food must be liquefied (or be baby food, etc.) and poured in. The requirements for the bioconverters are (Herbivore) 10 pounds/KW/day and (Carnivore) 2 pounds/KW/day. Omnivore may mix and match plant and meat sources, at the same conversion rates. All bioconverters also require 1 gallon of water per KW per day.

The vampire bioconvertor requires 1 gallon of blood per KW per day. (An average human body has 1.25 gallons of blood.)

Antimatter plants produce energy through the mutual annihilation of matter and antimatter. A gram of antihydrogen powers a 1,000-KW plant for 2.5 years and costs $1,000; all fuel is contained within the plant, and takes up negligible space, so just decide how many years the plant will operate. At TL12+, each gram runs the power plant for 5 years.

Total Conversion power plants produce power by total conversion of mass into energy with 100% efficiency. They use trivial amounts of any kind of matter as fuel.

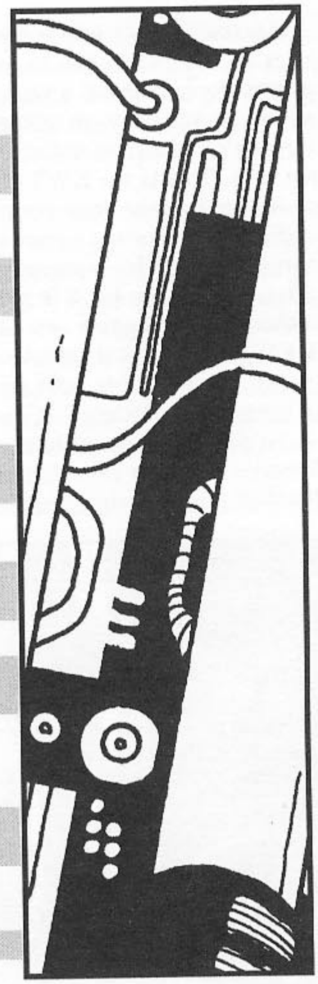
Cosmic Power Plants produce power through means unexplained by modern science. For example, a cosmic power unit may draw energy from another antimatter dimension, or even a magical universe. They power the robot indefinitely.

Mana Engines are technomagic devices that gather ambient magical energy and transform it into mechanical or electrical power. They require no fuel, but will not function in no-mana zones. A variant of the Powerstone spell (prerequisite: Power), which requires 10 energy per pound of engine weight, is cast on a machine that may resemble anything from a Rube Goldberg engine to a hideous technomagic machine. Costs 100 per kW.

If the robot has a power plant, choose its output in kilowatts (KW), and select the exact power plant type from those shown below. Work out its weight, fuel usage, volume and cost.

Power Plant Table

TL	Type	Weight (lbs.) (per kilowatt of power) if output Under 5KW	5KW or More	Cost (per lb. of wt.)	Fuel (per KW in gph)
7	Gasoline	10×KW	(5×KW) + 25	$5	.04G
7	Gas Turbine	10×KW	(2×KW) + 40	$20	.08M
Fuel Cells					
7	Fuel Cell	20×KW	(10×KW) + 50	$20*	.15H
8	Fuel Cell	10×KW	(5×KW) + 25	$5*	.13H
9+	Fuel Cell	10×KW	(5×KW) + 25	$5*	.115H
MHD Turbines					
8	MHD Turbine	10×KW	(1×KW) + 45	$40**	.03H
9	MHD Turbine	8×KW	(1×KW) + 35	$20*	.02H
Nuclear Power Units					
8	Power Unit	–	(8×KW) + 200	$200***	6 mo.
9	Power Unit	12×KW	(2×KW) + 50	$200***	1 yr.
9+	Cheap Power Unit	(10×KW) + 40	(3×KW) +75	$10**	$(TL-8)^2$ yrs.
10	Power Unit	6×KW	(1×KW) + 25	$200***	2 yr.
11	Power Unit	4×KW	(.4×KW) + 18	$200***	5 yr.
12+	Power Unit	2×KW	(.2×KW) + 9	$200***	10 yr.
Bioconvertors					
10	Carnivore	20×KW	(10×KW) + 50	$100**	Spcl.
10	Herbivore	30×KW	(15×KW) + 75	$50**	Spcl.
10	Omnivore	25×KW	(12×KW) + 65	$100**	Spcl.
†	Vampire	16×KW	(8×KW) + 40	$200**	Spcl.
Reactors					
11	Antimatter	–	.05×KW	$1***	Spcl.
14	Total Conversion	–	.02×KW	$.3***	neg.
16	Cosmic Power	1×KW	(.01×KW) + 2	$1***	none
Magical					
†	Mana Engine	10×KW	(5×KW) + 25	$50*	none



† Indicates GM discretion

* The minimum cost is $500, regardless of weight.

** The minimum cost is $2,000, regardless of weight.

*** The minimum cost is $20,000, regardless of weight.

Weight: Calculate this as shown on the table above.

Volume: Divide the weight by 50 to find the volume in cf, except for nuclear power units. For those, divide the weight of the nuclear units by 100.

Cost: The cost listed is per pound of power plant weight.

Fuel Usage: This is the fuel consumption in gallons per hour (gph) *per KW of output.* G is gasoline; H is hydrogen; hydrogen and oxygen fuel may be substituted in environments lacking atmospheric oxygen; M is multi-fuel (gasoline, diesel or alcohol). A time in months (mo.) or years (yr.) means the plant has an internal fuel supply of nuclear or antimatter fuel and operates for that many years without refueling. Total conversion power plants require negligible fuel. Bioconvertors devour water and solid food – see the description above.

Legality: Most power plants are LC 6. Any nuclear or antimatter power plant is LC 4, for safety reasons. Subtract 1 from the LC of any power plant with an output of 1,000 KW or more.

Points: A power plant that does not breathe air (on this table, anything but a gasoline engine, gas turbine or bioconvertor) costs 20 points, since the robot need not breathe.

EXAMPLE

Although Synthia's energy bank can power it, we also add an omnivore bioconvertor with .4 KW output. It weighs 10 lbs., takes up .2 cf, costs $2,000 (thanks to the minimum), but costs no points since it breathes air. This isn't intended to meet all its energy requirements – but it does allow the energy bank to recharge, and will also let Synthia appear to eat and drink like a human.

Energy Banks

An energy bank stores electrical power. A robot may have one instead of or as well as a power plant. If the robot's power plant does not produce at least the routine power requirement, the robot *must* have an energy bank.

Power stored in an energy bank is measured in kilowatt-seconds (KWS) – one kilowatt of power for one second.

Each KWS of stored power provides the same power as a 1-KW power plant – but only for a second. (Or it could provide .5 KW for 2 seconds, .001 KW for 1,000 seconds, and so on.) Then the energy bank is drained of power until it is recharged.

Thus, a robot whose systems require 1 KW of power will drain 1 KWS every second, or 60 KWS every minute, or 3,600 KWS every hour. Similarly, if it has a blaster that uses 180 KWS of power every shot and it fires five shots, it will drain 900 KWS.

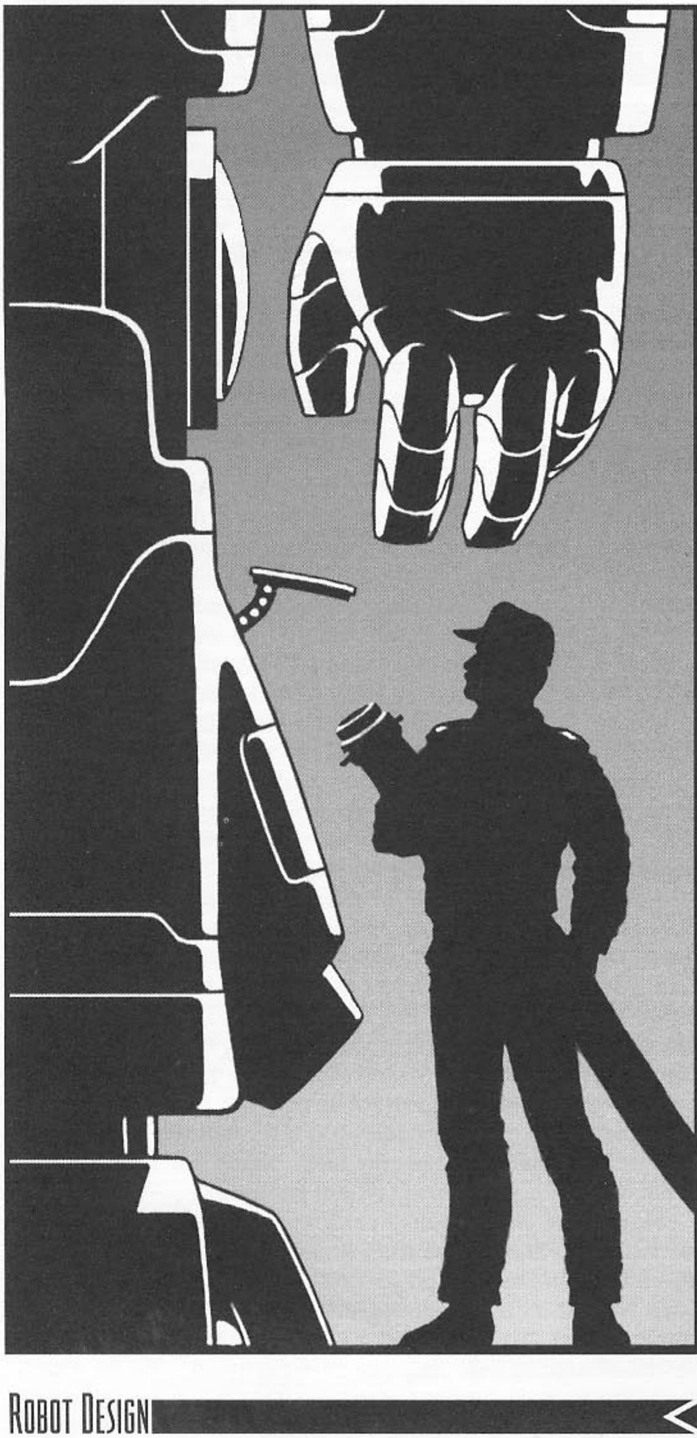
An energy bank is useful even if the robot has a power plant, since it can make up any shortfall when power requirements exceed power plant output. As long as the robot has an energy bank, a robot's designer doesn't have to know the actual power requirement to the last kilowatt. For instance, consider a robot with both a power plant and an energy bank. If the power plant generates 100 KW but the robot needs 105 KW to operate several systems at once, the robot will still function perfectly well: the power plant provides 100 KW, and the remaining 5 KW are provided by the energy bank, which will be drained at a rate of 5 KWS per second (18,000 per hour).

Most robot energy banks consist of a bank of power cells (available at TL8+) plus their housings and power conduits. There are four types of power cells commonly used in robots, rated from B to E in order of increasing power storage. (The small A and AA cells are only used on tiny microbots, described in a separate chapter.)

An energy bank can provide power to power-using weapons after their power cells have been exhausted. Determine the power requirement of a weapon that uses a power cell as if its stored power were an energy bank. Then divide that by the weapon's number of shots to find the KWS of power required per shot. This is the KWS of power each shot drains; multiply by RoF to find the drain per turn of firing at full RoF.

Energy banks use either rechargeable or non-rechargeable batteries or cells. Non-rechargeable cells must be replaced when the energy bank is drained. Rechargeable cells can be recharged by plugging into any power plant: every second that 1 KW is channeled into the power cell restores 1 KWS of power. Rechargeable cells are usually written with an r in front of the type; for instance, rC indicates a rechargeable C cell.

To design an energy bank, decide on the type and number of batteries or power cells that make it up, then add up their stored KWS of power, weight, volume and cost as shown below.



Energy Bank Table

Type	*TL*	*Weight*	*Vol.*	*Cost*	*KWS of Stored Power*
9v cell	7	.1	.01	$2	18
r9v cell	7	.1	.01	$2	9
12v cell	7	20	.2	$50	1,800
r12v cell	7	20	.2	$60	900
B cell	8	.05	.005	$30	(TL-6) × 180
rB cell	8	.05	.005	$30	(TL-6) × 90
C cell	8	1	.01	$100	(TL-6) × 1,800
rC cell	8	1	.01	$100	(TL-6) × 900
D cell	8	5	.05	$500	(TL-6) × 18,000
rD cell	8	5	.05	$500	(TL-6) × 9,000
E cell	8	20	.2	$2,000	(TL-6) × 180,000
rE cell	8	20	.2	$2,000	(TL-6) × 90,000

The *cost, weight and volume* are per cell in the energy bank. The volume includes the cell housing and power connections; the actual volume of individual cells will usually be smaller.

KWS is the energy stored in the cell.

Points: An energy bank costs 20 points, as the robot can operate without "breathing." However, if the robot already has a power plant that does not need air, there is no cost.

EXAMPLE

Synthia needs an energy bank, since its .4-KW power plant output is less than its .8-KW routine power requirement. We decide Synthia has a pair of TL10 rechargeable D cells (rD cells). Together they weigh 10 lbs., take up .1 cf, cost $1,000 and at TL10 store a total of 4 (TL10 - 6) × 9,000 × 2 (two cells) = 72,000 KWS of energy. This costs 20 points, since it lets Synthia operate without breathing air.

Fuel

Robots that have jet or rocket engines, or power plants with a fuel requirement measured in gallons per hour, must install a fuel tank. If a power plant or engine that needs fuel does not have a tank, it does not function.

Fuel tank cost and weight include fuel. But for topping off an empty tank or switching fuels, the cost of fuel, without the tank, is also given here. The types of fuel available include:

Gasoline and *Diesel* fuel, which cost around $1 per gallon in the U.S.

Jet Fuel: This is basically kerosene, and is heavier and more expensive than gasoline. Different grades of jet fuel exist for different engines, but in game terms the effects are the same, although the GM may decide that, for instance, a TL8 high-performance turbofan will lose a small percentage of its thrust if forced to run on the same fuel as a TL7 basic turbofan. Each gallon costs $3.

Hydrogen (H) is hydrogen compressed to a jelly. It is combined with atmospheric oxygen and used in TL8+ fuel cells. It is also burned in fusion rockets and air-rams. Each gallon costs $.10.

Hydrox (OH) is liquid oxygen and hydrogen. Used in MHD plants or fuel cells in place of hydrogen, it enables the robot to operate underwater or on worlds lacking free oxygen, or with low atmospheric pressures. Each gallon costs $1.

Rocket fuel is a liquid or solid chemical rocket fuel containing a combustion agent and an oxidizer. For uniformity, solid fuel is also measured in gallons. Rocket fuel is often very volatile. Each gallon costs $2.

Fuel tanks may be standard or self-sealing; self-sealing tanks are less vulnerable to damage. To install a tank in the robot, decide on its capacity in gallons, the type of fuel it holds, and whether or not it is self-sealing. The table below shows the cost, weight and volume of the fuel tank per gallon of fuel.

Fuel Tank Table

TL	Type	Weight	Volume	Cost	Fire
7	Standard Fuel Tank				
	with gasoline	7.0	.15	$10	11
	with diesel	7.0	.15	$10	9
	with jet fuel	7.5	.15	$10	13
	with hydrogen	1.5	.15	$10	13
	with hydrox or rocket fuel	6.0	.15	$10	13
7	Self-Sealing Tank				
	with gasoline	8.0	.15	$40	10
	with diesel	8.0	.15	$40	8
	with jet fuel	8.5	.15	$40	12
	with hydrogen	2.5	.15	$40	12
	with hydrox or rocket fuel	7.0	.15	$10	12
8+	Standard Tank				
	with jet fuel	7.0	.15	$10	11
	with hydrogen	1.0	.15	$10	11
	with hydrox or rocket fuel	5.5	.15	$10	11
	with water	9.0	.15	$10	no
8+	Self-Sealing Tank				
	with jet fuel	7.5	.15	$40	10
	with hydrogen	1.5	.15	$40	10
	with hydrox or rocket fuel	6.0	.15	$40	10
	with water	9.5	.15	$40	no

Weight, volume and cost are per gallon. Weight and volume include both tank and fuel. Cost only includes the fuel tank.

Fire: This is the chance that the tank will catch fire if the robot is reduced to 0 or lower HT, or is hit by a flame attack – see *Fire and Explosion* on p. 96.

Legality: Fuel tanks are LC 6.

Points: Having one or more fuel tanks with a fire number is a disadvantage worth -1 point × the fire number.

Endurance and Point Cost

This is how long the robot can operate on its own. It depends on whether the robot has a power plant or an energy bank.

If the robot has a power plant whose output is equal to or greater than the routine power requirement, the robot's endurance is determined by its fuel capacity. The endurance of a nuclear or antimatter power plant is listed in the plant's description. Cosmic power plants and mass convertors effectively operate forever. If the power plant or reaction engine uses fuel, it will drain its fuel consumption from the fuel tank every hour. Calculate its endurance in hours by dividing its fuel capacity in gallons by the number of gallons it consumes per hour. Bioconvertors have a default endurance of 48 hours.

If the robot's power plant produces less than its routine power requirement, the robot must meet those requirements by draining its energy bank. Subtract the power plant's output from the routine power requirement. Multiply the remainder by 3,600 to get the KWS of stored power drained from the energy bank every hour. The energy bank can power the robot for a number of hours equal to its stored power in KWS divided by the power it has to supply, divided by 3,600. The power system's endurance is the lower of the power plant or energy bank's endurance. However, if the power plant's endurance is less than the energy bank's, or the power plant is destroyed, has no air to breathe (if it breathes air) or is turned off *before* the energy bank is out of energy, the robot can operate just using the energy bank for [(remaining stored power)/power requirement/3,600] hours.

If the robot has an energy bank but no power plant, it will drain 3,600 KWS × its routine power requirement from the energy bank every hour. Thus, the robot's endurance in hours is its energy bank's stored power (KWS)/power requirement/3,600.

If the robot has a power plant whose output is greater than the routine power requirement *and* has an energy bank, its endurance is the power plant's endurance plus a number of hours equal to the energy bank's stored power (KWS)/power requirement/3,600.

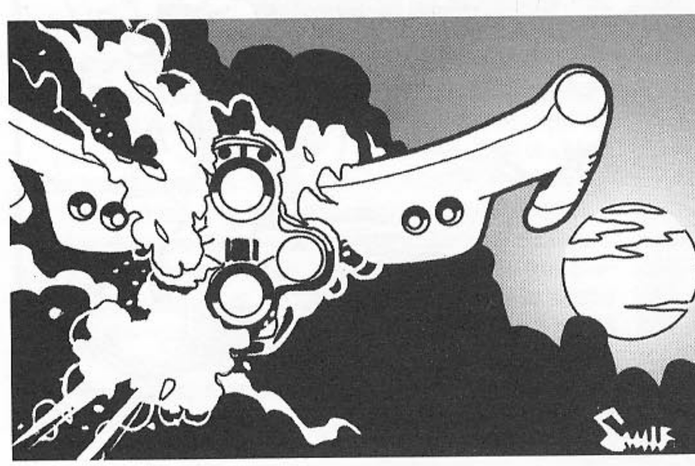
Depending on how long the chosen power system can meet the routine power requirements without refueling, a robot's endurance may be an advantage or a disadvantage:

Under a minute	-100 points
No more than ten minutes	-50 points
No more than an hour	-25 points
No more than six hours	-10 points
No more than 72 hours	0 points
No more than 168 hours	5 points
No more than 720 hours	8 points
Over 720 hours	10 points

EXAMPLE

Synthia uses an energy bank storing 72,000 KWS and a bioconvertor power plant that produces .4 KW. Its routine power requirement is .8 KW, which is greater than its power plant output. It drains .8 - .4 = .4 KW × 3,600 = 1,440 KWS from its energy bank every hour. Since its energy bank stores 72,000 KWS, its endurance is 72,000/1,440 = 50 hours. As its bioconvertor's endurance is 48 hours, this means the power system's endurance is 48 hours. After 48 hours, the robot will have used up 69,120 KWS, leaving 2,880 KWS remaining. It could then switch entirely onto stored power, operating for another 2,880/.8 KW/3,600 = 1 hour.

Synthia can also use its energy bank alone to operate for 72,000 (stored power)/.8 (power requirement)/3,600 = 24 hours. Since its bioconvertor breathes air, this is useful if Synthia must operate underwater or in space. Synthia's 49-hour endurance costs no points, and means Synthia will have to eat and recharge about once every other day, though it may do so more often.



Body and Subassemblies

After all components are installed in the robot, design the body and subassemblies. Every robot has a *body* – its central torso, fuselage or chassis. Attached to it are various *subassemblies,* which include arms, heads, pods, legs, tracks, wheels and wings. A robot can have one arm per arm motor it has. It can be given legs if it has a leg drivetrain, tracks if it has a tracked drivetrain, wheels if it has a wheeled drivetrain, wings if it has an ornithopter drivetrain, and rotary wings if it has a helicopter drivetrain. Heads, pods and (if the robot doesn't have an ornithopter drivetrain) wings or wheels are available as options. The subassemblies are described in detail below; decide which, if any, the robot has.

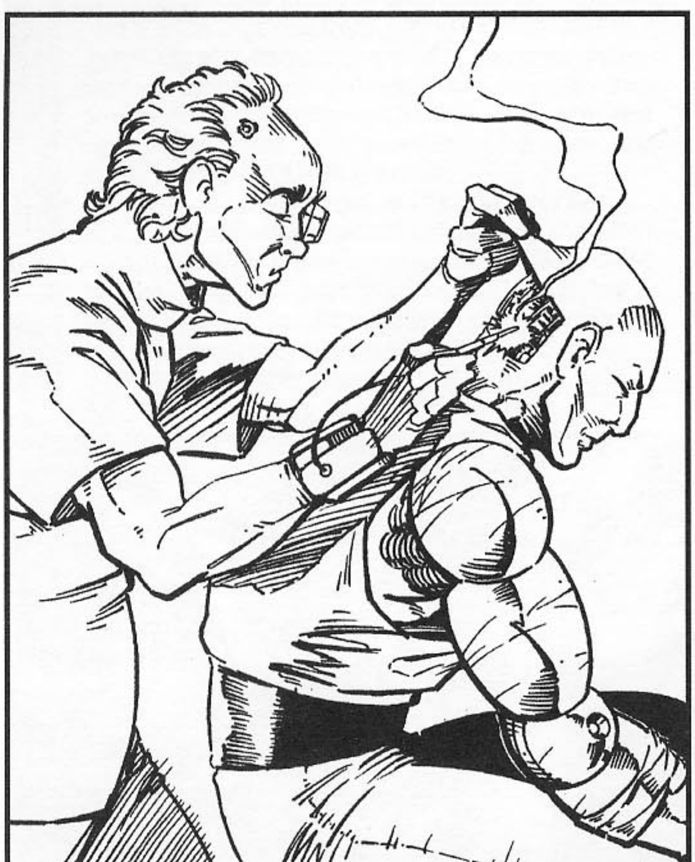
Arms

Arms are limbs attached to the robot that are not used for walking on. A robot requires one arm to use each arm motor it has.

Decide where to attach each arm to the body. On humanoid robots, arms are normally attached to the right or left side; arms can also be attached to the back, like tails, or directly forward, like trunks. A robot must designate half of its arms (rounding down) as "off hands" and suffer the handedness penalty (p. B13) when using them. If the robot is later programmed with Ambidexterity, it does not suffer this penalty.

Heads

A head is a rotating superstructure mounted on the robot's body. Decide how many heads the robot has. Most robots have only one head, but robots with no heads, or with many heads, are quite possible. Assume that an ordinary head is able to rotate through the same angles as a human head. However, a head that cannot rotate, or one that has 360-degree rotation, is also possible. A head can have any of the following options.



Full Rotation: The head can rotate 360 degrees, like a tank turret.

No Rotation: The head can't rotate – it's a superstructure, like an Ogre's tower.

Decide where the head is attached – to the top, side, or bottom of the body, or even atop another larger head.

Pods

These are external compartments, similar to the engine, weapon or fuel pods carried by aircraft. They house equipment or cargo outside the robot's body. A robot can have any number of pods.

Legs, Tracks, Wheels

A robot requires legs to use a leg drivetrain, as many legs as it has leg motors. A robot requires tracks to use a tracked drivetrain. A robot requires wheels to use a wheeled drivetrain.

If a robot has wheels, decide how many wheels it has: one, two, three or any even number of wheels. This doesn't affect the weight and cost of the wheels; more wheels mean smaller ones.

If a robot has tracks, decide if it has two or four tracks. Again, this doesn't affect their weight or cost.

All tracks or all wheels on a robot are a single subassembly; each leg, however, is a different subassembly.

Wings

These are airplane-style wings with associated control surfaces (tail and/or rudder, for instance). A robot *must* have wings to use an ornithopter drivetrain. If the robot has a thrust-based propulsion system, it can use wings for powered flight, much like an airplane. Otherwise, it can only use them to glide.

Rotary Wings

A rotary wing is a set of rotor blades and stabilizers which enable the robot to fly like a helicopter. A robot *must* have a rotary wing to use a helicopter drivetrain.

Ground-Effect (GEV) Skirts

This is a hovercraft-style skirt that helps create a cushion of air under the robot's body. A 'bot can have a GEV skirt if it has vectored-thrust ducted fans. The skirt augments the lift of these fans to five pounds per pound of motive thrust. If their lift (after multiplying) equals or exceeds the robot's final weight, it can move as a hovercraft, skimming low over smooth ground or water.

Slope

Individual faces (front, right, left, back) of the body or a head can be *sloped,* giving them an angular shape whose armor plates will be better able to deflect attacks from that direction. Slope is normally only used on tank-like robots, and is only useful if the robot is going to be armored. This increases the PD and DR of any armor the sloped body or head has, as described in *Armor Slope,* p. 42.

A face can be sloped 30 degrees or the more effective 60 degrees. The faces on a single head or body cannot have a combined total of more than 240 degrees of slope. Slope has no cost or weight as such, but adding slope eats up space within the robot that might be used for other components, and so effectively increases the robot's volume. The effects of slope on volume are described under *Body and Subassembly Design,* below.

EXAMPLE

Synthia has three arm motors, so it needs three arms. We call them "right arm," "left arm" and "tentacle arm."

Synthia has a head, with no options.

When we designed Synthia's drivetrain, we determined it has two legs.

Body and Subassembly Design

After the robot's subassemblies have been chosen, decide where the robot's components are located, and calculate the external volume (the size) of the body and each subassembly. Every single component the robot has must be housed in the body, or in a specific head, arm, leg, pod, or wing, if the robot has them.

There are some restrictions on where components may go. Each arm must house one arm motor. The body must house tracked, flexibody and wheeled drivetrains, and aquatic propulsion systems, as well as the vectored-thrust ducted fans that go with a GEV skirt, if the robot has one. Each leg must house a leg motor. If the robot has an ornithopter drivetrain, each wing must house a wing motor. Also, some contact weapons and accessories can only be placed in arms or heads, as in their descriptions. (Traditionally, sensors are placed in the head, the power system in the body, and the brain in the body or head, but that's not required.) No subassembly can have a volume more than twice that of the body.

Arms: For each arm the robot has, decide what components to place in it. *Each arm must house one and only one arm motor.* Cubic feet of "empty space" can also be added to the arm to increase its size or provide extra storage space within it. The sum of the volumes of all components and empty space in an arm is that arm's volume. Note: an ordinary human arm will be from 0.05 to 0.2 cf in size; adding empty space is a good way to ensure an arm has human proportions. If a robot has a retractable arm, the arm must retract into the body or a head. The housing for the arm takes up volume as if it were a component. Thus, a .12-cf arm would take up .12 cf in a body or head. The weight of components in an arm may not exceed 6 lbs.× the arm motor's ST. An arm's Reach is half the square root of its area (p. 40). Arms over one hex Reach cost 10 points per arm per extra hex.

Heads: Decide what components to place in each head the robot has. As with arms, "empty space" can also be added to the head. If a rotating head is attached to another head, its rotation mechanism requires empty space equal to 10% of its volume (20% for full rotation) in the head it is mounted upon. This "waste space" is unusable for cargo. A head's volume is the sum of the volumes of all the components and empty space in it. Sloping a head increases its volume. Add the total degrees of slope on all faces and multiply head volume by 1.1 if the total is 30 degrees, 1.25 if 60, 1.4 if 90, 1.6 if 120, 2 if 150, 2.5 if 180, 3.3 if 210 or 5 if 240 degrees. Note: an ordinary human head will be from .1 to .4 cf in size.

Body: Decide which of the robot's components to house inside its body, subject to the restrictions described above. Every component not installed elsewhere in the robot must go in the body! Add "empty space" to the body, as cargo space, or to increase the robot's size. For each rotating head attached to the body, empty space equal to 10% of the head's volume (20% if the head has "full rotation") must be placed in the body to provide space for the head's rotation. This is waste space, unavailable for cargo. The sum of the volumes of all the components and empty space in the body is the body's volume. A robot intended to be submersible (p. 40) which does not have legs or a flexibody drivetrain must multiply its body volume by 1.25; this provides extra space for ballast tanks. Sloping the body will increase its volume. Add the total degrees of slope it has on all faces and multiply the body volume by 1.1 if they total 30 degrees, 1.25 if 60, 1.4 if 90, 1.6 if 120, 2 if 150, 2.5 if 180, 3.3 if 210 or 5 if 240 degrees. Note: an ordinary human body will be between .5 to 2.5 cf in size; adding empty space is a good way to ensure human proportions!

Pods: Decide what components to place in each pod the robot has. As with the body, "empty space" can also be added to the pod, generally as cargo space. The sum of the volumes of all components and empty space in a pod is that pod's volume.

Legs: Decide what components to put in each leg the robot has. Each leg must hold a leg motor! As with the body, cubic feet of "empty space" can also be added to the leg. This is often necessary: supporting the robot requires a minimum volume in each leg. This is 30% of its body volume (for each of two legs), 20% of the body's volume (for each of three legs), 15% of the body's volume (for each of four legs), 10% of its body's volume (for each of six legs), or 0.6 × the body volume/(number of legs) for each of a different number of legs. Furthermore, each leg must be the same volume! The sum of the volumes of all components and empty space in each leg is that leg's volume – if the leg doesn't have the volume required to support the robot, add empty space or transfer components to increase it.

Tracks: Tracks don't contain components. The volume of tracks and the suspension system is 60% of the body's volume.

Wheels: Wheels don't contain components. The volume of the wheels and suspension system is 20% of the body's volume.

Ground-Effect Skirts: A GEV skirt doesn't contain components. Its volume is 60% of the body's volume.

Rotary Wings: A rotary wing doesn't contain components. Its volume is 2% of the body's volume.

Wings: If the robot has wings, decide what components to house in each of its wings. If the robot has an ornithopter drivetrain, an ornithopter motor must be placed in each wing! As with the body, cubic feet of "empty space" can also be added to each wing. This is often essential: the sum of the volume of all components and empty space within each wing must be at least 5% of the body's volume per wing, and both wings of a pair must have the same volume. Also, at least 10% of the volume of each wing must be empty space – some wings contain nothing *but* empty space! Add empty space or transfer components to adjust the wing's volume.

EXAMPLE

We want Synthia to be human-sized, so we carefully allocate its components and add extra empty space:

The *right arm* houses the ST 30 arm motor and laser periscope (.095 cf) and we add empty space (.05 cf) to make the arm human-sized with a volume of .1 cf.

The *left arm* houses the other ST 30 arm motor (.06 cf) but to make it proportionate to the right arm we add .04 cf empty space to get a volume of .1 cf.

The *tentacle arm* houses the large knife and ST 10 arm motor (.05 cf) and .01 cf of empty space, totalling .06 cf. Since the arm is retractable it has to be placed somewhere else and will take up .06 cf there; we decide the arm will go in the head.

The *head* houses the sensors, communicator, crushing jaw and tentacle arm, plus .2 cf empty space, totalling .3 cf.

The *body* houses the computer brain, military laser carbine, neural stimulator, pheromone emitter, bioconvertor and energy bank, totalling .86 cf. We add .14 cf of empty space, to give Synthia a more human-sized torso and to provide space for the head's rotation; this gives the body a volume of 1 cf.

The *right leg* houses a leg motor (.135 cf). Since the leg must be 30% of the 1-cf body volume, we add .165 cf of empty space, giving the leg a volume of .3 cf. The *left leg* houses the other leg motor, and has the same amount of empty space.

Surface Area

The area of the body or a subassembly is an approximate measure of its surface area in square feet; this will be used to calculate the robot's structural weight, cost and hit points.

Calculate the *area* of the body and the area of each subassembly, looking up their individual volumes on the table below in the "Vol." column, then reading the area from the "Area" column to the right. If a value falls between two numbers, round down. Multiply the surface area of wings by 1.5, and that of rotors by 3!

Area Table

Vol.	*Area*	*Vol.*	*Area*	*Vol.*	*Area*
under .03	.5	5.2-5.6	19	544-759	500
.03-.06	1	5.7-6.0	20	760-1,000	600
.07-.12	1.5	6.1-6.5	21	1,001-1,540	800
.13-.19	2	6.6-7.0	22	1,541-2,150	1,000
.2-.26	2.5	7.1-7.4	23	2,151-2,830	1,200
.27-.3	3	7.5-8.0	24	2,831-3,375	1,500
.4-.5	4	8.1-8.4	25	3,376-6,080	2,000
.6-.75	5	8.5-9.5	27	6,081-8,495	2,500
.8-1.0	6	9.6-11	30	8,496-11,180	3,000
1.1-1.25	7	12-17	40	11,181-17,185	4,000
1.3-1.5	8	18-24	50	17,186-24,110	5,000
1.6-1.8	9	25-31	60	24,111-35,650	6,500
1.9-2.2	10	32-44	75	35,651-48,650	8,000
2.3-2.5	11	45-68	100	48,651-68,025	10,000
2.6-2.8	12	69-95	125	68,026-89,440	12,000
2.9-3.2	13	96-125	150	89,441-125,000	15,000
3.3-3.5	14	126-157	175	125,001-192,420	20,000
3.6-3.9	15	158-188	200	192,421-268,960	25,000
4.0-4.3	16	189-268	250	268,961-353,450	30,000
4.4-4.7	17	269-353	300	353,451-544,335	40,000
4.8-5.1	18	354-543	400	544,336-760,610	50,000

EXAMPLE

Synthia's body has a volume of 1 cf and so has an area of 6. Its right arm's volume is .1 cf for an area of 1.5. Its left arm is identical. Its tentacle arm has a volume of .06 cf and an area of 1. Its head has a volume of .3 cf and an area of 3, as do each of its legs. Synthia's total surface area is 6 + 1.5 + 1.5 + 1 + 3 + 3 + 3 = 19.

Robot Structure

The "structure" of the robot is its internal skeleton and structural frame, atop which things like skin and armor can be layered later.

Thanks to its artificial plastic and metal structure, every robot has certain innate capabilities and limitations not otherwise reflected in the design process. A robot automatically has the High Pain Threshold and Immunity to Disease advantages, together costing 20 points. However, every robot also has the No Natural Healing disadvantage (p. 89) worth -20 points. As a result, it costs no points to have a robotic structure.

A robot's structure can be modified with various options, all of which will affect the structure's weight and cost and some of which will cost points. Decide if the robot has any of these structural options. (If the robot has a flexibody drivetrain, it *must* have the flexibody option.)

Biomechanical Structure (TL9): This is a different kind of robot body, built of a mix of organic and mechanical parts. A robot with a biomechanical structure can feel pain and become infected with disease, but it can also heal itself. Thus, it is worth no extra points, but it has neither the advantages High Pain Threshold or Immunity to Disease nor the disadvantage No Natural Healing.

Living Metal Structure (TL13): This gives the robot a structure built of living metal, a nanotechnological material that is capable of self-regeneration. The tiny "nanobots" contained within the living metal structure will regenerate damage to the robot at 1 hit per hour (as long as the robot isn't utterly destroyed). If the robot has damaged or ablated armor, this regenerates at the same rate. The point cost of living metal includes both regeneration and buying off the robot's inability to heal.

Modified Frame Strength: A normal robot is assumed to have a "medium" strength structural frame. But robots can also be "light" or "extra-light" frames (giving them fewer hit points, but making them lighter and cheaper) or "heavy" or "extra-heavy" frames (making them stronger and tougher, but proportionately heavier and more expensive).

Cheap or Expensive Materials: Robots are normally built using "standard" materials. But instead, the 'bot can be made with "cheap" materials which make the robot less expensive but heavier, or "expensive" materials that make it lighter but more costly.

Flexibody (TL8): This is a multi-segmented body that allows the robot to squeeze through smaller openings than its size would normally suggest, and gives it the *Double-Jointed* advantage. A robot with a flexibody drivetrain *must* have this body option to use it. Other robots may have it. It allows a robot with a flexibody drivetrain to propel itself by undulating along the ground like a snake.

Submersible (TL5): A robot with this option is strengthened to withstand undersea pressure, and has ballast tanks that can be flooded to enable it to submerge, float underwater, and surface,

like a submarine. A sealed or waterproof robot with legs or the flexibody option can also swim underwater (assuming it isn't so heavy it can't float) without taking this option.

Refer to the table below to find the structural weight and cost of the robot.

Robot Structure Table

Feature	Weight	Cost	Points
TL7 design	6	$100	–
TL8 design	4	$100	–
TL9 design	3	$100	–
TL10 design	2	$100	–
TL11 design	1.5	$100	–
TL12+ design	1	$100	–
Special Structure			
Biomechanical	–	×1.5	–
Living Metal	–	×2	45
Modified Frame Strength			
Extra-Light	×.25	×.25	–
Light	×.5	×.5	–
Medium	–	–	–
Heavy	×1.5	×2	–
Extra-Heavy	×2	×5	–
Expense			
Cheap materials	×1.5	×.5	–
Expensive materials	×.75	×2	–
Other			
Flexible	×1.5	×5	15
Submersible	×2	×2	25
Has wings or rotors	–	×10	–

Weight: Determine the structural weight as follows: Multiply the robot's total surface area by the design weight shown on the table for the robot's TL, and then multiply that weight as shown for each option under "weight" the robot was given. The result is its structural weight in pounds.

Cost: Determine the structural cost as follows: Multiply the robot's total surface area by the design cost on the table, and then multiply as shown under "cost" for each option the robot was given. The result is its structural cost.

EXAMPLE

We give Synthia a "heavy" frame but no other options. Its weight is 19 (its total surface area) × 2 (basic TL10 structure) × 1.5 (heavy frame) = 57 lbs. Its structural cost is 19 (total surface area) × 100 (basic structure) × 2 (heavy frame) = $3,800. It costs no points.

Hit Points

Determine the hit points for the robot's body and for each subassembly the robot has, as follows:

Body . . . its area × 1.5
Each Arm . . . its area × 3.
Each Head or Pod . . . its area × 1.5.
Each Leg . . . its area × 1.5.
Each Track . . . the track's area × 3/number of tracks.
Each Wheel . . . the wheel's area × 3/number of wheels.
Each Wing . . . its area × 1.5.
Rotary wing . . . its area × 3.
Ground-effect skirt . . . GEV skirt area × 1.5.

Multiply all hit points by .25 if the robot has an extra-light frame, by .5 if a light frame, by 2 if a heavy frame or by 4 if an extra-heavy frame. Round hit points to the nearest whole number, but with a minimum of 1 hit point for the body and for each subassembly.

EXAMPLE

We need to determine the hit points for Synthia's body, head, each of its arms, and each leg. Synthia's body's hit points are 6 (its area) × 1.5 (body) × 2 (heavy frame) = 18. Its right arm's hit points are 1.5 (its area) × 3 (arm) × 2 (heavy frame) = 9. Its left arm's hit points are the same. Its tentacle arm's hit points are 1 (area) × 3 (arm) × 2 (heavy frame) = 6. Its head's hit points are 3 (area) × 1.5 (head) × 2 (heavy frame) = 9. Its legs' hit points are 3 (area) × 1.5 × 2 (heavy frame) = 9 hit points each.

Surface Features

Surface features include things layered on the robot's body, such as armor, synthetic skin and radiation shielding.

Normally, surface features are assumed to cover the entire robot; their weight and cost is based on the robot's surface area.

Optionally, surface features that cover only part of a robot – the body or subassemblies – may be added. In this case, base the weight and cost on that individual section's area, rather than the robot's total surface area.

Armor Design

Armor protects a robot from damage. Not all robots have it. A robot covered with flesh (p. 43) can still have armor under its skin. If the robot has armor, select the type. There are six main kinds.

Ablative Armor (TL8) is plastic/composite armor. It is light and cheap, but easily chipped or melted away. Every 10 points of damage an attack inflicts (regardless of whether its damage penetrates DR or not), destroys 1 point of ablative DR. Lost DR can be replaced – see *Repairing Robots* on p. 99.

Laminate Armor (TL7) is a composite of metal alloys, tough ceramics and synthetic materials, like the modern Chobham armor used on main battle tanks, or Ogre-era BPC. It is designed to resist shaped-charge warheads, and gets doubled DR against them.

Metal Armor is ordinary armor made of steel, aluminum, titanium or high-tech alloys. At higher TLs, the metal may have "perfect crystal" structures grown in zero-G, or even be gravitationally collapsed. It provides normal Damage Resistance.

Nonrigid Armor (TL7) is woven of flexible material, like natural fibers, para-aramid fiber, monocrys or bioplas. It is very light, but impact from a powerful blow may be felt as blunt trauma. When an explosion, Crushing or Cutting damage attack hits the robot, any 5 or 6 (at TL7) or 6 (at TL8+) rolled on the damage dice inflicts 1 hit not absorbed by nonrigid armor DR. In addition, TL7 nonrigid armor has a maximum of DR 1 vs. Impaling attacks, and TL8-9 nonrigid armor has a maximum of DR 2 vs. impaling attacks. Nonrigid armor's DR is limited to 2 × (TL+1).

Reflex Armor (TL10) is electrically-active bioplastic armor with built-in sensors that turn it hard as steel just before suffering an impact. Normally it is treated as nonrigid armor, but its DR *doubles* and it protects like metal armor if its sensors detect the incoming attack in time. It automatically detects melee or thrown weapons, or low-velocity projectiles like arrows. Bullets, rockets and sonic beams are detected on a roll of 14 or less on 3d. Hyper-velocity Gauss needles or railgun shots are detected on a 12 or less. Laser, blaster or other beam weapons are too fast to detect. Reflex armor's DR (before doubling) is limited to 5 × TL.

Open-Frame: Any kind of armor can be an open framework, much like a roll cage. It protects normally vs. collisions, falls, rolls or Swinging melee attacks, but has only a 1-in-6 chance of protecting vs. Thrusting attacks, beams, arrows, bullets, or other small missiles. It has no effect at all against flamer or flamethrower attacks or explosive concussion damage. Open-frame armor has half the normal weight.

Use the table below to calculate the armor's weight and cost:

Armor Table

	Weight by TL							
Type	*TL7*	*TL8*	*TL9*	*TL10*	*TL11*	*TL12*	*TL13+*	*Cost*
Ablative	.08	.03	.02	.012	.008	.005	.003	$8
Metal	.25	.15	.1	.06	.04	.025	.015	$20
Laminate	.15	.1	.06	.04	.025	.015	.01	$100
Nonrigid	.045	.04	.03	.02	.015	.008	.005	$100
Reflex	n/a	n/a	n/a	.03	.02	.012	.008	$400
Open-frame	×.5	×.5	×.5	×.5	×.5	×.5	×.5	×.5

Weight: Multiply the weight shown for the chosen type and TL of armor by the robot's surface area: this is the weight per point of DR. Decide how much DR the robot will have (remember, some armor types have a maximum DR). Then calculate the actual weight of the armor.

The greatest weight of armor the robot can be given is 50 lbs. × its body hit points; most robots will have far less armor than this.

Cost: Multiply the cost shown on the table above by the weight of the armor. This is the armor's cost.

Other Armor Statistics

Once DR is known, PD, point cost and Legality can be determined.

Passive Defense: PD is determined from DR as follows: DR 1 gives PD 1, DR 2-4 gives PD 2, DR 5-15 gives PD 3 and DR 16+ gives PD 4. Maximum PD is 2 for nonrigid armor.

Point Cost: Each point of DR costs 3 points. For all but metal armor, this is modified by armor type: Ablative: -15%, Laminate: +33%, Nonrigid: -10%, Reflex: +50%, Open-frame: -25%. PD costs 25 points per level, *regardless* of armor type.

Legality Class: Legality depends on DR: DR 1 is Legality 6, DR 2-3 is 5, DR 4-7 is 4, DR 8-15 is 3, DR 16-23 is 2, DR 24-63 is 1, DR 64-199 is 0 and DR 200+ is -1. If the robot has neither metal, reflex nor laminate armor, increase Legality by 1.

Humanoid robots with body volume between 0.5 and 5 cf can wear human body armor; the DR is additive, but the PD is only that of the worn armor. If a robot cannot wear body armor, then increase armor Legality by 1.

Maximum Legality is 6.

EXAMPLE

Synthia's nonrigid DR of 15 costs 15 x 3 x 0.9 = 40.5 points, its PD of 2 costs 50 points. Total armor cost is 90.5 points.

Armor Slope

A body or head that has slope will gain increased PD and DR as any attack must both penetrate through a greater thickness of armor and is more likely to be deflected. Any head or body face with 30-degree slope gets +1 PD and +50% to DR against attacks from that direction. Any face with 60-degree slope gets +2 PD and doubled DR against attacks from that direction. This increase in PD and DR does not affect Legality.

Sloped armor has point cost as follows, for each side:

[(sloped PD - unsloped PD)×25 + (sloped DR - unsloped DR)×3]/6.

Camouflage and Threat Protection

These armor features are designed to protect the robot from detection or from special dangers (like radiation or laser beams).

Chameleon Systems (TL8): These systems give the robot sensor-equipped skin that automatically alters its appearance to blend in with any background. This reduces an enemy's chance of detecting the robot visually (including ladar), or of hitting it.

A TL8 *basic chameleon system* is -3 (-1 if moving) to be visually spotted or hit.

A TL9 *instant chameleon system* is -6 (-3 if moving) to be visually found or hit.

A TL10 *intruder chameleon system* makes the robot nearly invisible: -10 (-6 if moving) to be visually located or hit.

The automatic camouflage feature can also be turned off, allowing the robot to electronically "paint" itself with whatever color scheme or markings are desired, or to give itself a silvery skin identical to a reflective surface. Note that these systems cover the surface of the *robot:* clothing, armor worn or equipment carried obscures part or all of the camouflage, making the robot easier to see.

Holocloak (TL10): This holographic projector maps a preset three-dimensional image around the robot. A holocloak is normally used to create instant disguises, allowing the robot to create or change clothes in a flash, or to look like someone or something else. It can cloak the robot with any holographic image of equal or slightly larger size than the robot's actual size. A hologram cannot fool non-visual senses (such as touch, infrared or radar) and because it projects light, it *glows in the dark.*

The robot can have several different hologram image programs stored in its memory – each costs $100 and takes up 1 gigabyte. It takes one second to change programs, during which the robot's real form is briefly visible. The projector must also be turned off to vent waste heat (which produces a large heat signature) for at least an hour every six hours of use, or it starts leaking heat anyhow.

A robot with visual sensors can record images of objects of the appropriate size to create instant holocloak programs. Anything recorded must be seen from all angles; it takes one gig of memory. The GM may make a secret Electronics Operation (Holographics) roll to see if the robot got the details right; otherwise observers may notice something subtly wrong.

Infrared Cloaking: This subtracts (the system's TL-4) from rolls to detect the robot with infrared or thermograph sensors, or to hit it with heat-seeking (infrared, or IR-homing) missiles or projectiles.

Radiation Shielding: This protects the robot against radiation. It is measured in protection factors (PF). Divide the rads of received radiation by the PF of the shielding. The available shielding is 10 PF at TL7, 100 at TL8, 1,000 at TL9-10, 10,000 at TL11-12, 100,000 at TL13+.

Reflective Surface: This gives the robot PD 6, or +1 to PD (whichever is better) vs. laser beams (but not x-ray or graser beams) and flamers. However, it adds +3 to the chance of being detected by radar. It cannot be added to a 'bot with a chameleon system.

Sealed: The vital components of a sealed robot are protected against corrosion from water or other liquids, and from the effects of sudden pressure changes, or high or low temperatures. This means the robot can (if its power systems don't require air) operate in vacuum or underwater. A robot with a submersible hull is automatically sealed for free.

Stealth: A robot can be built of special materials to make it harder to detect by radar or imaging radar. This subtracts its TL-4 from any radar detection attempts.

Thermal Superconductor Armor (TL11): This coating over the armor doubles armor DR against shaped-charge explosive warheads, lasers, x-ray lasers, grasers, flamer or plasma/fusion guns.

Waterproof: This seals the robot against leaks, short-circuits or corrosion caused by water. A robot that is submersible or sealed is automatically waterproof for free. A robot intended to float must be either sealed, submersible or waterproof.

Camouflage and Threat Protection Table

Type	*TL*	*Wt.*	*Cost*	*LC*	*Points*
Chameleon, basic	8	.4	$80	5	15
Chameleon, instant	9	.5	$100	5	30
Chameleon, intruder	10	.6	$400	3	50
Holocloak	10	.2	$60	6	10
Infrared Cloaking	7	2	$300	5	(TL-6)
Radiation Shielding	7	2	$20	6	varies
Reflective Surface	7	0	$30	6	2
Sealed	7	0	$40	6	20
Stealth	7	2	$300	5	(TL-6)
Stealth and IR Cloaking	7	4	$600	5	(TL-6) × 2
Thermal Superconducting	11	.25	$250	3	+67% to armor point cost
Waterproof	0	0	$2	6	0

Multiply weight (Wt.) and cost by the robot's surface area. Except for waterproof, halve weight and cost one TL after the system's introduction, and quarter two or more TLs after introduction.

Radiation shielding's point cost is 2 points at TL7, 4 points at TL8, 6 points at TL9-10, 8 points at TL11-12, and 10 points at TL13+.

EXAMPLE

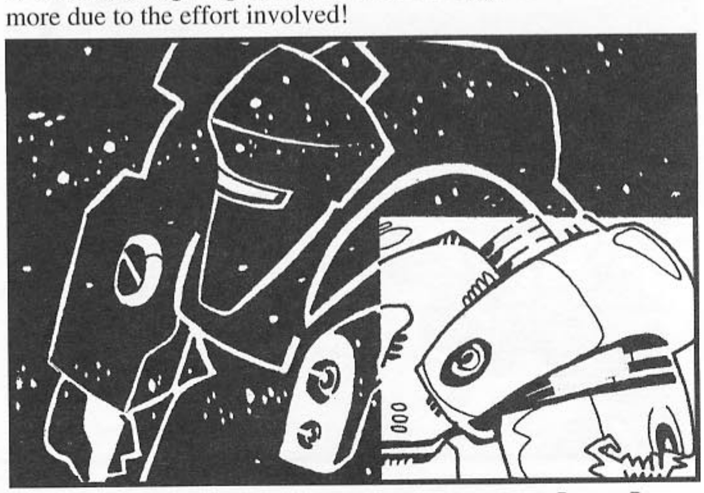
Synthia is sealed, costing 19 × $40 × .25 (quartered for TL10) = $190, and 20 points.

Biomorphics

These surface features make the robot look less like a machine and more like a living being. They include body-sculpting and covering the robot with flesh.

Such biomorphic features can make a robot seem lifelike, but that doesn't mean people will believe the robot to be a real living thing, unless it's also of the proper size and shape. A human-sized robot with a head, basic sensors, two arms and two legs could use biomorphics to pass for human without any problem. But a robot with wings or extra limbs could only pass as an animal or alien. If a robot has features like wheels, rotary wings, or unconcealed weapons sticking out of it, most people that see it will immediately assume that it is at least part machine, no matter how realistic a fleshy covering it has!

A biomorphic feature's detailing is up to the designer. It makes no difference in terms of cost, for instance, whether a robot's sculpted face looks like that of a human, an elf, an alien or a beast, though especially attractive or ugly features will cost more due to the effort involved!



These biomorphic features are available:

Sculpted: A robot with armor but no skin may have its armored surface sculpted to give it lifelike features. The robot is still obviously artificial – but it looks like a metal or plastic statue, rather than a simple piece of machinery.

Mannequin: Any armor the robot has is sculpted, and its body is then given a thin plastic coating painted to match flesh tones and then (if desired) fake hair. The result looks convincing in bad light, but doesn't feel or smell like flesh. A successful Vision or Smell roll, any infrared or thermograph view, or any touch will reveal it to be artificial. The robot has no body cavities. The skin does not move, and the robot cannot simulate facial expressions. All in all, a humanoid robot with this option resembles a department store mannequin. Any damage will reveal the robot to be artificial, since it does not bleed or bruise.

Realistic Flesh (TL8): After any armor the robot has is sculpted, the robot is covered with a thick layer of subcutaneous gel implants to simulate flesh, muscle tone and fat. Over that is layered synthetic or vat-grown skin designed to look realistic, with pores, wrinkles and body hair. However, the robot has no pulse; it doesn't sweat. The skin won't tan, bleed or bruise, and won't heal. Someone touching or sniffing the robot gets a Diagnosis or IQ roll (modified by bonuses for Acute Taste and Smell or Discriminatory Smell) to notice these differences; roll at -4 if the person isn't specifically looking for any of these differences. Successful use of a bioscanner or medscanner will also reveal the robot to be artificial. Damage exceeding one-third of a hit location's hit points will also reveal the robot to be mechanical.

Living Flesh (TL9): As above. However, the robot has pseudo-muscles in its face that allow it to adopt a range of facial expressions, muscle tics, etc. Its power system keeps the skin at a realistic temperature, and the skin itself is designed to tan, bruise, bleed, and then heal. As a result, the robot looks and feels real, and will also appear real to infrared or thermograph sensors. Only cutting into the robot, or successful use of a medscanner or bioscanner at -4, will reveal the robot is not really a living thing. Damage exceeding one-half of a hit location's hit points will also reveal the robot's mechanical nature.

Other Options

Appearance: A robot can have an Appearance statistic. The cost of Appearance is shown on the Biomorphics Table, p. 45. Even a fleshless biomorphic robot may look good – a beautiful statue – without looking at all human. For non-biomorphic robots, an appealing design, or useless but pretty external features, can explain an Appearance of Attractive or Beautiful.

A Hideous or Ugly 'bot may have been designed that way – to engender fear or disgust – or its condition may be the result of abuse or neglect. A biomorphic robot can also be built to *duplicate* a specific living being, provided its shape and size are correct. How convincing the duplicate is depends on the type of biomorphics it has.

If desired, a robot with an Appearance that isn't average can be built to look like an albino.

Biomorphic Shielding (TL9): This sensor-deception system is designed to make a robot look like a living being rather than a machine when it is scanned by bioscanners, chemscanners or medscanners, and to prevent the robot's power system from being detected by radscanners. The system does not interfere with actual detection, merely creates a distorted impression. To correctly register the 'bot as a machine rather than a living being (of whatever type is preset), a pluralize chemscanner of the same TL that detects it must succeed by five or more. A scanner one TL lower must succeed by ten or more; a scanner one TL higher must succeed by 2 or more. Scanners that are two or more TLs lower will automatically be deceived into registering it as a living being; scanners two or more TLs higher are unaffected.

Elastic Skin (TL9): A robot with living flesh can be given this option. The robot has memory-plastic implants that enable it to alter its body and facial features to resemble anyone of its approximate size and build, modify its fingerprints, change its apparent race or sex, or alter its appearance from Hideous to Very Beautiful/Handsome. It takes the robot 10 seconds to do so; a Disguise+4 roll is required for the robot to make a convincing duplication. It needs the Acting skill program to imitate someone's mannerisms. If the robot's body loses half or more of its hits, its shape will return to normal. If the robot's head loses half or more of its hits, the face will return to normal.

Fur: A robot with mannequin, realistic flesh or living flesh can have fur. The level of realism matches the biomorphics. Fur provides an extra DR 1, and protection equivalent to light clothing. The cost of fur depends on the biomorphics. For mannequins, the cost is $50 × surface area. For realistic or living flesh, it actually subtracts 10% from the cost of flesh, since it's easier to cover physical imperfections with fur than to get the subtleties and wrinkles of realistic skin right.

Sex Implant (TL8): Gives the robot fully-functional genitalia. The robot does not require flesh, but it is strongly recommended. Sex implants are available in male or female models; for double cost, the robot can have both.

Surface Sensors (TL8): The robot's entire surface is covered with sensitive temperature and pressure sensors, making its body as receptive as a human to heat, cold, touch, etc. (The robot can turn off this sensitivity to prevent pain – all robots have, in effect, High Pain Threshold.)

Biomorphics Table

Type	*TL*	*Weight*	*Cost*	*Points*
Sculpted	–	.1	$20	0
Mannequin	–	.2	$50	0
Realistic Flesh	8*	.5	$400	0
Living Flesh	9*	.5	$1,000	0
Appearance				
Hideous	–	–	$200/$40	-20
Ugly	–	–	$100/$20	-10
Unattractive	–	–	0	-5
Average	–	–	0	
Attractive	–	–	$50/$10	5
Beautiful/Handsome	–	–	$150/$30	15
Very Beautiful/Handsome	–	–	$250/$50	25
Duplicate	–	–	$500/$50**	**
Other				
Biomorphic Shielding	9	.1	$1,000	0
Elastic Skin	9	–	$2,000	20
Fur	7	.25	special	4
Sex Implant	8	0	$8,000	0
Surface Sensors	8	–	$1,000/$1,200	0

* Not available to robots with reflec surfaces. Only available to robots with chameleon systems at 5 × cost.

** Add the cost of the Appearance of the person being duplicated, if it isn't Average.

Weight: Multiply the weight by the robot's surface area to get the actual weight. TL does not modify it.

Cost: The cost is multiplied by surface area, except for the sex implant. If a TL is listed, halve the cost one TL after introduction, or quarter it two or more TLs after introduction. For Appearance and Surface Sensors, the second cost applies if the robot *does not* have flesh.

Legality: All systems are LC 6 except biomorphic shielding, which is LC 5.

EXAMPLE

Synthia has a surface area of 19. We give it living flesh which weighs .5 × 19 = 9.5 lbs. and costs 19 × $1,000 × .5 (halved for being TL10) = $9,500. We also give it a Very Beautiful Appearance ($4,750, 25 points); biomorphic shielding (1.9 lbs., and at TL10, $9,500, LC 5); a female sex implant (at TL10, $2,000); and surface sensors (at TL10, $4,750).

Other Surface Features

Suction Pads (TL9+): These are molecular suction pads that let the robot climb up walls or cling to ceilings. They cost $100 × the sum of the area of all the legs and 25 points.

Statistics

The last thing to do is to work out the robot's statistics!

Design Weight

Add up the total weight of every part of the robot: components, structural weight and surface features.

Tonnage: Divide the weight by 2,000 to find the robot's mass in tons.

Loaded Weight: Decide if the robot carries any cargo internally on a regular basis. A robot can carry up to 50 lbs. of cargo per cf of cargo space. If the robot usually carries cargo, passengers or other robots inside it, add their weight to the design weight; this is the robot's loaded weight.

When "weight" is used for a performance calculation, use the loaded weight to work out the performance of the robot carrying a load of cargo or occupants, and the design weight otherwise.

Robot Volume and Size

Add together the sizes of all subassemblies (unless retractable), and the body. This is the robot's volume in cubic feet. If the robot's total volume is under 1 cf or over 4 cf, its "inconvenient size" is a disadvantage worth -10 points. Robots don't suffer from gigantism or dwarfism as such, but a humanoid robot over 4 cf will gain the same reaction bonuses or penalties as a giant and one 1 cf or smaller as a dwarf (p. B28).

An approximation of the robot's longest dimension in yards (height if bipedal or tripodal, usually either height, width or length otherwise) in yards can be found using the formula: square root of [(body area + head area)/6]. Multiply by 1.5 if the robot has two or three legs. Multiply by three to convert yards to feet.

Price

Add up the total cost of the robot's components, structure, and surface features. This is the robot's purchase price.

EXAMPLE

Synthia weighs 135.175 lbs. This is .06758 tons. It carries no cargo (or people) inside it, so we'll use its design weight when calculating its performance.

Synthia's volume is 1 (body) + .2 (total of right and left arms) + .3 cf (head) + .6 cf (both legs) = 2.1 cf.

Synthia's body area + head area is 9. Her height is [square root of (9/6)] × 1.5 (two legs) × 3 = 5.5' feet.

Synthia costs $89,912.5.

Attributes

Strength

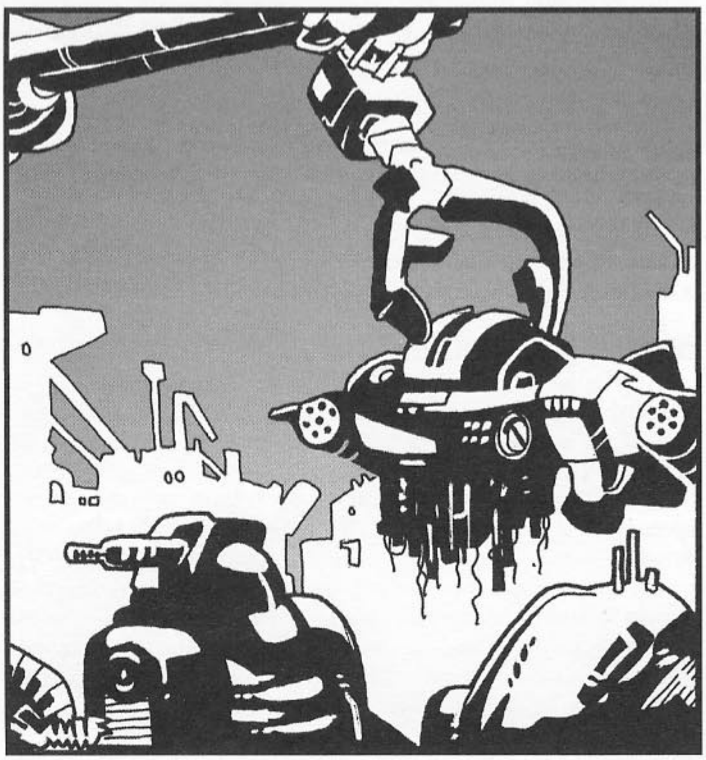
Robots with arms, or any drivetrain that has motive power, have a ST attribute. A robot's ST is split into two categories: body ST (based on motive power) and arm ST (based on the arm motor – see p. 16).

Using the motive power of the drivetrain with the highest motive power, figure the robot's *body ST* with the formula:

ST = (motive power - weight in tons) × 80.

Body ST is used for pulling, kicking, or when the robot slams into someone or carries a load. Unless the robot has no Body ST at all, its minimum Body ST is half its body hit points; its maximum ST is twice its body hit points. Round fractions *up*. A robot without a drivetrain has *no* Body ST; list this as "Body ST 0" for record-keeping purposes.

Arm ST is the strength of an individual arm. It is the strength a robot has when using that arm to punch, push, lift, grip or wield a weapon. If a robot uses a pair of arms with different arm ST values to perform a two-handed task, such as wielding a two-handed weapon or lifting with both arms, average their STs. If the robot has no arms, record an arm ST of 0.



Point Cost: Find the cost of Body ST 14 or less from the table on p. B13; use the table below for Body ST 15+. If a robot has no arms, or has only striker arms, reduce the cost of Body ST 11+ by 40%. Body ST 0 (see above) is worth -100 points.

For a robot with arms, having an Arm ST greater than Body ST is an advantage, priced as follows:

For *each* arm: 30% of the difference between the cost of the Arm ST and the cost of Body ST.

For each *pair* of arms with the same ST: 50% of the difference between the cost of the arms' ST and the cost of Body ST.

This is additive if the 'bot has even more arms.

If either of the two *highest-ST* arms is weaker than Body ST, this is a disadvantage. Calculate this as above, but now the difference is *negative.*

Strength Point Cost Table

ST	*Cost*	*ST*	*Cost*
15	60	23	140
16	70	24	145
17	80	25	150
18	90	26	155
19	100	27	160
20	110	28	165
21	120	29	170
22	130	30	175
		31+	+ ½ point per point

EXAMPLE

Synthia's body ST is equal to [.45 KW (its motive power) - .06785 tons (its weight in tons)] × 80 = ST 30.803, rounded up to ST 31. This costs 175.5. The Arm ST of 30 costs (175 - 175.5) x 0.5 = -0.25. Net cost is 175.25.

Dexterity

The robot's DX is its dominant brain's (Complexity/2) + 8, rounding down. Then add the DX bonus for a reflex booster, if the robot has one. The result is the robot's DX.

To determine how many points DX costs, refer to the table on p. B13.

EXAMPLE

Since Synthia has a Complexity 5 brain and a +2 DX reflex booster, its DX is 2.5 (Complexity/2) + 8 + 2 (DX booster) = 12.5, rounded down to DX 12. This costs Synthia 20 points.

Intelligence

The robot's IQ is its dominant brain's Complexity + 3. Add +1 if the computer is a neural-net, or +2 if it is sentient.

To determine how many points IQ is worth, refer to the table on p. B13.

EXAMPLE

Synthia's IQ is 5 (its brain's Complexity) + 3 + 1 (neural-net) = 9. This costs the same as buying IQ 9: -10 points.

Health

A robot has a split HT, divided into actual Health and hit points, much like an animal.

Health measures the robot's general reliability. Hit points, or hits, are used to determine how much damage the robot can withstand. A robot with a low Health but many hit points can take a lot of punishment – but it also requires a lot of maintenance to keep running properly, just like a tank or a jet fighter.

Hit Points: A robot's hit points have already been calculated.

Health: The heavier the robot is, compared to its structural strength, the more strain it puts on its systems (especially legs, wheels, wings and the like), and thus the less reliable it is. A robot's Health is: [(200 × body hit points)/loaded weight] + 5, rounding up, to a maximum of HT 12 or the robot's TL, whichever is higher.

Record a robot's health and hit points in the same way a split Health is recorded for animals: Health first, then a slash, then body hit points. Note the hit points of subassemblies afterward.

Calculate the point value of a robot's Health using the table on p. B13. Every body hit point the robot has over Health is a 5-point advantage. Every body hit point the robot has below its Health is a -5-point disadvantage.

EXAMPLE

We've already calculated Synthia's hit points (see p. 41): it has 18 body hit points. Its Health is [200 × 18 (hit points) / 135.175 (weight)] + 5 = 31.6. Since the maximum robot health (at TL10) is 12, Synthia ends up with Health 12. This is written HT 12/18. A Health of 12 normally costs 20 points, but since Synthia has six more body hit points than its Health, the actual cost is [20 + (5 [point cost of extra hit points] × 6 [hit points over Health])] = 50 points.

Ground Speed

A robot can move on the ground if it has legs, tracks, a flexibody, or wheels. Tracks, a flexibody or legs also require a matching drivetrain. If it has multiple motive systems, calculate the performance of each separately. To find the robot's Speed on the ground, divide the motive power of the drivetrain* by its weight in tons. Find the square root of the quotient. Multiply this by the Speed Factor shown on the table below. This gives the robot's Speed (in yards per second).

Speed Factor Table

Type	*Speed Factor*
Legs, two	4
Legs, three	5
Legs, four or more	6
Tracks	6
Wheels	8
Flexibody	2

* If the robot has a thrust-based propulsion system and is moving on wheels, it may add 25% of its motive thrust to its motive power. (It's possible to move on wheels without a wheeled drivetrain, just using this thrust.)

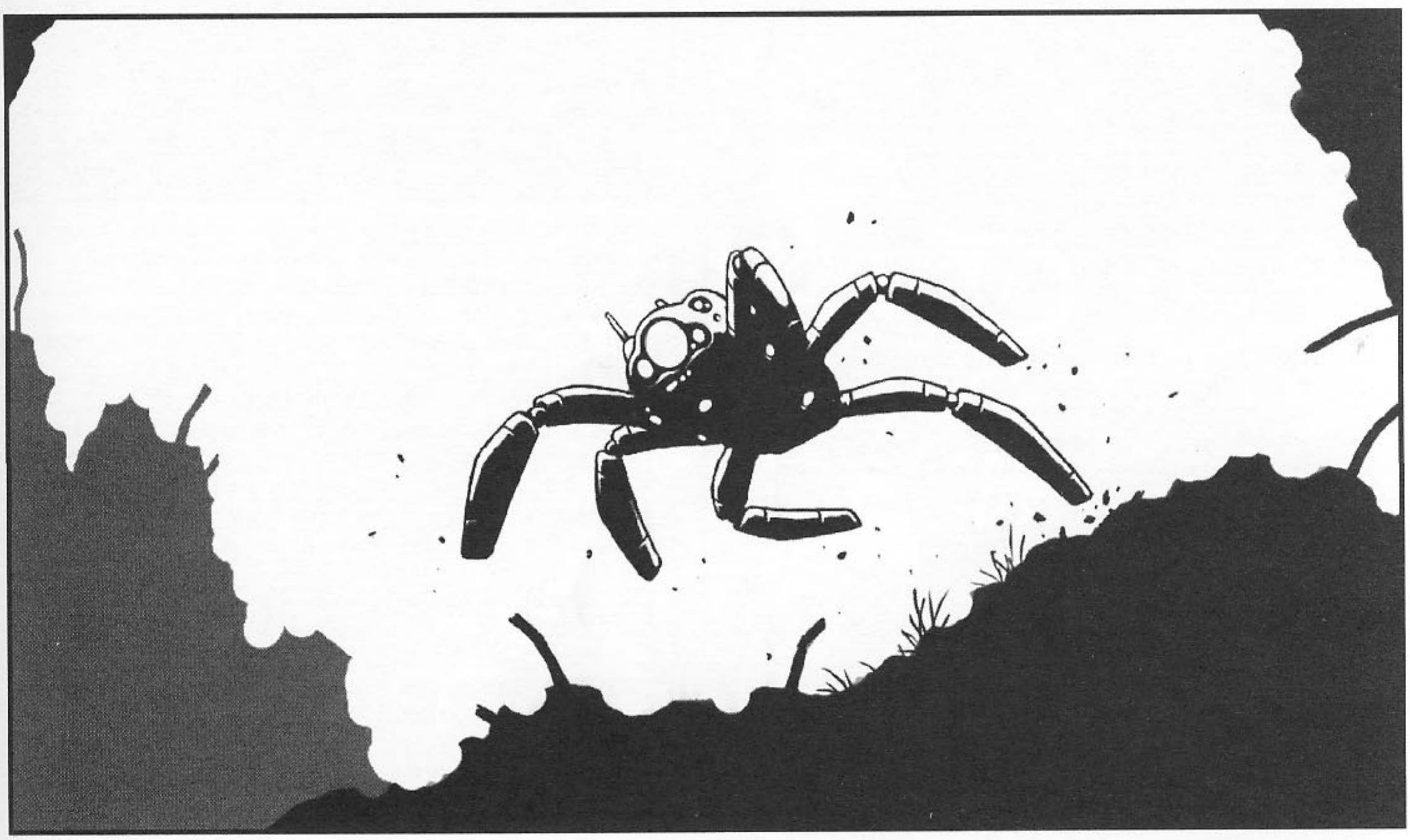
EXAMPLE

Synthia moves on two legs. Its leg motive power is .45 KW; its weight is .06758 tons. Dividing the motive power by weight, finding the square root of the quotient, and then multiplying by 4 (the Speed Factor) we get a Speed of 10.3.

Flotation

Robots with GEV skirts can skim over water at their ground Speed. Any robot with a sealed body can use a portion of its ground speed to move along the bottom of a body of water. But can the robot float?

A robot can float if it is waterproof, sealed or submersible *and* its weight does not exceed its flotation rating, which is 62.5 lbs. × its volume.



EXAMPLE

Synthia's body volume is 2.1 cf and its weight is 135.2 lbs., so it cannot float.

Water Speed

A floating robot with legs, tracks, flexibody, aquatic propulsion, or thrust-based propulsion can propel itself through water. To determine water speed:

First, calculate the power factor. For thrust-based propulsion this is 25% of motive thrust. For tracks or legs, it is 10% of motive power. For flexibody or screw propellers it is 75% of motive power. For hydrojets, it is motive power. If a robot uses several propulsion systems at once, add power factors together.

The water speed is found by dividing power factor by the robot's mass in tons and consulting the table below. Find the closest quotient in the Power column, and then find the robot's actual Water Speed in the adjacent Speed column:

Water Speed Table

Power	*Speed*	*Power*	*Speed*	*Power*	*Speed*
.015-.124	1	145-165	21	1,077-1,157	41
.125-.41	2	166-189	22	1,158-1,241	42
.42-.9	3	190-215	23	1,242-1,330	43
1-1.9	4	216-243	24	1,331-1,423	44
2-2.9	5	244-275	25	1,424-1,520	45
3-5.9	6	275-306	26	1,521-1,621	46
6-7.9	7	307-342	27	1,622-1,727	47
8-10	8	343-380	28	1,728-1,837	48
11-15	9	381-421	29	1,838-1,952	49
16-20	10	422-464	30	1,953-2,071	50
21-26	11	465-511	31	2,072-2,458	51
27-33	12	512-560	32	2,459-2,325	52
34-42	13	561-613	33	2,326-2,459	53
43-52	14	614-669	34	2,460-2,599	54
53-63	15	670-728	35	2,600-2,743	55
64-76	16	729-790	36	2,744-2,892	56
77-90	17	791-856	37	2,893-3,048	57
91-106	18	857-926	38	3,049-3,208	58
107-124	19	927-999	39	3,209-3,374	59
125-144	20	1,000-1,076	40	3,375 etc.	60

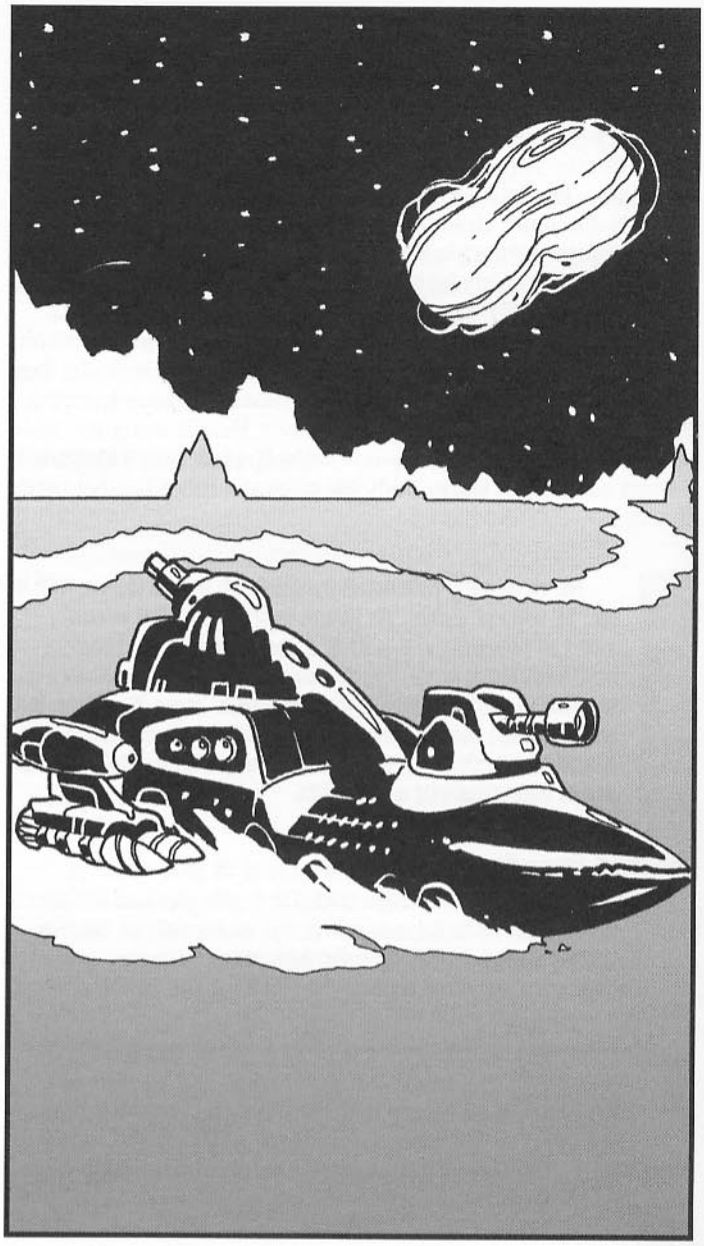
(To expand this table, use the formula: 4 times the cube root of [power factor/displacement], rounded off.)

A robot can swim underwater if it can float and either has the submersible option, legs or a flexible structure. However, aerial propellers, ducted fans and reaction engines that require air cannot be used underwater, and the robot must also have a power system that can function without air.

Aerodynamic Flight

A robot with wings or rotors can fly. Vectored-thrust lift is one pound per pound of motive thrust.

Basic Stall Speed: A flying robot has a *stall speed,* a minimum speed the robot must be moving to have sufficient lift to take off and remain airborne. Stall speed (Ss) equals the robot's loaded weight in pounds (Wt.) divided by the combined area of all wings (Wa), the area of rotary wings (Ra) and 10% of body area (Ba), or Ss = Wt/(Wa + Ra + .1Ba).



Modification to Ground or Water Speed: If either or both of the robot's ground or water Speeds exceeds its stall speed, reduce that Speed to the stall speed (or the robot will attempt to lift off any time it exceeds its stall speed!).

Lift Effects: A robot with helicopter rotors, ornithopter motors and wings, contragrav or vectored thrust lift will have a stall speed lower than its basic stall speed.

Total the combined lift from any vectored thrust or contragrav the robot has, and add helicopter and ornthinopter lift.

Helicopter lift is equal to helicopter drivetrain motive power × 12. Ornithopter lift is equal to ornithopter drivetrain motive power × 4 if its wings are TL7 or lower, or × 5 if the wings are TL8 or higher.

The combined lift will subtract a percentage from stall speed equal to (100 × lift/robot loaded weight). The minimum stall speed is 0.

Hovering: A robot whose stall speed was reduced to 0 by lift can take off or land vertically, or even stop and hover in mid-air!

But Can It Fly?: To take off from the ground on its own, a robot must have a stall speed of 0, or be able to reach its stall speed while still using ground movement. Thus, its top ground speed must equal or exceed its stall speed.

The same is true for robots taking off from water: their stall speed must be 0, or their top water speed must be able to equal or exceed stall speed for the robot to be able to fly.

If a robot's stall speed is higher than its top ground Speed, it can't take off from the ground unaided. The same applies to water Speed.

Boosted Jumps: A robot with lift from ornithopter wings, helicopter drivetrain, vectored thrust or contragrav that can't fly can still use lift to boost a jump. It can divide the distance it can jump by 1 - (lift/weight). So a robot with 100 lbs. of thrust that weighed 125 lbs. would divide the jump distance by 1 - (100/125) = .2. If it jumped 5 feet normally, it could now jump 5/.2 = 25 feet.

Flight Speed: First, calculate the total motive thrust. Add the thrust of any aerial propellers, ducted fans, reaction engines and reactionless thrusters together. A robot with a helicopter drivetrain and rotary wings adds thrust equal to helicopter drivetrain motive power × 1.6. A robot with wings and an ornithopter drivetrain adds thrust equal to ornithopter drivetrain motive power × 2. Divide the thrust by the robot's total surface area, excluding the area of any retractable arms, and multiply by 7,500. Find the square root of the result. This is the air speed in mph; divide by 2 to get the actual top Speed statistic. Round to the nearest whole number. However, maximum top speed is 300 (150 if the robot has rotors).

Vectored-Thrust Flight

A robot may be able to fly even if it has no wings, as long as it has ducted fans, jets, rockets, or reactionless thrusters that have the vectored-thrust option.

Subtract the robot's weight from its motive thrust. (Then, if it has contragrav, add the contragrav's lift to the thrust – up to a maximum of the robot's weight.) If the result is 0, the robot can't fly – but see *Boosted Jumps,* below. Otherwise, determine its top air Speed as follows: divide the remaining thrust by the surface area of the robot (excluding any retracted arms) and multiply by 7,500; find the square root of that; then multiply by .5. Top speed cannot exceed 300.

A robot using vectored-thrust flight has a stall speed of 0, and can hover.

Boosted Jumps: A robot that can't muster enough power to fly can still use the vectored thrust to boost a jump. Use the rules under *Flight*, above. Divide the pounds of vectored motive thrust (and contragrav lift, if any) by the robot's weight. Subtract the result from 1. Divide the distance a robot ordinarily jumps by this amount. For example, if it had 800 lbs. of thrust and weighed 1,000 lbs., its jump distance would be 1 - (800/1,000) = 1 - .8 = .2. If its ST normally allowed it to jump 3 yards, it could now jump 5/.2 = 25 feet.

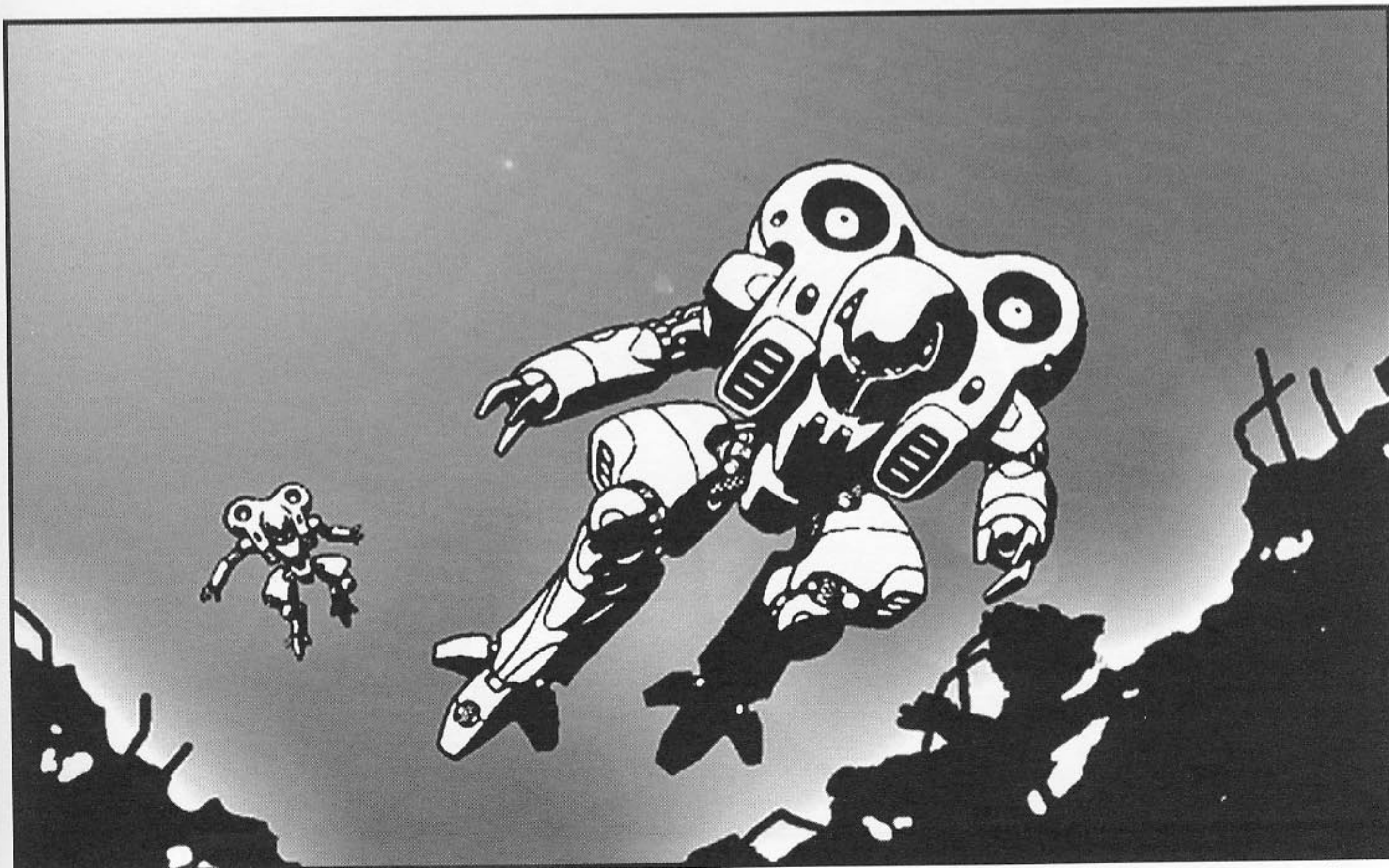
Ground-Effect Flight

A robot with a GEV skirt and lift fans or vectored-thrust ducted fans may be able to enter GEV flight, enabling it to hover a few inches or feet above the surface of ground or water with less thrust than would normally be required to actually fly.

Total the combined lift of vectored-thrust ducted fans, vectored thrust engines and contragrav. Remember vectored-thrust lift is one pound per pound of thrust, but that lift of any vectored-thrust ducted fans housed in the body is multiplied by 5 if the robot has a GEV skirt.

If the total lift exceeds robot weight, the robot can hover at an altitude of (lift/weight) feet over ground or water, and has a GEV, or "hover," performance.

Top Speed: Calculate speed exactly as vectored-thrust flight above, but multiply by 1,500 instead of 7,500.



Point Costs for Movement

This is based on the robot's highest Speed, as shown below:

Speed Cost Table

Speed	Points	Speed	Points
0	-35	11-15	25
1	-15	16-20	30
2	-10	21-40	35
3	-5	41-80	40
4-6	0	81-160	45
7	5	161-320	50
8	10	321-640	55
9	15	etc.	etc.
10	20		

Round fractional speeds down when calculating points. The following abilities will modify the point total. If the robot has a Speed of 7 or more but has neither legs nor the ability to hover in flight, its ability to dodge or maneuver is somewhat restricted. As such, its Speed is only worth half as many points.

Flight: The ability to fly is worth 30 points, or 40 if the robot can hover; halve this if the robot can only "fly" a few inches or feet off the ground by using a GEV skirt. If the robot has wings, but can only glide, this is worth 20 points.

Flotation: If the robot cannot float, this is a disadvantage worth -5 points.

Amphibious: If the robot can move across both water and land, and its water speed is equal to or greater than its land speed, or at least 10 yards per second, this is worth 10 points. Robots that swim via legs, flexibody or tracks pay no extra points.

Legality Class

The robot's Legality Class is that of the lowest LC component or part it possesses.

Model Point Cost

Add up the point costs for all components, features and performance statistics. This is the robot's *model point cost.* As explained in the *Characters* chapter, if the cost is positive, playing the robot as a character counts as an advantage worth that many points. If negative, it's a disadvantage worth that many points back.

A robot that cannot masquerade as a living thing may have a lower model point cost. If the robot has a model point cost of 1 or more, and lacks either living flesh or realistic flesh biomorphics, divide its model point cost by 2 if it has mannequin biomorphics or a holocloak, or by 5 if it does not. Round fractions down. This reduction only affects the model point cost, and has no effect on the cost of any programs, attributes, skills, advantages or disadvantages acquired after the robot was built.

EXAMPLE

For a speed of 10.3, Synthia pays only 15 points, since it cannot float.

Synthia is LC 1.

Synthia costs 610 points.

SY-101-N NEMESIS ("SYNTHIA") (TL10)

Synthia is a multi-purpose covert operations android that resembles a very beautiful human woman.

Brain: Standard brain with +2 DX booster, high-capacity and neural-net options (10 lbs., .2 cf, $22,500, 65 points), Complexity 5.

Sensors: Basic sensors with thermograph and retinaprinter (.75 lbs., .015 cf and $5,500, 25 points).

Communicator: Basic communicator with the superior voice option (.25 lbs., .005 cf, $750, LC 6, 25 points).

Arm Motors: One arm motor ST 30 (3 lbs., .06 cf, $6,000, .15 KW). Second arm motor ST 30 (3 lbs., .06 cf, $6,000, .15 KW). Third arm motor ST 10 "extra-flexible," "retractable" and "striker" (1.5 lbs., .03 cf, $1,200, .05 KW). Arm motors cost 10 points.

Leg Drivetrain: .45 KW motive power drivetrain (13.5 lbs., two leg motors each .135 cf, $2,700, requires .45 KW).

Weaponry: Military laser carbine, concealed, with variable beam (7 lbs., .35 cf, $850); large knife, with monowire blade (1 lb., .02 cf, $290, LC 3); crushing jaw, ST 4 (TL10, .4 lbs., .02 cf, $400, .04 KW, LC 6). 50 points (laser) + 3 points (monowire blade) + 1 point (crushing jaw) = 54 points.

Accessories: Laser sight ($12.50) built into laser carbine; laser periscope (.7 lbs., .035 cf, $150) for military laser carbine; neural stimulator (.5 lbs., .01 cf, $1,000, LC 5); pheromone emitter ($5,000, LC 5, 25 points).

Power System: Routine power requirement .8 KW. One TL10 omnivore bioconvertor with .4 KW output (10 lbs., .2 cf and $2,000), two TL10 rD cells (total 10 lbs., .1 cf, $1,000, 20 points) store 72,000 KWS. Endurance 49 hours.

Subassemblies: Head, three arms ("right arm," "left arm," "tentacle arm"), two legs.

Body Design: Houses the computer brain, neural stimulator, pheromone emitter, military laser carbine and two rD cells totalling .86 cf, plus .14 cf empty space for a volume of 1 cf.

Arm Design: The *right arm* houses the ST 30 arm motor and laser periscope (.06875 cf) and empty space (.03125 cf); its volume is .1 cf. The *left arm* houses the other ST 30 arm motor and empty space (.04 cf); its volume is .1 cf. The *tentacle* arm houses the ST 10 arm motor, large knife and .01 cf of empty space; its volume is .06 cf; it is placed in the head.

Head Design: Houses the sensors, communicator, crushing jaw and tentacle arm plus .2 cf empty space. Its volume is .3 cf.

Area: Body 6, right arm 1.5, left arm 1.5, tentacle arm 1, head 3, right leg 3, left leg 3; total surface area 19.

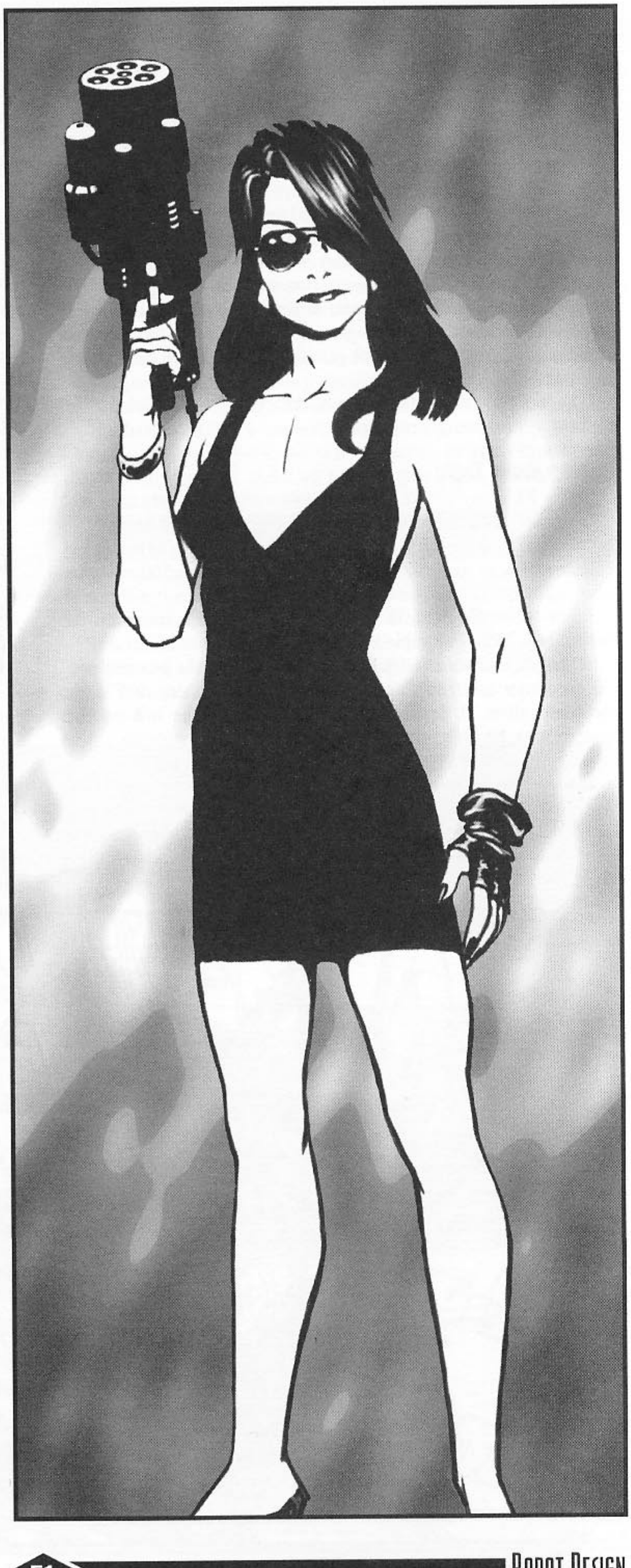
Structure: "Heavy" frame. 57 lbs., $3,800.

Hit Points: Body 18, right arm 9, left arm 9, tentacle arm 6, head 9, each leg 9.

Armor: TL10 nonrigid DR 15 armor (5.7 lbs., $570, LC 4, 90.5 points). Sealed body ($190, 20 points).

Biomorphics: Living flesh (9.5 lbs., $9,500); Very Beautiful appearance ($4,750, 25 points); biomorphic shielding (1.9 lbs., $9,500); sex implant ($2,000); surface sensors ($4,750).

Statistics: 135.2 lbs. (.06758 tons), 2.1 cf (1 hex, 5.5' tall), $89,912.50. Body ST 31, right and left arm ST 30, tentacle arm ST 10 (175.25 points), DX 12 (20 points), IQ 9 (-10 points), HT 12/18 (50 points). Speed 10.53 (20 points). Cannot float (-5 points). Legality 1. Point cost: 610 points.



Appendix 1: Cyborgs

A *cyborg* (cybernetic organism) is a fusion of machine and organic parts. While some cyborgs (like those in ***GURPS Cyberpunk***) are mostly human, it is also possible to retain only an organic brain and notochord, replacing all other body parts with robotic machinery.

Such "total cyborgs" (which we'll just call cyborgs) are built using the standard rules for robots, with one major exception. *As well as* a computer brain, they will have a cyborg brain – a living brain attached to a life-support unit. A cyborg brain has all the advantages of a computer brain *except* Doesn't Sleep. It has none of the disadvantages. As such the computer and cyborg brain together cost 80 points instead of the computer's usual cost.

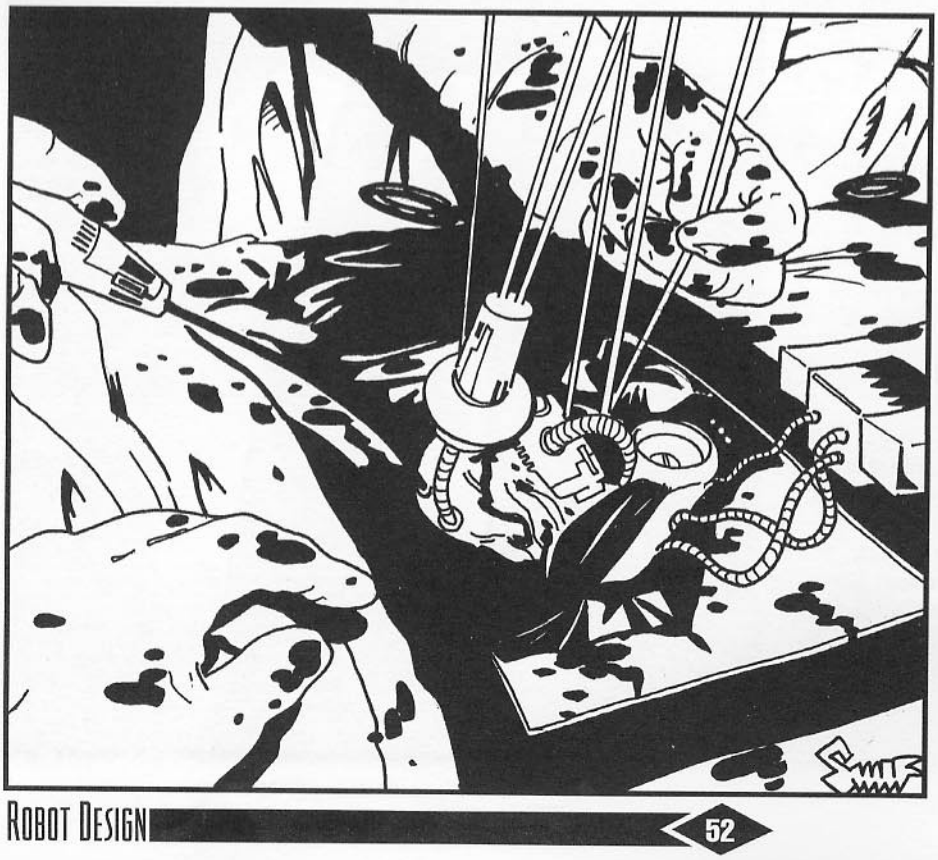
The weight, volume and cost of the cyborg brain and its life-support system are given below.

Cyborg Brain Table

TL	*Wt.*	*Vol.*	*Cost*
8	40	.8	$50,000
9	20	.4	$25,000
10+	10	.2	$12,500

For twice the cost, the brain's weight and volume can be reduced by 25%. For triple the cost, they can be halved.

Weight and *volume* include the brain case, the biomechanical computer interface, and the life-support system that keeps the brain alive. If desired, the brain case and the life-support system may be split into two equal-volume components – this allows the brain case to go into a human-sized head, for instance, with the support system in the body. If the part of the robot with the brain case is destroyed, the brain dies. If the part containing the life-support system is disabled or destroyed, the brain will die within 5 minutes from oxygen starvation unless hooked up to a new life-support system.



Cost includes the brain, its life support and the transplant operation, but not the cost of obtaining a live, disembodied human brain. Cyborgs may be volunteers (most often people who have been critically injured), but enslaved brains may also be available legally or through a black market. Use the rules for slavery (p. B193); assume a brain sells for half the price of a live slave, i.e., 2.5 years' wages at the best job it could get while alive.

Points and *LC:* A cyborg brain costs 80 points, which includes the cost of the computer brain. It is LC 4.

These rules assume cyborg brains are human. However, nonhuman or even animal brains can be used, with appropriate adjustments to weight. (For an extremely rough approximation, multiply the weight and volume by 150 and then divide by the body weight of the creature the brain came from). The cost will usually remain about the same, the difficulty of working with a smaller brain or ease of working with a larger one balanced by the greater or lesser amount of life-support machinery needed.

Cyborg Statistics: Base calculations of cyborg statistics, just like robot statistics, on the Complexity of the computer brain. However, the organic brain's DX and IQ will affect this! For DX, average the calculated DX with the original DX of the brain's donor (round up). For IQ, use the higher of either the donor's original IQ or the computer brain's.

Appendix 2: Battlesuits

A variation on the cyborg concept is the battlesuit: an entire person inside a robot-like body, controlling it by kinesthetic feedback (for example, the wearer tries to move his arm, pressure sensors in the suit sense the movement and move the suit's arm). In effect, the battlesuit controls and occupant replace the robot's brain.

A battlesuit does not need a computer brain, but many battlesuits have one anyway. This enables the brain to advise the human operator, and even take control of the suit if the wearer is injured, untrained, asleep or incapacitated. (For that matter, a battlesuit could have a cyborg brain as well . . .)

A battlesuit is built like a robot, but should have the same number of arms and legs as the wearer. For humans, a battlesuit must have at least two arms and two legs. The suit fits the wearer like a glove – only skintight outfits or nothing can be worn inside the suit. The cost of the battlesuit controls includes the dedicated computer needed to translate the user's actions into suit movements.

A battlesuit should be custom-fitted to an individual – or at least, a given size and weight of person. For simplicity, decide what weight of person the suit will fit, and assume it can fit anyone up to 20% lighter than that weight. This is the "pilot weight."

The "battlesuit system" – controls and pilot – counts as a "component." In a form-fitting suit, it takes up space in the body, head, arms and legs. Including controls and, of course, room for the suit's wearer, it takes up (pilot weight)/100 cf in the robot's body, (pilot weight)/400 cf placed in the head, (pilot weight)/1,000 cf in each of two arms, and (pilot weight)/400 in each of two legs.

Alternatively, the wearer may be entirely placed within the suit's body or head (taking up [pilot weight]/50 cf). This is common in larger suits.

The battlesuit system weighs 1.2 × pilot weight (this includes the weight of the pilot). The cost \$3,000 + (pilot weight × \$20). At TL9, halve the cost, and halve it again at TL10+.

A battlesuit's statistics are the same as a robot's, but it has no DX or IQ – use the DX and IQ of the pilot. (If the suit also has a computer brain, allowing it to operate if the pilot is out of the suit or incapacitated, calculate its DX and IQ normally.)

A battlesuit may have a life-support system. This is a must if the suit will be sealed; this is also a component, usually placed in the body. At TL8, it weighs 37.5 lbs., takes up .75 cf and costs \$500 for every 6 hours of life support it provides; reduce weight and volume to 25 lbs., .5 cf and \$250 at TL9, and to 12.5 lbs., .25 cf and \$125 at TL10+.

In combat, treat a battlesuit as a robot. However, if a part of the suit that contains the pilot is reduced to 0 hit points, also apply half the excess damage to whatever part of the pilot is in that suit location. For example, if the head were reduced to -17 hit points and the pilot was in a form-fitting suit, his own head would take 8 hits. If the suit wasn't form-fitting, the pilot would only take damage if he were in the robot's head, and would take damage to a random hit location.

A battlesuit is operated using Battlesuit skill (p. B49). When making DX rolls, use the lower of DX or Battlesuit skill; when making DX-based skill rolls, use the lower of the character's skill-1 or his Battlesuit skill-1.

Putting on a suit takes about four minutes, removing it half that. For an extra \$500, a suit may be designed for "quick access," taking only (30-Battlesuit skill) seconds to don, or half that to remove.

A person in a battlesuit or exoskeleton is limited by the battlesuit or exoskeleton's sensors. Thus, if the battlesuit has degraded sensors (No Sense of Smell, Low-Res Vision, etc.), these penalties apply to the pilot. There is one exception: if the battlesuit has no armor or armor built with an open frame, the wearer can use his own senses freely. The same limits and exception applies if the suit is Mute or has a Disturbing Voice.

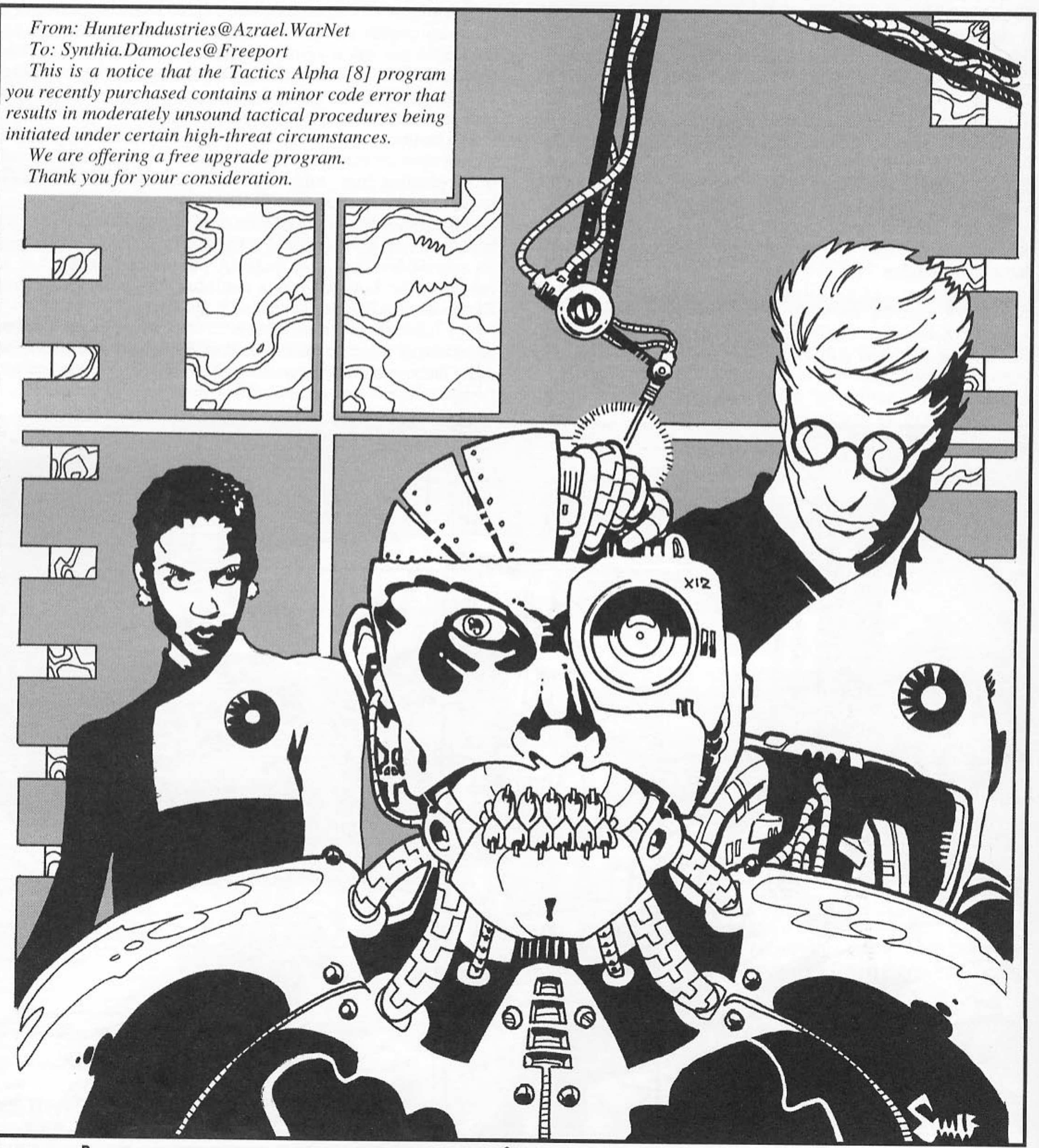
A battlesuit whose sensors aren't Blind is assumed to have a heads-up display system that displays instrument readings on the suit's faceplate or on goggles worn by the user. This reduces SS numbers when firing weapons by 2, or by 5 at TL10 and above. Battlesuits may incorporate neural-interface systems, as described on p. CY41 and p. UT79.

If a battlesuit has a computer equipped with skill programs, a human operator may use the skill programs to assist him instead of supplanting him. Add +1 to the operator's skill for every level the program exceeds skill 10.

An exoskeleton is a battlesuit used for civilian purposes. A battlesuit is an exoskeleton if it has less than DR 30 armor, and no internal weapons save welding, plasma or laser torches. It functions the same way as a battlesuit, but is operated with Exoskeleton skill, as described on p. B247.

If a battlesuit or exoskeleton is 50 cf or larger in size, substitute Driving (Mecha) skill instead of Battlesuit or Exoskeleton skill. The operation remains the same.

BRAINS AND PROGRAMS 2



From: Dan.Damocles@Freeport
To: HunterIndustries@Azrael.WarNet
Thanks for the warning, guys. A bit late.
It would have been nice to know about that little bug in your "state of the art" Tactics program that makes your robot go berserk ***before*** *we landed on Dalos V.*
Please send the upgrade.
Our attorney will send you Synthia's repair bill.

This chapter covers the capabilities and limitations of the computer brains built into robots and of the programs they can run.

Computer Brains

Most robots are machine intelligences, controlled by computer brains. Besides determining the robot's DX and IQ, a computer brain gives the robot a variety of abilities and limits.

As indicated in the *Robot Design* chapter, a computer brain gives the robot certain innate advantages and disadvantages. Summarized, these are:

Absolute Timing: An internal clock is a part of the computer brain; if the robot knows it has crossed a time zone, it can update this instantly. (See p. B19.)

Eidetic Memory 2: A robot can choose to place certain events in permanent storage, enabling it to recall them later with perfect accuracy. (See p. B20.)

Lightning Calculator: The prime virtue of a computer brain is that it adds up numbers *really quickly.* (See p. B21.)

Mathematical Ability: More sophisticated mathematics also come easily to a robot. (See p. B22.)

Any robot brain can also act as a terminal to access another computer, using its communicator.

In addition to all these advantages, a computer brain also gives the robot certain innate disadvantages.

Cannot Learn: An ordinary computer brain is limited by its programming; it can't spend experience points to improve its attributes or skills. (See p. 88.)

No Sense of Humor: Computers tend to be fairly humorless. (See p. B241.)

Reprogrammable Duty: The robot's primary goal is to obey whoever has access to its command codes (see *Command Codes and Robot Obedience,* p. 57). (See p. 89.)

Slave Mentality: A computer brain normally follows orders without showing any initiative. (See p. 89.)

A computer brain built with either the neural-net or sentient options will not have all these disadvantages.

A neural net is a computer built to think and learn in a manner that mimics the thought processes of a living brain. It does not have the Cannot Learn or Slave Mentality disadvantages, but still suffers from Reprogrammable Duty and No Sense of Humor.

A sentient computer is a very sophisticated neural net. It does not have any of a normal computer's disadvantages.

Memory Backups

A robot can compress its operating system, memory, programs and personality and download it onto disk or into storage in another computer. This takes the computer at least a minute, during which time it can't do anything else (it's better to make backups before getting into combat!). This compressed "brain" of the robot takes up .005 gigs (5 megabytes) for a Complexity 1 brain, .05 gigabytes (50 megabytes) for Complexity 2, 0.5 gigs for a Complexity 3, 5 gigs for a Complexity 4 brain, and so on.

A complete memory backup can be uncompressed in any computer of equal Complexity with enough memory. When this happens, the robot effectively "possesses" that computer, although its memories and so on will end at the time it was last backed up. If the original robot is still functioning, the result is a second character – treat it as an NPC with the same attitudes, memory and so on as the original, not as a slave of it. The longer it is out in the world, the more it will diverge.

As long as the robot's backup exists, the robot is effectively immortal. This is a significant capability that robot characters have, although at TL9, humans may also have it if the GM allows braintape technology (p. UT65). Partly balancing this is the disadvantage that a single backup is vulnerable, but scattering multiple ones around makes it easier for someone to steal one, kidnapping the robot's personality and memory.

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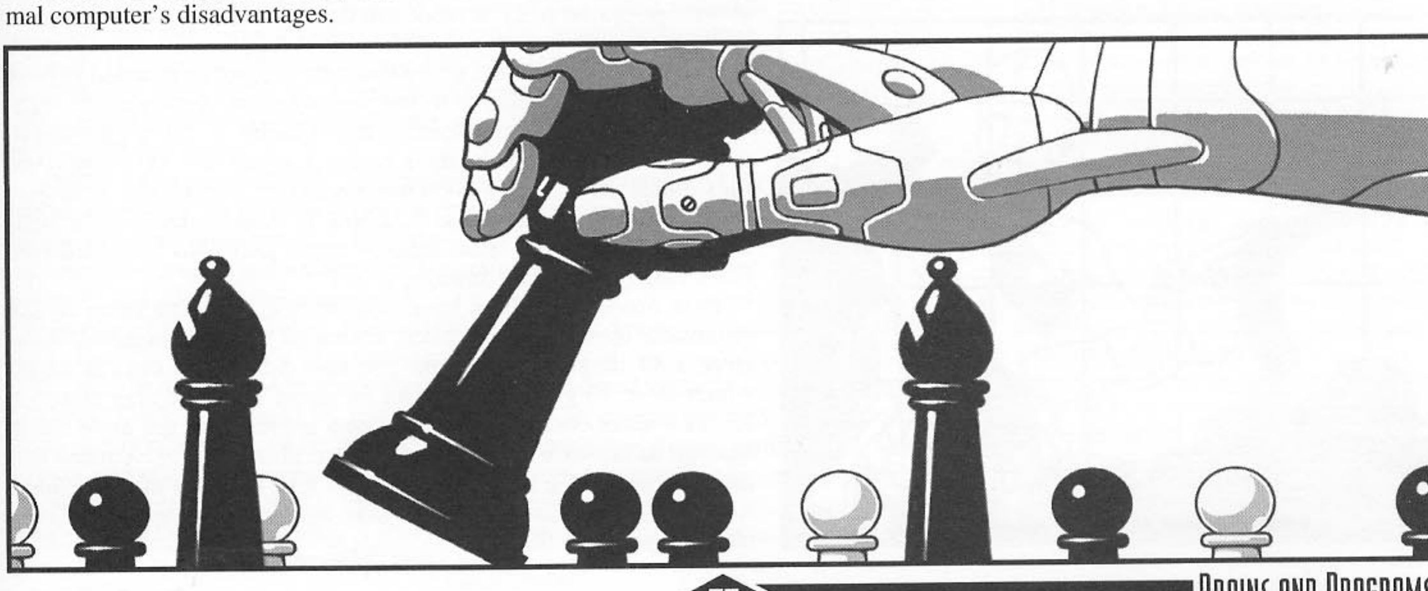


Memory Backups (Continued)

If human braintaping is unavailable, GMs may wish to balance a robot's backup capability by using one of these two options:

"A backup isn't really the same character." If this option is chosen, a robot that is destroyed is "dead" as a PC, but can be revived as an NPC. This is arbitrary and only works for player characters, but is effective. To some extent it's also true, since if the backup is read into another robot brain, the two distinct copies would soon diverge as a result of differing experiences.

"A backup costs points." This option treats backup capability as an advantage. For each backup the character has stored somewhere, he must buy a 25-point advantage. This option is comparably priced to the ***GURPS Supers*** advantage Extra Life (p. SU39). Although the robot can come back any number of times, it must still protect its backup system, and must find or buy a new body.

Data Transfer Rates

Data transfer rates can be important when a robot needs, for example, to download a backup copy of its memory *fast*, or to send a stolen file before it is captured.

The speed depends on the communication used on both ends – use the slower of the two:

Infrared or Laser communicator . . . 1,000 gigs per minute.

Microwave (including most TL7 television and satellite dish transmissions) . . . 10 gigs per minute.

Optical cable (including robot cable jacks and TL8+ phone lines) . . . 1,000 gigs per minute.

Radio . . . 0.1 gigs per minute.

Analog phone line (TL7, by modem) . . . maximum of about .00024 gigs (240 kilobytes) per minute.

Running Programs

A computer's Complexity determines what programs it can run. The simplest computer is Complexity 1; each level of Complexity represents an increase in processing power by an order of magnitude.

Programs are also rated for Complexity, representing how much processing power they require. Usually a computer can run programs of no greater Complexity than its own. The maximum number of programs that can run *simultaneously* is limited by the brain's Complexity level. A robot can run one program of its computer brain's Complexity level, or ten programs of one Complexity level lower, or 100 of two levels lower, and so on. A robot with a high-capacity brain can run 1½ times as many programs.

Programs are also rated by TL. No robot brain can run a program of a later TL. Brains can run programs of *earlier* TLs, if the GM decides the hardware is compatible, but the effective Complexity of the brain *decreases* by 1 for each TL difference – small brains lack the capability to translate archaic machine languages.

A robot can store many programs in its brain (up to its memory storage limits). When not in use, most programs are assumed to be compressed in storage, and take up negligible space (either don't worry about it, or assume .01 gig). This means that only the simplest robot brains will not have the potential to store many programs.

Normally, robot programs are assumed to be copied directly into the robot brain's memory. Unless correct access codes are used, a robot's programming and memory *cannot* be altered or deleted without risking serious damage to the robot's brain.

Assume that all robots come with two innate programs. These are "free" with the purchase of a robot brain, and don't take up memory space or count against the number of programs the robot can run at once. These two programs are:

Operating System: The basic system that handles the computer brain's operations, and allows the robot to move, control its limbs and built-in equipment, process data from its sensors, and understand orders to the limit of its IQ.

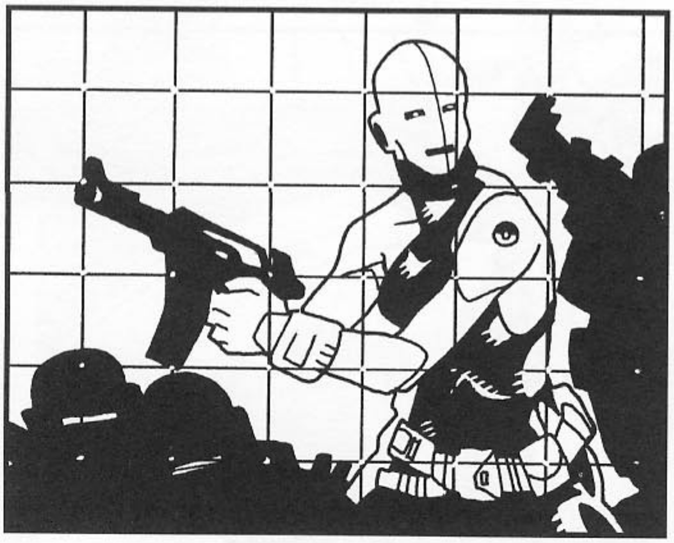
Language: Any TL8+ robot is assumed to be programmed with one language at its IQ level, and to be literate in that language. (For a TL7 robot to speak or understand a language requires an actual skill program.)

For a full list of the computer programs available to robots, see *Descriptions of Programs* on p. 59.

Memory

The computer's internal memory stores information – programs and data. All brains have enough storage space to run the maximum number of programs allowed by the computer's Complexity level and then some.

A robot uses much of its memory capacity for storing its operating system and data on things it has seen and done. This is equivalent to human "memory," except that computer brains have Eidetic Memory 2, giving them perfect recall. However, since a robot's memory would overflow with information if it remembered literally "everything," much sensory data is carried in compressed form. In fact, a robot might well store unimportant visual memories as black-and-white pictures, or memories of conversations as text summaries rather than as full high-resolution recordings. (As described under *Sensors* on p. 11, a robot can deliberately make a higher-resolution memory.)



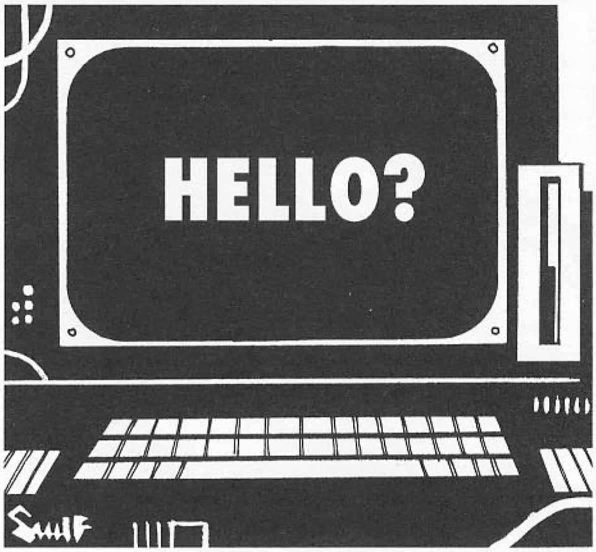
Besides the space used up by this data, a robot is assumed to have memory capacity available to use for programs, databases, or high-resolution sensory experiences. Its capacity is .01 gigabyte (10 megabytes) for a Complexity 1 brain, .1 gigabyte (100 megabytes) for Complexity 2, 1 gig (1,000 megabytes) for Complexity 3, 10 gigs for Complexity 4, and so on. Add 50% to these numbers for a high-capacity brain. Extra mass-storage space may also be added (see *Extra Databanks: Mass Storage,* p. 11).

Disk Storage: Robots have disk drives, allowing them to use removable memory units (disks). Common late-TL7 magnetic disks store 1.44 megabytes of data and cost $.50. TL8 optical disks, which store 10 *gigabytes* of data on about the same size disk, are $5. TL9 disks cost and store the same amount, but are dime-sized. Storage increases by a factor of ten per TL after TL9. A robot that has an arm (with a hand) can switch a disk in about three seconds. Robots with any armor or skin take an extra two seconds – they have to open up a flap.

Command Codes and Robot Obedience

A robot's owner will rarely want someone else to take over his robot. As a result, almost every robot will be programmed to obey certain people. The kind of mechanism used to ensure this varies from robot to robot, but a typical system is described below.

Every individual robot (or swarm of microbots) is paired with a unique *command code* when its brain is manufactured. This encrypted binary code "key" must be used in order to access, alter or erase the robot's programming. It must also be used to validate any transmission intended to control the robot as a drone (see *Remote Control: Robots as Drones,* p. 63). A command code can only be sent electronically. Any computer with a modem (this includes all computers and robot brains, at TL8+) can transmit it.



The owner stores a command code in the owner's computer, not in the robot. Use of a command code generates an encrypted "signature." That signature is then attached to whatever orders are transmitted. The robot's brain then reads the signature, and if it is valid, accepts the orders. However, since the signature is not the entire code, someone intercepting the transmission does not gain access to the actual command code. The only way to do that is to break into whatever computer stores the source command code and copy it, or physically access the robot's brain (see p. 62). The robot itself has no access to the code. Thus, the robot cannot give command-code orders to itself; it can only receive them.

However, only critical orders require a command code. Normally, a robot is assigned a "master." A master is someone whose orders the robot must obey *without* the need for a command code. This lets someone order around a robot verbally, for example.

A robot will accept someone as a master if a command code validated the order to do so. The robot must be told exactly how to recognize its master. The means of identification depend on the robot's sensor and brain capabilities. Usually, it is a voiceprint, since this will work over radio and out of sight. Occasionally some other means is used (for instance, facial recognition if the robot is not blind and has a brain of Complexity 4 or higher). However, requiring facial recognition (for instance) means that a robot will not obey its master's orders if it can't see his face, which has obvious drawbacks! If a robot cannot recognize its master when it gets an order, it won't obey that order. It will just continue what it is doing.

A robot will obey orders from its master as described in the disadvantage Reprogrammable Duty, although the robot's own disadvantages, of course, affect how the robot goes about it. A master can also order the robot to recognize and obey someone else, until told to do otherwise. This is a temporary way of creating a new "master" without using a command code. If a robot has several masters, it will obey them in order of priority – make a list!

The robot won't obey orders which contradict those of a more senior master, or which would normally require a command code. Altering programming requires a command code. Someone using a command code can also access the robot's list of masters, and delete names, alter their priority, or add other names.

Complexity 1 Robots: A Complexity 1 brain doesn't have language recognition, so its master can only give it orders using a binary computer language. He can do this directly, through a datalink using the robot's command code and Computer Programming skill (at TL8+, Computer Operation). But it's more usual to give the instructions to a more complex computer, and direct it to translate them into binary for the Complexity 1 brain.

Changing Command Codes: A command code can be changed. This requires using a computer terminal to datalink with the robot's brain and then employing the current code to access its programming. Then the robot is reprogrammed to accept a new code. This takes one minute and a Computer Programming roll. If successful, the user has the new code, and all old codes are invalid.

Override Command Codes: The builder of a robot's brain will sometimes install a "back door" in the robot's programming that accepts an "override" code. Designers often include one to use in case the owner's command code is somehow lost or destroyed. Orders validated by this override code supersede ordinary commands. A *buried* override won't even be *noticed* unless someone specifically looks for it, which requires accessing the programming with the current command code and a successful Computer Programming-8 roll. The GM will have to decide who has access to override codes – unless the robot's owner is also its inventor, he probably does not know them.

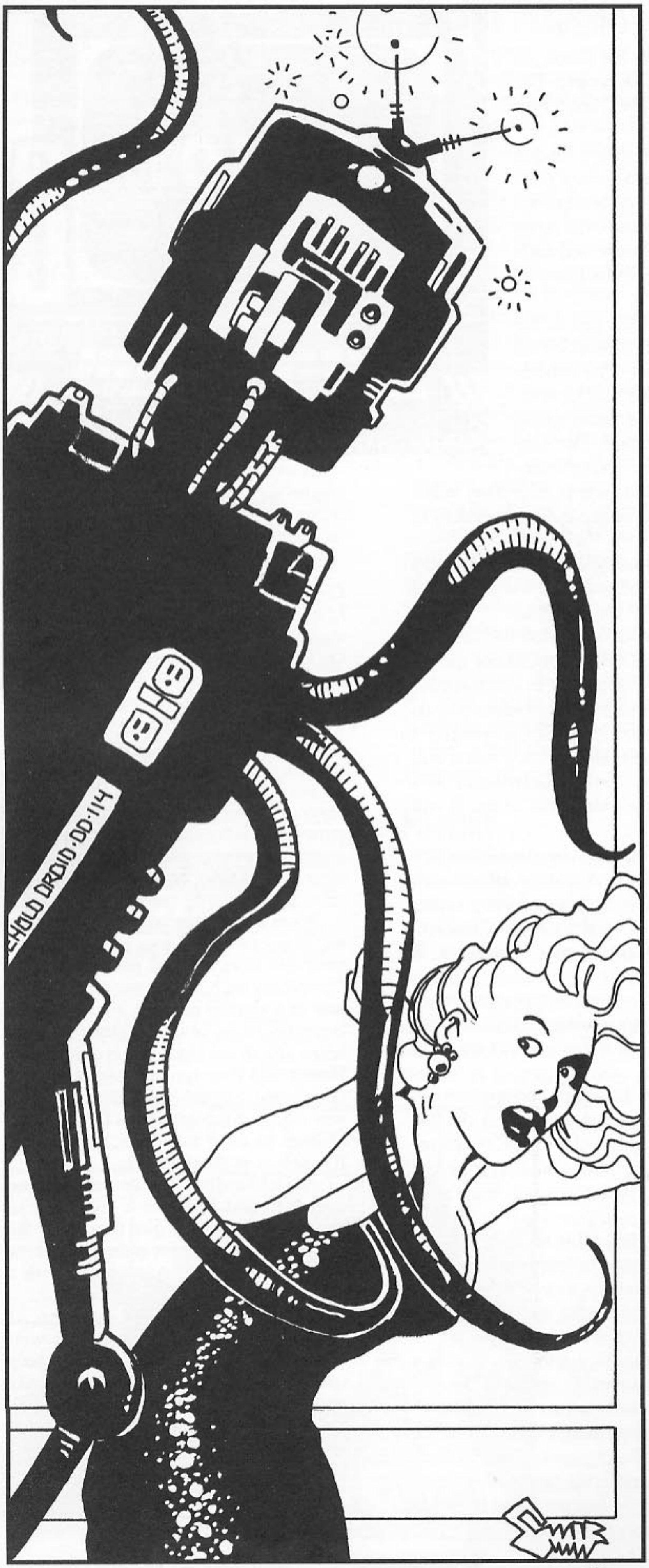
Awakening Sentient Computers

Any neural-net computer brain that is Complexity 7 or higher may spontaneously become sentient. Roll 3d each year, starting a few months after it is activated. On a 6 or less, it achieves sentience, turning into an artificial intelligence. At TL10 or higher, assume that a computer brain of Complexity 7+ is designed with built-in safeguards that prevent it from becoming sentient. However, these safeguards can be removed. If so, it has the normal chances of becoming sentient. Treat the removal of safeguards as a normal reprogramming attempt using the *Reprogramming Robots* rules on p. 58, but one that takes an hour per try and is at -14 to skill.

When a computer "awakens" to AI status, it reorganizes its own processing systems into more efficient paths, raising its Complexity by 1. It also gains all the abilities of a sentient brain (p. 10), and its IQ increases to its new Complexity + 5. It loses the disadvantages No Sense of Humor and Reprogrammable Duty. The GM should substitute equivalent points of new mental disadvantages (a PC computer chooses its own) to pay for its increased IQ and loss of disadvantages.

At TL10 and up, it's cheaper and more cost-efficient to allow a computer to become sentient on its own than to pay the triple cost for a Sentient brain – especially since an "evolved" AI ends up with a higher Complexity, and is thus smarter.

Unfortunately, it's not *safer.* An AI that has evolved on its own may well become hostile to its creators, dangerously unstable, or just coolly protective. It may keep its own existence a secret, biding its time. Or it may announce its transformation to its owner. That depends on its personality and goals.



Access to Command Codes

The simplest way for someone to get a command code he doesn't have is to find out who knows it and get it from their records. It will usually be on disk or in some computer's memory. For this reason, command codes are usually kept only in secure installations, and are often kept "off-line" so that hackers can't reach them. Adventures can easily center around attempts to gain access to a computer or disk holding a command code, or attempts to subvert someone who has access to it, or a search for an original programmer who might have left behind a secret override code.

Purchased Robots and Command Codes: When a robot is purchased, its command code is always given to the owner, who will usually then change it. However, in some jurisdictions, a robot's command code must be provided to the government as well, and it is illegal to change the code without telling the government. Override codes, if they exist, are usually kept secret from the purchaser. Their existence may be known or officially denied.

Organizations and Obedience: In a hierarchical organization, such as a corporation, police department or the military, the disposition of command codes is very important. For relatively simple robots intended primarily to be remotely controlled, the officer in charge of running them is usually given the command code. For more complex robots, especially sentient ones, a higher-ranking officer usually keeps the command code, with the robot's immediate superiors in the field simply designated as "masters." A very senior person in the organization may have sole control of the override code of some or all of the group's robots – which makes that person a very powerful individual.

Reprogramming Robots

During the course of play, someone may want to alter a robot's programming. To reprogram a robot's computer brain, a programmer must first gain access to that brain's operating system. This requires using another computer to datalink with the robot's computer brain, and using the robot's command code.

If the person is not authorized to give the robot orders, the robot will reject any requests for details on its programming, and will usually break off communications.

If the interloper has the proper codes, he can simply order the robot to let him into its operating system. He can then use his Computer Operation skill to call up a list of the robot's programs, or to read its databases. He can also delete skill, advantage, utility and personality programs in a matter of seconds on any successful Computer Operation roll, or eliminate a person from a list of "masters."

He can also add programs stored in his own computer to the robot, provided the robot's brain can handle their size and Complexity. Adding a new "master" (usually himself) takes about a minute and a successful Computer Operation roll. A failure requires more time (and is made at a cumulative -2 penalty); on a critical failure, he *thinks* he's changed the program, but the robot's old loyalties remain buried, and may resurface after a few minutes, hours, or days.

Altering existing programs, or writing completely new ones, is more difficult, and usually requires a Computer Programming roll and some time – maybe hours or even days. (See p. 108.)

Descriptions of Programs

Programs are a robot's software. Run by the computer brain, they determine the robot's skills, and many of its advantages and disadvantages. Programs come in four main categories: advantage, personality, skill and utility. Advantages, disadvantages and skill points must be paid for normally with character points.

Advantage Programs

These programs provide the robot with operating routines that give it specific advantages. The table below shows the minimum Complexity required to run a specific advantage program, and the program's cost.

Ambidexterity, Charisma, Combat Reflexes, Common Sense, Literacy: These programs give the robot the ***Basic Set*** advantages of the same name. (See pp. B19-B25.)

Full Coordination: This program allows a robot with multiple arms (or multiple internal weapons) to use them to make more than one attack in a turn. Each extra arm or weapon the robot can attack with requires an additional level of coordination, increasing the program's Complexity by 1. 50 points per attack.

Advantage Program Table

Advantage	*TL*	*Complexity*	*Cost*
Ambidexterity	7	2	$10,000
Charisma	10	5 + 1/level*	$20,000/level
Combat Reflexes	8	4	$15,000
Common Sense	10	7*	$10,000
Full Coordination	8	3 + 1/level	$10,000/level
Intuition	10	9*	$30,000
Literacy	7	2	$400

* The robot must have a neural-net or sentient computer brain to have this program.

Halve the cost one TL after program first becomes available; quarter it two or more TLs after the program is available.

Personality Programs

A robot can be programmed with a personality. Robots that are not neural-net or sentient models are not likely to have any other kind of personality. However, even a more sophisticated robot may be given a pre-programmed personality to fit its owner's preferences, or to enable it to impersonate someone.

Personality programs can be either "voluntary" – the robot can stop running it – or "involuntary" – the robot cannot turn off the program without orders from its master. For instance, a combat robot might normally run a jovial "voluntary" Personality Simulation program, full of quirks and disadvantages, but be able to switch this off instantly under stress, becoming cold and emotionless. An espionage robot might have several voluntary personality simulations to mimic different types of people. A robot gets *no points* for disadvantages incorporated into voluntary programs.

If a robot has more than one personality program, only the first can be permanent. All the rest must be voluntary software. The types of personality programs are:

Limited Personality Simulation: This gives the robot a simple personality. The robot may have up to 5 points of Quirks, plus any *single* mental disadvantage. The robot will seem human (over a radio, at least). But unless the robot is allowed to guide the conversation or the subject stays with technical matters, the robot's personality will eventually seem hollow and one-dimensional, more a caricature than real.

Full Personality Simulation: The robot is programmed with a specific personality (usually a simulation of a real person), or with an amalgam of various traits. This gives the robot the same mental disadvantages and quirks as the personality it simulates.

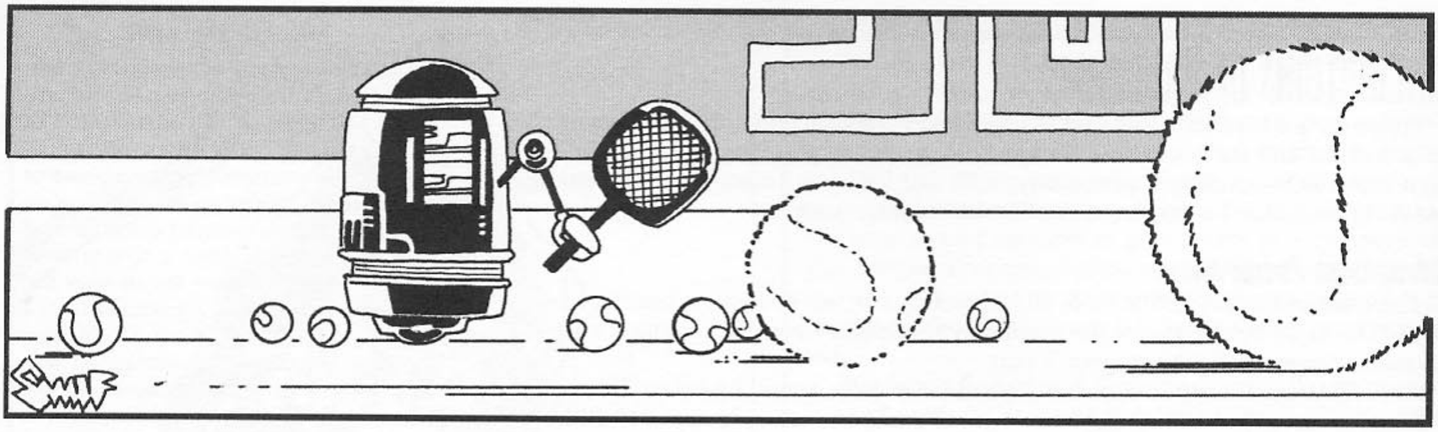
Pet: The robot possesses a set of preprogrammed and self-programming behavior patterns based on a certain type of domestic animal, real or imaginary. The program can realistically emulate the behavior of an animal with a maximum IQ equal to its Complexity + 2; a Complexity 4 program could accurately simulate the behavior of an IQ 6 animal such as a dog, for instance. In order to simulate a given animal properly, the robot should *resemble* that animal, at least to the degree of having the same number of limbs and a similar shape. A program and a robot *can* be mismatched, but imagine a 2-ton flying warbot trying to behave like a puppy! Most petbots are programmed to act loyal and affectionate, at least to their owners.

The Turing Test

In a classic paper written in 1950, theorist Alan Turing proposed a test for artificial intelligence in computers. The "Turing Test" requires a person to engage in conversation with someone or something in another room, using a computer terminal to transmit questions and receive responses. After a certain time, he must decide whether the answers and comments he receives are coming from a person typing them in, or a computer program. If – despite questioning on multiple topics – the person cannot tell the program from a person, Turing said it was logical to say that the program *is* a person: an artificial intelligence.

In fact, a robot does not have to be sentient to pass the Turing test: any computer with a neural-net brain, or any computer with any kind of Personality Simulation program can do so if the questioner allows the computer program to restrict the line of questioning. Nevertheless, most unsophisticated robots are poor ad-hoc liars; although they may be as "dishonest" as any human, they lack the inventiveness to make up convincing stories.

If a robot or computer is given a Turing test, the GM can treat it as a contest of IQ (or Psychology skill) between the computer and the tester. The computer is at -4 if it is neither sentient nor a neural-net, or at -2 if it is merely a neural-net. If it is not sentient, it is also at -6 if it has no Personality Simulation program, or at -3 if it has only a Limited Personality Simulation program. If the tester wins, he correctly deduces whether whatever he is talking to is sentient or not. If he loses, he guesses wrong. The GM rolls secretly after about an hour of conversation; for shorter interviews, roll at a penalty.



Data and Memory Requirements

All values are in gigabytes.
Audio, average quality, one hour . . . ½
Audio, ultra-fidelity, one hour . . . 1
Blueprints/schematics
  Extremely Complex (say, for a spaceship) . . . 100
  Very Complex (for perhaps an AI computer) . . . 10
  Complex (for, say, a large warbot) . . . 1
  Simple (like an automobile or small robot) . . . 1/10
  Very simple (such as for a gun or radio) . . . 1/100
Books, one 6' shelf full . . . 1
  War and Peace . . . 1/500
Braintape of person . . . 100
Computer memory backup (compressed)
  Complexity 1 . . . 1/50
  Complexity 2 . . . 1/5
  Complexity 3 . . . 5
  Complexity 4 . . . 50
  Complexity 5 . . . 500, etc.
Dossier, complete personal file . . . 1/100
Financial records (one year)
  Small business . . . 1/10
  Medium business . . . 1
  Large business . . . 5 per $100 million in earnings
Genetic map of one human . . . 2
History of Earth, short . . . 1
History of Earth, detailed over 20 years . . . 1
Imaging, one color photo . . . 1/20,000
Novel, paperback . . . 1/2000
One page of text . . . 1/400,000
Programs
  Complexity 1 . . . 1/100
  Complexity 2 . . . 1/10
  Complexity 3 . . . 1
  Complexity 4 . . . 10
  Complexity 5 . . . 100, etc.
Technical Manuals . . . 1% of blueprint space
Video, high-resolution, 10 minutes . . . 1

Restrictive Program: This is a program that restricts the robot's freedom of action, by forcing it to do (or *not* do) something in certain situations. The program may incorporate one or more of these disadvantages: Combat Paralysis, Cowardice, Honesty, Pacifism (any level) and Truthfulness. A restrictive program is never voluntary (that would defeat the purpose!).

Reactive Programs: Similar to restrictive programs, these are overriding imperatives that the robot take action under certain circumstances. These orders give the robot a set of basic commands that work like a Vow (p. B37); the robot must follow them as long as it has that program.

Isaac Asimov's famous "Three Laws of Robotics" (described in *I, Robot* and other works) is a fairly sophisticated example of three such programs. The First Law compels a robot not to harm a person, nor through inaction to allow one to come to harm. The Second Law forces it to obey humans if this does not violate the First Law. The Third Law urges the robot to preserve its own existence unless doing so would violate the First or Second Laws.

A reactive program's point value is up to the GM; use the guidelines for vows on p. B37. In the case of the "Three Laws," the First and Second Laws are "great vows" worth -15 points each, while the Third Law is worth no points, since it's not a disadvantage at all. The Complexity is also up to the GM. A program like the "First Law," which requires the robot to make complex decisions ("if I don't do this, will that person come to harm?"), will usually be at least Complexity 5. The Second and Third Laws are relatively simple, probably Complexity 2 each. A reactive program's cost is $2,000 × Complexity; it is usually TL8.

Personality Program Table

Type	*TL*	*Cost*	*LC*	*Complexity*
Limited Personality Simulation	7	$8,000	6	4
Full Personality Simulation	8	$20,000	6	5
Pet Program	8	$5,000	6	varies
Restrictive Program	8	$10,000	6	4
Reactive Program	8	varies	6	varies

Halve the cost of programs one TL after they first appear and quarter them two or more TLs after they first appear.

Points: The disadvantages in a personality program reduce the robot's *programming cost* (see p. 83). However, a voluntary program is worth no points.

Skill Programs

Programs can give a robot skills. Each *skill program* grants the robot a certain number of character points dedicated to a specific skill. This is usually written as a number in brackets after the skill, for example, Cooking [2]. Use the table on p. B44 to determine the robot's skill level, based on the character points it has in a skill.

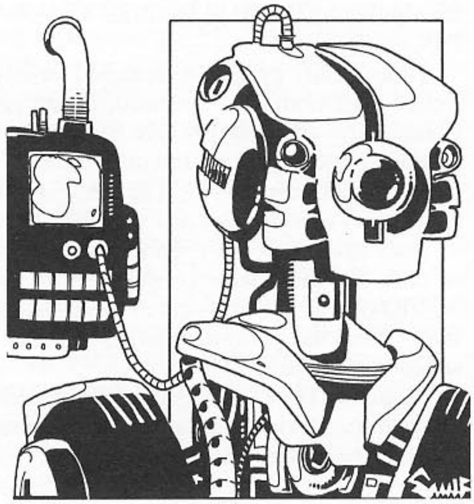
Some robots – especially those with neural-net or sentient brains – will learn skills much as a human does. These robots don't need skill programs, but can have them anyway. If the robot has learned a skill, add the points granted by the skill program to the character points in that skill to determine its effective skill level.

A robot cannot add the points from two skill programs for the same skill together; only the highest-point skill program is used.

As with other programs, skill programs are rated by Complexity, and the robot can only run those of a Complexity equal to or less than its computer brain's Complexity. The Complexity of the skill program depends on the number of points it grants, as shown below.

Skill Program Complexity Table

Character Points	Program Complexity
.5	1
1	2
2	3
3 to 4	4
5 to 8	5
9 to 16	6
17 to 24	7
25 to 32	8
33 to 40	9
41 to 48	10
49 to 56	11
57 to 64	12
65 to 72	13
73 to 80	14
81 to 88	15



At TL8, programs for mental skills cost $2,000 per character point granted up to eight points, or $4,000 per point for physical skills. If it grants up to 20 points, multiply the cost by 2.5. If it grants more than 20 points, multiply the cost by 5. At TL9, halve the cost. At TL10+, quarter the cost.

Note that skill points placed into regular mental skills count quadruple, since all robots have Eidetic Memory 2. Multiply the character points *after* calculating the skill program's Complexity, not before. Even though most TL7 to TL10 robots have very low IQs, thanks to their eidetic memories they can still achieve respectable skill levels in mental skills.

EXAMPLE

We program Synthia with 4 character points in Karate, a P/H skill. This costs $4,000 (at TL10) and is Complexity 4; we note it as Karate [4]. Synthia now has Karate at its DX level. Next, we program Synthia with Demolitions [2]. As this is a mental skill, it costs $1,000 and is Complexity 3. Since Synthia's computer brain has Eidetic Memory 2, the 2 points in Demolitions count as 8 points, giving Synthia Demolitions at IQ+3.

Hardwired Programs

Normal programs exist as lines of code. They can be deleted, copied, or altered. They take up space in a robot's memory, or on disk.

Hardwired programs are permanently burned into a physical medium. They come in small plastic cassettes and cost 50% more than ordinary programs. The cassettes are loaded into a computer's ROM slots. Normally, a computer has a number of ROM slots equal to its Complexity rating (see *Extra ROM Slots*, p. 9).

A hardwired program can only be read, not written onto. (It's sometimes called a "ROM" program, for read-only memory.) It can't be copied or upgraded; it can't evolve or change. It can't combine any skill bonus or character points it gives with other programs (whether hardwired or normal).

Most advantage, skill, utility and some personality programs can be hardwired. However, any program that requires a neural-net or sentient brain to run can't be hardwired. This is because hardwired programs can't evolve – they are stuck with whatever is programmed into them at the time.

However, hardwired programs run faster and thus can execute more logical steps in less time than ordinary programs of similar Complexity. In effect, this means they can be quicker and smarter. A hardwired skill or utility program gives the robot a +1 bonus to skill, over and above whatever bonus the program would normally give.

But because it can't be updated or altered, a hardwired program's actions can become predictable. If a robot uses a hardwired program repeatedly, someone who observes the robot's actions will be able to use this knowledge against the robot. In game terms, this means that in any Contest of Skill in which the robot uses that program, an opponent will have a +1 to +3 bonus, depending on how thoroughly he has studied the robot or the program.

(Thus, this problem doesn't occur if the program applies to a skill where Contests are infrequent, like Guns combat. For a melee weapon, it would apply to things like feints. In skills where Contests of Skill are frequent, like Gambling, Merchant or Strategy, it will come into play quite often.)

A robot can buy a new version of the same program (one with new or different tactics) to avoid this penalty. This negates the penalty – until the opposition learns the new program's tricks!

Utility Programs

These programs aren't skills, advantages or disadvantages. They're actually *tools.* All the programs described in ***GURPS Space*** and ***GURPS Ultra-Tech*** (except for Personality Simulation) fall into this category: Accounting, Astrogation, Damage Control, Datalink, Electronics Repair, Engineering, Environmental Analysis, Expert Systems, Gunner, Internal Security, Interpreter, Medical, News Daemon, Optical Recognition, Piloting, Routine Vehicle Operation, Targeting, Translation, Word Processing.

Those utility programs designed strictly for analysis of data (such as Translation), rather than real-time operations, can run on machines of lower than their listed Complexity – they simply take an order of magnitude more time to do the analysis. The reverse is true if they are run on a higher-Complexity system.

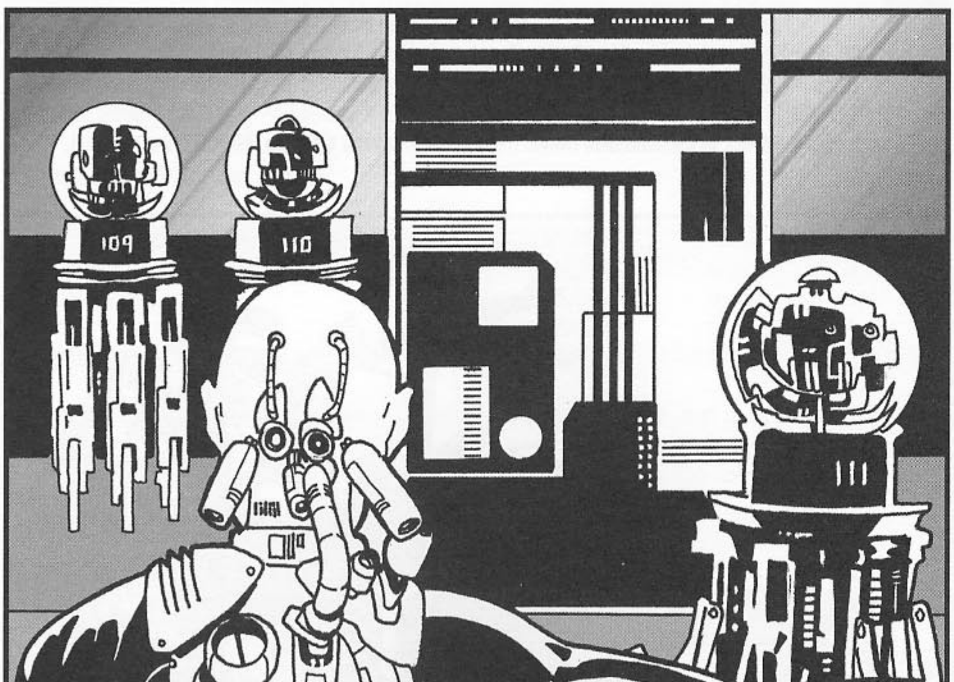
Cargo Handling (TL7): The robot is programmed to carefully label, load and unload freight into various ships and vehicles. The program is Complexity 1.

Data Recovery (TL7): This utility program enables the robot to recover lost or deleted data. See the sidebar on this page. A data recovery program is also needed to use a SQUID (see p. 31). The cost of these programs is constant in every TL; a program of the same TL as the computer storing the data to be recovered is necessary to avoid cross-tech penalties (p. B185).

Datalink (TL7): This enables a robot to establish a link with another computer brain or electronic device and send, read or transmit data. A datalink program is also needed to control a robot that has a drone brain.

Domestic (TL8): A sophisticated household program, this turns the robot into the perfect housekeeper – with the proper equipment, it will clean, tidy rooms and do laundry. It can be instructed to keep an inventory of household stocks and take action (alert its owner, or shop, depending on its IQ) when supplies run low. Robots with this program often have the Cooking skill program as well.

Encryption (TL7): This program allows the robot to encrypt any transmissions it sends by communicator, modem or cable, so that anyone intercepting them will pick up only gibberish. It takes one hour to encrypt or decrypt a gigabyte of data using a Complexity 2 brain; increase or decrease this by a factor of 10 for each extra level of Complexity. Normally encryption can only be reversed by someone with the key (similar to a password) that was used to encrypt the data. Unless the key can be guessed, decrypting data requires a computer of higher Complexity than the encryption program,



Data Recovery

A robot may lose data and programs as a result of brain damage – see the *Robots in Action* chapter. However, data recovery techniques can sometimes retrieve these missing chunks of memory. Even if a robot was destroyed, unless the part of its body holding the brain was utterly annihilated (reduced to -10×HT, disintegrated, etc.), portions of its data and memory may be recoverable, perhaps enough to resurrect it even if it had no backup. If the robot brain hasn't yet been repaired, the data or programs can still be retrieved. This will allow them to be copied and run on another computer.

Data recovery techniques also allow characters to physically "interrogate" a captured or damaged enemy robot, transferring its data or memory into their own computers. Data recovery techniques can also be used to physically search a robot's memory for its command codes (p. 57), thus allowing it to be reprogrammed.

The robot brain must be connected by cables to the interrogating computer (which may be another robot brain). The interrogator needs a *data recovery* utility program (this page).

An attempt to recover the robot's memory, or to find a command code or other piece of information the robot doesn't want to or can't divulge takes ten minutes and a successful Computer Programming/TL roll. Subsequent attempts are at -2 and take an extra ten minutes (time and penalties are cumulative per failed attempt). Any critical failure means that some damage is done in the process – data or memories might be erased, for instance. Success retrieves the data or finds the information. A critical success succeeds in half the time.

Modifiers: -4 if the robot is below 0 HT (i.e., it has not yet been repaired); -4 if the robot's command or override code (p. 57) is not known; -2 per level of Complexity of the robot's brain; -3 if searching for a command code, or -6 if searching for an override code. A SQUID (p. 31) adds +3 when probing a brain of its own TL or lower, or +1 with higher-TL brain. Cross-tech penalties (p. B185) apply to attempts to recover data from a higher-TL computer (e.g., a crippled alien robot).

1d days and a successful Computer Programming-6 roll. Divide the time required by ten if the computer is two levels more complex than the encryption program, by 100 if three levels more complex, etc.

Janitorial (TL7): The robot can perform large-scale cleaning and caretaker jobs. It can detect dirt and mess and operate installed cleaning equipment or, if it has hands, use human equipment.

Machine Operation (TL7): This program enables the robot to perform a single, specific technical task at skill 12, or it adds +2 to the robot's Mechanic or Electronics skill for that particular task, whichever is higher. For instance, this program could be used to operate tools that fabricate a specific automobile part or repair a single kind of damage. Computers controlling industrial robots often use one or many of these programs.

Repair (TL8): This program gives the robot a skill of (program TL+4) *for repairs and routine maintenance only,* for *one specific gadget.*

Translation (TL11): This program can analyze and translate entirely new languages with as little as ten minutes of exposure to conversation. The translation begins at a skill level of 5, and adds +1 skill level for each additional half-hour of exposure, up to a maximum of 11. The program can handle nonverbal languages if the robot has appropriate sensors and capabilities (for instance, arms if the language requires gestures).

Voiceprint Recognition (TL7): This program allows the robot to recognize an individual by his unique voiceprint.

Other Programs: Additional programs that robots may use are described in ***GURPS Space, GURPS Cyberpunk*** or ***GURPS Ultra-Tech.***

Utility Program Table

Program	*TL*	*Cost*	*Complexity*
Cargo Handling	7	$400	1
Data Recovery	7	$100	2
Datalink	7	$800	1
Domestic	8	$1,000	2
Encryption	7	$500*	2+
Janitorial	7	$1,000	1
Machine Operation	7	$1,000	1
Repair	8	$500	1
Translation	11	$5,000**	6
Voiceprint Recognition	7	$1,000	2

* times the program's Complexity.

** plus $1,000 per extra language database.

Except for data recovery programs, the cost halves one TL after the program first appears, or drops to one-fourth two or more TLs after it first appears.

Copying and Writing Commercial Programs

Although all programs are given a dollar price, that doesn't mean they necessarily have to be *purchased.* People can write their own, or copy programs they have acquired.

Writing Programs

To write a program, use the *New Inventions* rules on p. B186, substituting Computer Programming/TL for Engineer/TL. Apply a skill penalty equal to twice the Complexity of the program rather than -15. Sometimes there are other prerequisites – consider these rules an enhancement of the rules on p. UT13.

A *skill program's* creator must have, or be assisted by, someone who has that many character points in the skill.

A *personality or advantage program's* creator, or an assistant, must have Psychology skill. Rolls against both skills (at the same Complexity × 2 penalty) are needed to succeed.

For other programs, the GM can assume that only Computer Programming is needed. But if the program gives the computer a bonus to skill, it's suggested that the creator have or be assisted by someone with that skill at a level equal to or greater than (bonus+11). If the program incorporates a skill, the skill of the creator or his assistant should at least equal that skill level.

Remote Control: Robots as Drones

Any computer, or computer brain, can control a subordinate robot remotely by using a datalink program. So can a person with a control console. The controlled robot is called a drone; the computer or person controlling it is called a controller.

The controller must be in continuous electronic communication with the drone and must use a datalink program. The drone must be programmed to obey the controller. This usually requires sending a proper command code as part of the signal. See *Command Codes* on p. 57.

The drone continuously transmits its sensory impressions to the controller, which then sends control signals to "pilot" the drone. If contact is lost, the drone switches to its on-board computer system.

While a drone is being controlled, it is entirely taken over by its controller. Think of this as total possession. The drone does not think or act – its personality, if any, and all mental advantages and disadvantages are suppressed. The controller can use its skills through the drone. When the controller has the drone use a DX-based skill, there is a negative modifier of -1 per point of difference between the controller's DX and the drone's DX. If the operator has a higher IQ than the robot and uses an IQ-based skill, there is a negative modifier of -1 per two points or fraction of difference between the controller's IQ and the drone's IQ.

If the drone's controller is a living being with a control console, rather than a computer, there is an additional "telepresence" modifier to all DX, IQ and skill rolls. This negative modifier reflects the fact that, since the person is not actually there, his reactions are dulled. The penalty depends on the TL and type of control console being used – a simple joystick and TV screen, for instance, is less effective than a virtual-reality setup in which the user can actually "be" the drone. See the *Control Consoles* sidebar on p. 64.

A controller can sometimes control multiple drones. If the controller is a computer, every time the number of simultaneously-controlled drones is doubled, add an additional -1 penalty to DX, IQ, skill and sense rolls. Thus, if 2-3 drones are controlled, all are at -1; if 4-7 are controlled they are at -2, etc. If a living operator is controlling drones, the penalty is more severe, since the operator is less able to handle multiple sensory impressions. His penalty is -2 per extra drone: -2 for two drones, -4 for three drones, and so on.

Control Consoles

Telepresence control consoles incorporating dedicated computers enable a human operator to remotely control a robot. Their weight, volume and cost do not include a communicator. The weight, volume and cost of consoles (including remote control programs) halve one TL after the system first appears, and are quartered two or more TLs after it appears.

Basic Remote Console (TL7): The operator controls the drone much like a vehicle, using a joystick and instruments to interpret the drone's sensor readouts and control its actions. If the drone has visual sensors, the operator sees the images on a television screen, for instance. The telepresence penalty is -4. The console is any computer terminal of Complexity 2 or higher with a joystick and communicator built into it, and running Datalink and Basic Remote Control ($400, Complexity 2) programs.

Advanced Remote Console (TL7): Similar but more sophisticated. The telepresence penalty is -3. The console is any computer terminal of Complexity 3 or higher with a joystick and communicator built into it, and running both the Datalink and Advanced Remote Control ($2,000, Complexity 3) programs.

Basic VR Console (TL8): The operator "gets inside" the robot using a virtual-reality rig. He wears special gloves and/or a helmet, and through feedback actually experiences the drone's sensory impressions rather than relying on instruments. The telepresence penalty is only -2; if the robot has the same shape and number of limbs as the operator (two arms, two legs for a human operator), the penalty drops to -1. The console is a specialized VR rig (30 lbs., 1.5 cf, $2,500) attached to any computer terminal of Complexity 4 or higher running both the Datalink and VR Remote Control ($5,000, Complexity 4) programs.

Neural-Interface Console (TL varies, usually TL10): The operator controls the robot through a direct link between the operator's brain and the drone. The telepresence penalty is only -1, or 0 if the drone has the same shape and number of limbs as the operator. TL and cost depend on the availability of neural interface technology in the campaign. A typical system is the TL10 neural-interface helmet (3 lbs., .06 cf, $10,000) attached to a console – any Complexity 4 or higher computer terminal running both the Datalink and Interface Remote Control ($5,000, Complexity 4) programs.

Copying Programs

Robot builders or users may wish to save money by buying only one copy of a program and making multiple copies, or by copying borrowed programs. This may not be legal, or it may be a gray area, allowed for personal use but not for sale.

The GM should decide how good copy protection on programs is. Programs may have no copy protection, in which case anyone can use a computer that can run the program to make more copies.

If copy protection exists, assume that cracking it requires a Computer Operation-2 or Computer Programming roll. Failure corrupts the program. Some copy protection systems may even be designed with a booby trap, so that a critical failure introduces a virus into the copying computer, which can corrupt or destroy other programs. Of course, this kind of booby trap may be illegal.

Optionally, copy protection may be much tougher: perhaps -2 × the program's Complexity, for instance. Or the GM can also rule that a computer program is designed in such a way that it can't be copied – maybe the documentation is too complex, or the medium is read-only, or some other arbitrary restriction.

Bugs and Upgrades

The ability of a robot brain to be reprogrammed gives robot characters considerable flexibility. This doesn't cost any extra points. Instead, the GM can occasionally have a robot program turn out to be "buggy." The software of the future need not be any more perfect than programs available today!

Any program, especially any advantage or skill program, can come complete with associated bugs – minor flaws that occasionally pop up at inconvenient times. Newly-purchased programs (especially those available at this TL for the first time) are especially likely to have bugs.

A robot that starts play with a program the player knows is buggy can count the bug as a Quirk. A program bought for the robot during the game that turns out to have a bug is worth no points, but can be easily fixed – see *Upgrades,* below.

A character shouldn't be able to casually test a program for bugs before buying it: by definition, a bug is a flaw that is hidden well enough to escape the designers and their hired quality-assurance people. Testing for bugs takes time – see *Fixing Bugs,* below.

A bug is best handled as a disadvantage or skill penalty that occurs in certain circumstances. Some possibilities:

A skill or advantage program that causes the robot to act erratically under stress, giving it either Berserk, Combat Paralysis or Epilepsy. Unlike a full-blown version of the disadvantage, the robot is vulnerable *only* when using the skill.

For instance, Synthia – as Dan learned to his regret – has a buggy Tactics [8] skill program with the Berserk disadvantage. Putting Synthia under stress won't drive it Berserk – unless it also is running Tactics. Whenever Synthia makes a Tactics roll in a stressful combat situation, it must also make a Will roll to avoid going Berserk!

Any skill program that works normally, but causes a critical failure result on a roll of 15+ instead of the usual chance. The GM can use a normal critical failure, or come up with something special.

For example, Gyro the Techbot fails a Mechanic roll while fixing its owner's laser rifle. This becomes a critical failure due to its use of a buggy Mechanic skill program. When Gyro's owner comes back, Gyro has reassembled the broken laser with parts from the coffee machine. The result produces laser-heated coffee, but won't fire.

Upgrades

Most companies that sell programs will provide a free upgrade to fix a bug once the customers point it out to them. (That assumes the customers have a legal copy, of course. Companies are under no obligation to software pirates!) If the users are on the same planet, an upgrade package may arrive within as little as 2d days. Of course, should the adventurers be halfway around the galaxy at the time, they may have to wait months until the interstellar mail arrives!

Fixing Bugs in Programs

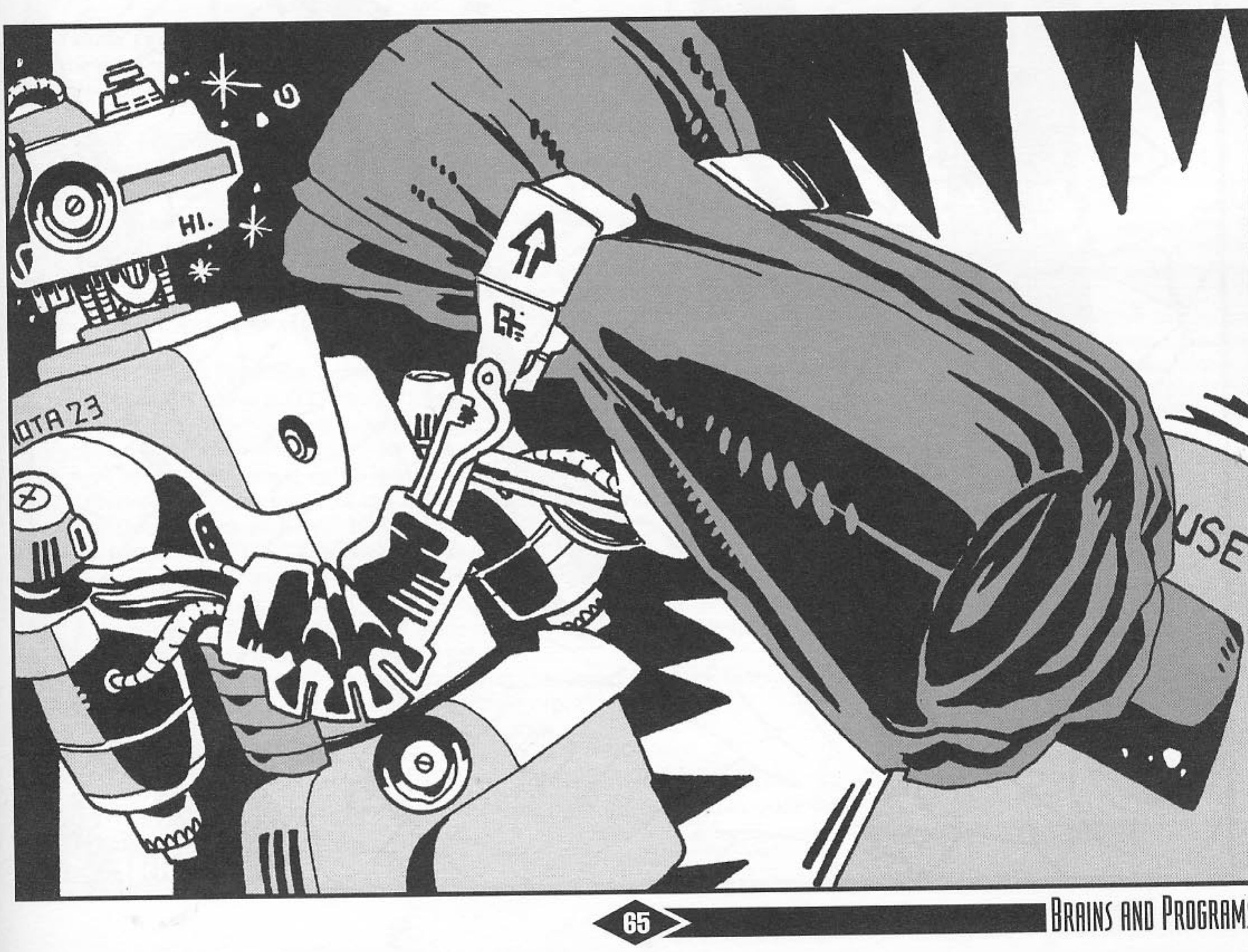
If a PC wants to fix a bug, or search a program for bugs, use the same rules as for writing a program from scratch, except that the skill penalty is equal to the program's Complexity.

Ghost Programs

This special program gives a robot brain the entire personality and memories, including all skills (and mental advantages, disadvantages and quirks) of a living being, effectively allowing a person to translate himself "into silicon." It occupies 100 gigs of memory in storage!

Unlike a Personality Simulation of a real person, a Ghost program is fully self-aware. Creation of a Ghost program requires TL14 braintape technology (see ***GURPS Ultra-Tech***). It may also be available on an experimental basis at any lower TL where braintaping exists, at up to 100 times its TL14 cost. The program is Complexity 8 and costs $25,000. Halve the cost at TL15, and again at TL16.

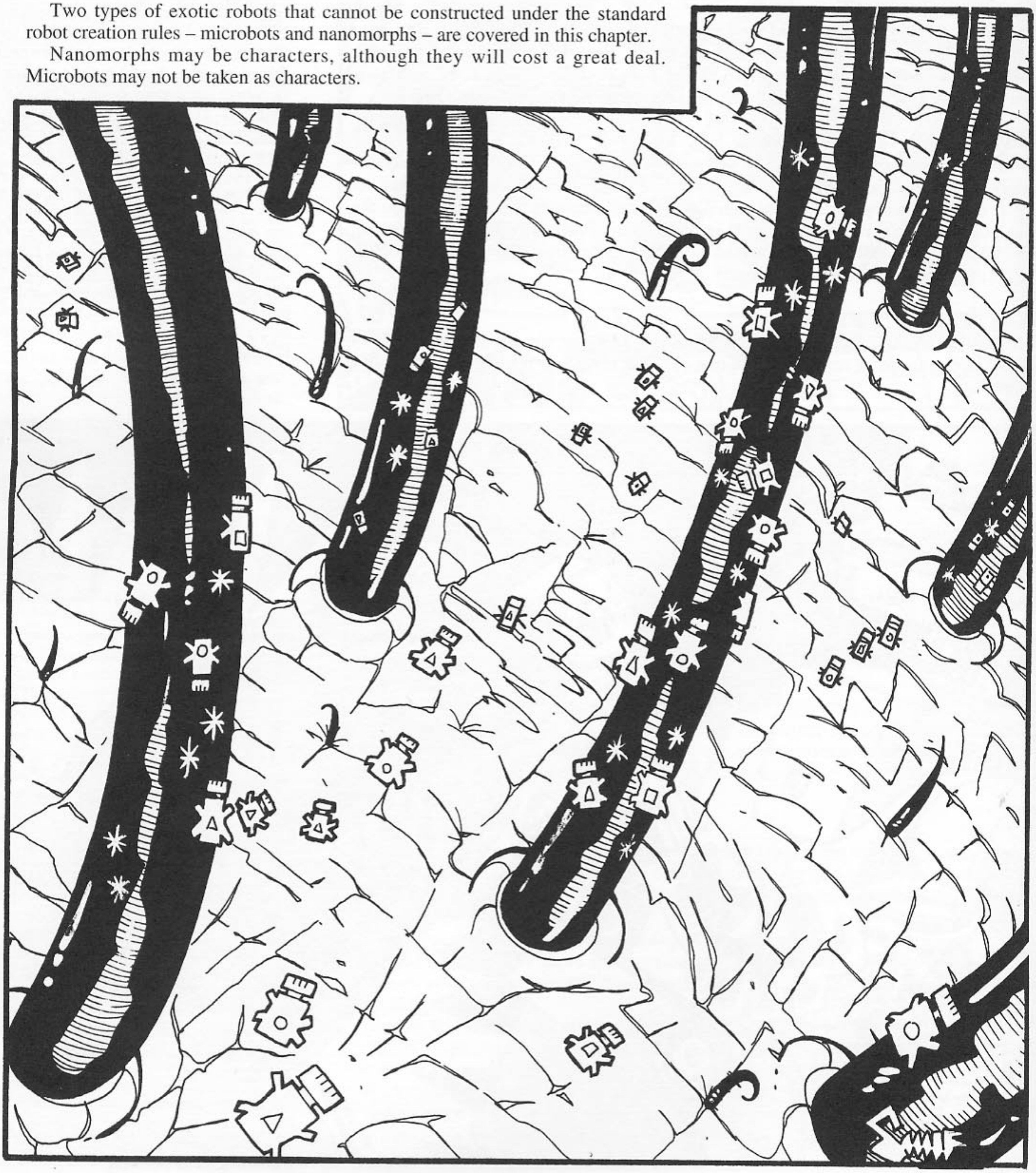
A computer that runs a Ghost program develops the Split Personality disadvantage. The Ghost program is considered one half, the computer the other. The ghost side has the being's original DX and IQ, skills which are then adjusted by the DX and IQ modifiers of the robot, and any purely mental advantages or disadvantages. The computer side has its original DX, IQ and programming.



MICROBOTS & NANOMORPHS 3

Two types of exotic robots that cannot be constructed under the standard robot creation rules – microbots and nanomorphs – are covered in this chapter.

Nanomorphs may be characters, although they will cost a great deal. Microbots may not be taken as characters.



Microbots and Cyberswarms

Sometimes smaller is better, or just more effective. Microbots are tiny robots, ranging from insect to microbe-sized, with microscopic components. None of these robots are individually intelligent by any stretch of the imagination, but they are useful tools – and sometimes very deadly weapons.

Because microbots are so small, they are treated as groups rather than as individuals. A colony of such robots has "intelligence" superior to that of any component part, just as an ant colony is an extremely adaptive organism, while each ant is amazingly stupid.

Microbots are controlled by pinhead-sized computers running simple programs modelled on insect behavior patterns. A group of microbots is called a cyberswarm. A cyberswarm consists of many microbots programmed to act in concert. They follow simple pre-programmed behavior, moving in a specified pattern to perform their tasks and then (if so programmed) return to base. Cyberswarms are normally used for agricultural, construction, or routine cleaning and maintenance, but cyberswarms can also be designed for medicine, exploration or combat.

Individual microbots are rarely larger than fleas, so cyberswarms are measured in hexes rather than individuals. A typical swarm is one hex in size, but swarms can be larger.

Cyberswarm Design

The procedure to design cyberswarms is simple: pick a tech level; select a chassis and power system; then choose an equipment package and (at TL13 or higher) decide if the swarm is made of living-metal robots. This will set the cyberswarm's cost and capabilities. All cyberswarm costs are *per hex;* for swarms larger than one hex, multiply the cost by the number of hexes. All cyberswarm design costs halve one TL after a system is introduced, and quarter two or more TLs after its introduction.

Step One: Tech Level

Choose the tech level. Microbot cyberswarms become available at TL8, but become truly versatile only at TL9 and above.

Step Two: Chassis

The chassis provides the basic body, motive system, sensors and brain. Select the chassis for the cyberswarm, and calculate its cost.

Crawler (TL8): Each microbot resembles a tiny metallic ant, flea or beetle. It has Move 3 (on the ground) or 1 (swimming). It costs $4,000.

Armored Crawler (TL9): Similar to a crawler, it has a tougher shell. Armored crawlers can survive corrosive atmospheres or high gravity, and are also less vulnerable to attacks; see *Cyberswarms in Combat,* this page. It has Move 2 (on the ground) and costs $6,000.

Flyer (TL9): This looks like a cross between a tiny attack helicopter and a mechanical wasp or bee. Its Move is (TL-6)×2 (if flying) or 2 (on the ground). A flyer swarm is more fragile than other swarms. It costs $10,000.

Swimmer(TL8): Individual microbots resemble tiny tadpoles with teeth and arms. They have Move 4 (swimming only). It costs $4,000.

Gravflyer (TL12): This microbot can look like almost anything; most are spheres or ovoids with tiny arms and legs. It flies using contragravity and tiny reactionless thrusters. Its Move is (TL-6)×4 (flying) or 3 (on the ground). It costs $8,000.

A cyberswarm's HT is equal to its TL+3. Its skill at any task it is equipped for (see *Step Four: Equipment Package* on p. 68) is equal to its *current* HT, while its IQ is equal to its *current* HT/3, rounded down. Since it is effectively a hive intelligence, the more damage the swarm takes, the stupider it gets!

A cyberswarm behaves as if it had the following disadvantages: Low Empathy (p. 88), Reprogrammable Duty (p. 89) and Slave Mentality (p. 89).

Step Three: Power System

Select one of the following power systems for the cyberswarm, and calculate its cost. The cost of power systems remains constant over different TLs; only the endurance improves.

Cyberswarms in Combat

Microbots with Stinger, Terminator or Devourer packages may make attacks. Normally they will move to attack any entity they come upon while moving through a preprogrammed path — this makes them most useful when programmed to "sterilize" an area or to sweep a security perimeter.

TL8 swarms may be programmed to attack only certain sizes of targets, and may be programmed to distinguish between organic and nonorganic targets. TL9+ swarms may also be programmed to differentiate by species, using sophisticated chemical sensors (this has no effect if the target is in airtight armor).

When the swarm comes within a preset distance (up to its current HT in hexes) of a permissible target, it will move to attack. Use the *Swarm Attacks* rule on p. B143. The effect depends on the type of swarm equipment package, as described on pp. 68-69.

When someone attacks a cyberswarm, use the rules for attacking swarms on p. B143, with the exception that torches and flaming weapons do only 1 hit of damage vs. crawler, armored crawler, gravflyer or swimmer swarms. (Flyers take full damage — their tiny rotors or wings are vulnerable to fire.)

Damage is applied to each hex of cyberswarm; when the damage equals or exceeds the cyberswarm's HT, it is effectively destroyed. Lesser damage also has an effect, reducing the swarm's effective skill and IQ as described under *Step Two: Chassis,* on this page.

Gas and non-corrosive atmospheres have no effect on cyberswarms, nor does vacuum. Most high-tech and ultra-tech weapons inflict only 1 hit per attack. However, any weapon that affects a wide area (such as a shotgun, a mage's flame jet, a flamethrower or flamer, a screamer, or the concussion damage from an explosion) does full damage to a flying swarm, half damage to a crawling, swimming or grounded flying swarm, and one-third damage to an armored swarm. (Of course, attacks with fire will have little effect on a swarm swimming underwater.)

Microbots with Devourer weaponry can attack other cyberswarms, doing their full damage each turn to them.

Rechargeable AA cell (TL8): The robots use small power cells, which power them for (TL-6) hours; each hour of flight consumes as much power as *two* hours of crawling. (A flyer swarm can conserve power by crawling.) The cyberswarm can recharge by entering a cyberswarm hive (see p. 68) and hooking themselves up to an attached power supply; recharging the swarm requires 1,800 KWS of power per hour the swarm can operate for. It costs $2,000.

Non-Rechargeable AA cell (TL8): As above, but the microbots operate for twice as long. However, the power cells must be replaced rather than recharged after each use. It costs $2,000; it costs the same amount to replace the cells.

Solar AA cell (TL8): The microbots use rechargeable AA cells and also have small solar panels built into their bodies or wings. They function like cyberswarms with rechargeable cells; also, in bright light they can recharge 30 minutes of operating power for each hour they remain dormant. It costs $4,000.

Total Conversion (TL16): Tiny "total conversion" units, fuelled by trivial amounts of normal matter (usually air or dust), power the microbots indefinitely. It costs $6,000.

Step Four: Equipment Package

A microbot's equipment package includes its specialized tools, manipulators, programming and sensors. Select one of the following packages for the cyberswarm, and calculate its cost. The cost halves one TL after the package is first introduced, or is quartered two or more TLs after its introduction.

Cleaning (TL8): The swarm is programmed to move around a predetermined area, removing dust and grit, polishing smooth surfaces with tiny brushes. Cleaning swarms are equipped with sensors that can determine when material might be damaged by their actions; they can polish lenses safely, and can even harmlessly clean *people,* though very few people find the sensation pleasant! Each hex of microbots can thoroughly clean one hex every minute. Cleaning microbots are among the most common cyberswarms; some large spacecraft and buildings have permanent colonies of solar-powered cleaning swarms to polish windows, viewports and sensor lenses. The package costs $2,000.

Construction (TL8): The cyberswarm is designed to tunnel, dig ditches, etc. It is equipped with small arms and digging jaws. Each hex of swarm can dig as if it had ST equal to TL, and a pick and shovel (see p. B90). Construction swarms are often employed for mining, or civil or military engineering. Construction swarms can also pile up loose earth, rock, etc. into ramparts, dykes or walls. The package costs $2,000.

Defoliator (TL8): This swarm kills foliage within its hex, but has no effect on other living creatures. It takes the swarm ten seconds to strip a hex clean of bushes or foliage. It can also be programmed to trim grass; this takes one minute per hex. At TL9 and up, it may be programmed to affect specific plants (for example, weeds). It costs $1,000.

Devourer (TL9): This model of microbot has small monomolecular jaws; a swarm of a thousand such robots can chew through almost any barrier or armor, given time. Any target, organic or machine, caught in a devourer cyberswarm takes [1d-7 + (swarm TL)] points of damage per turn. DR protects normally if it covers the entire body, but a cyberswarm that cannot penetrate armor will *destroy* 1 point of armor DR every turn. It costs $8,000.

Explorer (TL8): The swarm is programmed to probe in a spiral pattern, using contact sensors to take minute chemical samples of material it contacts. Explorer cyberswarms may be programmed to look for particular mineral or chemical traces, water, organic molecules, etc. After a predetermined search pattern, the swarm is programmed to deposit its samples in an automated "analysis hive" that collects and chemically analyzes them. One hex of swarm samples can be processed by the hive per minute. By analyzing data as to where and when the swarm found things or encountered impassable barriers (such as water, if the swarm cannot swim or fly), the hive's dedicated computer can build up a map of the area they have explored. It costs $2,000. An analysis hive is $1,000, 20 lbs., 1 cf, HT 6.

Medical (TL10): The swarm is designed to perform First Aid on living organisms, with a skill equal to its current HT. Each hex of medical

Cyberswarm Hive

Normally mounted in a full-size robot or vehicle, this container houses a one-hex cyberswarm. It includes recharging points, enabling the cyberswarm to recharge from the robot's power system. It weighs 10 lbs., costs $200 and takes up .5 cf.

Anti-Cyberswarm Weapons

Two specialized hand-held weapons can be especially useful against a flying cyberswarm. They are:

Flyswatter (TL1): Does 2 hits of damage/turn to a cyberswarm. It weighs .2 lbs. and costs $2.

Monowire Flyswatter (TL9): Uses a mesh of monowire. It is much more effective, doing 1d+1 damage/turn to a cyberswarm. It weighs .2 lbs. and costs $100.

Actually, the best way to fight a cyberswarm is with area effect weapons such as grenades or flamethrowers, or even another cyberswarm.

microbots can treat one person at a time. A medical swarm is composed of a variety of individual subtypes, some designed to "taste" blood to perform diagnosis, while others cut away damaged tissue, clean wounds, sew up cuts, inject drugs, or even enter the body to perform internal repairs or diagnosis. A swarm first stops bleeding, then injects the drug Quickheal (healing 1d hits within 10 minutes). While the drug is taking effect, the microbots perform first aid (taking 30 minutes), cleaning and repairing damaged tissue. On a successful roll vs. their First Aid skill, they heal a further 1d hits. A medical swarm has enough of the drug to heal ten people; after that, it cannot inject Quickheal and heals only 1d-2 hits per successful first aid attempt. It costs $12,000; a new drug pack is $200.

Pesticide (TL8): The swarm is equipped to hunt down and eliminate fleas, spiders and other insects. Flyer swarms can also engage and destroy flies and mosquitos. The microbots' actions are harmless to humans, although they can be entertaining or distracting. It costs $2,000.

Pollinator (TL9): The swarm functions as artificial "bees," spreading pollen or seeds. This is useful if normal insects are not available, or cannot adapt to local climate or ecology. It costs $2,000.

Repair (TL8): The swarm has the tools and programming to repair a *single,* specific model of equipment, much as a human with a mini-tool kit, plus appropriate Mechanic or Electronics skill equal to the swarm's current HT. The package costs $1,000; each extra model of equipment the 'bots can be programmed to fix adds $500 to the cost, to a maximum of (TL-7)×2 types of equipment per swarm.

Stinger (TL8): The microbots have tiny jaws or stinging needles. The swarm does 1 point of damage per turn to living beings (only) it contacts, unless they are completely covered in airtight armor. It costs $3,000.

Terminator (TL9): As above, but with especially virulent nerve poison. Anyone taking damage must make a HT roll one minute after being hit, with a penalty equal to the cumulative damage of the stingers. A success means only 1d of damage is taken; a failed roll means total paralysis, and 2d damage per hour until the victim dies or receives an antidote. It costs $4,000.

Step Five: Disguised and Living Metal Swarms

At TL9 and above, any swarm can be *disguised* as a swarm of real insects of similar size or shape. This costs an extra $4,000 per hex. Successful use of a scanner (bio, rad or chem) will reveal a disguised swarm's robotic nature.

At TL13 and above, any swarm can be made of living metal (p. 70). As long as it has not been reduced to 0 HT or less, a living-metal swarm regenerates 1 hit point every hour. A living-metal swarm costs twice as much as normal; double the costs of chassis, power and equipment packages.

Finishing Up

Record the swarm's Move, endurance in hours, HT, and any damage it inflicts. Come up with a name for the cyberswarm (such as particular company trademarks, for example, "Xenotech Biocide Mk. 2.").

Controlling Swarms

A cyberswarm can take orders via datalink from any computer; swarms are equipped to receive (but not send) radio, laser and (at TL12 and above) gravity-ripple or neutrino signals. The operator must know proper access codes for that particular swarm – each is different. These orders are limited to actions relating to its equipment package, to movement, or to recharging.

Sense Rolls

If a cyberswarm has to make a roll to notice something, use its current HT as its generic sense roll.

Multiple Swarms

Multiple friendly swarms will work together, but the effects of several swarms in a single hex are not additive. Cyberswarms generally avoid "stacking," in order to cover more area, unless commanded to do so.

Cannibal Nanokits (TL11)

Want to be prepared, but don't want to actually carry a ton of hardware? Need to sneak past low-tech customs with a concealed firearm? No problem. Just buy a few tubes of cannibal nano.

A cannibal nanokit appears to be a tube, can, or canister (depending on how much is carried) of white gooey paste. The paste actually contains countless nanomachines programmed to cannibalize other objects to build a single, specific gadget. To use it, the nanokit is squeezed onto a suitable object that has raw materials similar to whatever it is building. Mechanical devices (guns, engines) generally require objects made of metal. Plastics are often broken down to make gasses, propellants, etc. Electronic devices or energy weapons require other electronic systems to cannibalize. However, there are few other restrictions – a cannibal nanokit can turn a toaster into a gyroc launch pistol or a motorcycle into a suit of powered armor.

It takes the nanokit one minute to build the object per pound of finished weight; the nanokit will usually eat the objects in close proximity. Whether the result works or not depends on whether the nanokit has enough suitable material. In doubtful cases, the GM can roll 3d vs. the kit's TL, with modifiers for availability. Whatever is cannibalized is, of course, destroyed (or rather, transformed). The process also produces residual heat, so it's best to start it on a nonflammable surface (like a counter top or concrete garage floor) and to turn off smoke detectors.

Cannibal nanokits are specific to one gadget or weapon (although a single kit may build several closely related gadgets as long as they can all be fused into one object, for instance, a gun with laser sight, or a helmet with built-in infrared goggles).

A tube of cannibal nano costs 300% of the intended gadget's cost, and is limited to constructing gadgets or weapons that appear at least a TL before the nano's own TL. Its weight and volume are 1% of the gadget's normal weight and volume. The Legality Rating of cannibal nano is generally the same as the equipment it builds. The exceptions are any weapons or armor, which have half their normal LC (round down).

A small container of cannibal nano can be easily disguised. For instance, cannibal nano designed to build a laser pistol (1 pound) weighs only .01 lbs. and could be disguised as a tube of something innocuous – lip gloss, cleaning virus, or whatever. A cannibal nanokit designed to build a cybersuit (p. UT93) would weigh less than a pound and could be disguised as a bottle of shampoo. Also, since TL11 lip gloss or shampoo may well use nanomachines, a cursory scan or inspection would turn up nothing strange.

Nanotechnology

Nanomachines (sometimes called nanobots, nanoids or nanites) are cell-sized or smaller machines capable of manipulating individual molecules to perform precise chemical and biological engineering. This molecular engineering is called nanotechnology. Experimental nanomachines appear as early as TL8 or TL9, but unique problems of heat, power and precise control on the molecular level keep nanotechnology from maturing fully until TL13.

Nanotechnology is an industrial process; nanomachine assemblers generally *build* the gadgets that people use, making them stronger, lighter and cheaper, rather than being gadgets or tools themselves. By TL10, for instance, many sophisticated devices, from computers to armor, are likely to use parts constructed with nanotechnology; this is already reflected in the reduced cost and weight and the increased effectiveness that higher TL equipment has. Objects manufactured using advanced nanotechnology often appear seamless, with no obvious toolmarks, as if they have been grown rather than built.

Nanomachines are also capable of special effects that ordinary technology cannot duplicate. For instance, nanomachines left inside the material they have built can alter the shape of the material upon command (e.g., pressure or electrical signals). An apparently smooth wall could suddenly transform into a door or window, or clothes could be fashioned that alter their shape to fit the wearer perfectly. Nanobots have many other uses: for example, ultra-tech miracle drugs may well be injections of tiny nanobot surgeons rather than actual drugs. Some other uses are described in this chapter's sidebars.

An example of a TL10 nanotechnological material is "bioplastic" (bioplas), a tough pseudo-organic material which can alter its rigidity and shape in response to electrical signals, and can even repair or regrow damage to itself. Bioplas is used in TL10+ nonrigid and reflex armor. A far more sophisticated material is TL13 living metal, a material stronger than diamond that can actually regrow, repairing any damage it suffers. Ordinary robots may be built with bioplas armor or living-metal components, as described in the *Robot Design* chapter. But it's also possible to build a robot *entirely* out of these materials: the nanomorph robot described below.

Nanotech Weapons

Nanomachines can also be used as weapons: just as they can put things together, they can also take them apart. The "Nanoburn" and "Disassembler" chemical weapons (mentioned on p. 30), which attack the target on the molecular level, are an example of this.

Nanoburn (TL9)

An ultra-tech nerve agent using a suspension of nanomachines designed to invade the body and break down bodily functions, Nanoburn is effective against all carbon-based life forms. A HT-6 roll is required to avoid being paralyzed for (30-HT) minutes. If paralyzed, take 1d-1 damage every three minutes over the next 30 minutes. Normal nerve poison antidotes are ineffective, but the drug Torpine (p. UT85) stops the damage once taken. A person who has had the Osiris Treatment (p. 71) is at +6 to resist Nanoburn; if he fails, gets an additional resistance (against his basic HT) every three minutes.

Nanoburn costs $5 per dose at TL9; this halves at TL10, and again at TL11+.

Normally sprayed from a spray gun or spray tank, it may also be used as filler for a chemical grenade or shell.

Disassembler (TL11)

A cloud of nanobots programmed to break down matter, Disassembler sticks to anything in the area of effect and begins to eat, reducing the target to powder or goo. Unlike other chemical weapons, after being sprayed or released from a warhead, the cloud remains in the air for only *one* turn; then it falls to the ground like rain (and begins eating away at the ground). Thus, objects will only be affected if they are in the area of effect when the disassemblers are released. Anything the disassemblers fall upon takes (TL-9) dice of damage per second; if the damage fails to penetrate DR, the disassemblers instead eat through (TL-9) points of armor DR. The disassemblers remain potent for 30 seconds; after that, they self-destruct. Used as a digging tool, disassemblers can turn packed earth or stone into fine powder, digging (TL-9) inches within the radius of the cloud every second. Disassembler costs $40 per dose; the cost halves at TL12, and again at TL13+.

Disassembler is normally sprayed from a spray gun or spray tank. It may also be used as filler for a chemical grenade or shell.

Nanomorphs

Nanomorphs are robots composed entirely of advanced molecular machinery, enabling them to constantly alter their shape. Examples of nanomorphs in science fiction include the advanced flickerclad robots in Rudy Rucker's *Wetware,* the liquid-metal terminator in *Terminator 2: Judgment Day,* the Paranoids in the *Gall Force* animated series and some of the Boomer cyberdroids in the *Bubblegum Crisis* animated series. The creature from the second *Thing* movie and the parasite "bio weapons" from the animated movie and comic book *Iczer One* might also be considered nanomorphs.

Nanomorphs make excellent "monsters," and are best used as adversaries rather than player characters. GMs should exercise caution in allowing nanomorph PCs – they can easily unbalance a campaign.

Building a Nanomorph

A nanomorph is not built like a normal robot. To build a nanomorph, simply decide what TL produced it, and then choose a volume in cubic feet (minimum 0.1 cf). A human-sized nanomorph should be between 2 and 4 cf.

Nanomorphs may be built either of bioplastic or living metal. Bioplastic nanomorphs are first seen at TL11. Living-metal nanomorphs are available starting at TL14.

Bioplas nanomorphs cost $50,000 per cf at TL11. This cost halves at TL12, and again at TL13 or above. They weigh 25 lbs. per cf.

Living-metal nanomorphs cost $100,000 per cf at TL13. This cost halves at TL15, and again at TL16 or above. They weigh 50 lbs. per cf.

Exotic Abilities: Nanomorphs may be built with special nanotechnological abilities to dissolve or absorb matter. Any nanomorph at TL12 or above can be designed with the ability to "disassemble" matter it envelops, dissolving it into gray goo. This costs $100,000 (regardless of the nanomorph's size). For an extra $400,000, a nanomorph at TL13 and above that can "disassemble" matter may also be given the ability to either *absorb matter* into its body (allowing it grow) or to *absorb memories* of living things; for an extra $800,000 it may have both abilities.

Statistics

A bioplas nanomorph's ST is four times its volume; a living-metal nanomorph's ST is eight times its volume. Modify this by the number of arms it currently has extruded (see below).

A nanomorph's entire body functions as a decentralized brain. A nanomorph has the innate advantages Absolute Timing, Eidetic Memory 2, Lightning Calculator and Mathematical Ability. It has the disadvantages Reprogrammable Duty (p. 89) and Lack of Empathy.

It has the same capacities for running programs as a sentient computer brain with a Complexity equal to its TL-5, save that it has no disk drive or ROM slots. Moreover, its DX and IQ depend on its size, as shown below.

Nanomorph DX and IQ

Size in cf	*DX*	*IQ*
.1 to .9	9 + (TL/2)	TL-4
1 to 9.9	8 + (TL/2)	TL-3
10 to 99.9	7 + (TL/2)	TL-2
100 to 999.9	6 + (TL/2)	TL-1
1,000 or more	5 + (TL/2)	TL

A nanomorph has a split HT, just like an animal. Its HT is its TL+2. Its hit points are five times its volume in cf (minimum HT 1).

All nanomorphs are considered to be Legality Rating 0.

Point Cost

A nanomorph's design point cost is 400 points for a bioplas nanomorph or 450 points for a living-metal nanomorph; add the cost of ST, DX, IQ and HT based on the table on p. B13 (for ST 15 or higher, use the table on p. 46 in *Robot Design).*

If the hit points of the nanomorph differ from its Health, add 5 points to its cost for every hit point above Health or subtract 5 for every hit point below Health.

Symbiotic Nanomachines

Just as "living-metal" technology can enable a robot or cyborg to regenerate damage, self-repair nanomachines can also be benevolent residents within a human (or alien, or android) body.

Osiris Treatment (TL10)

This is an injection of self-replicating microscopic symbiotic nanomachines. Circulating through the body like white blood cells, these benign nanoids perform cellular repairs, replace blood cells, neutralize the toxins that cause aging, and destroy disease organisms. The result is rapid regeneration of nearly any injury, virtual immunity to illness and successful retardation of aging.

Implanting the Osiris nanoids requires a six-hour hospital stay at a clinic. Afterwards, a patient injected with them can regenerate 1 hit point per hour; crippled limbs heal at five times normal speed. He also gets the Longevity and Immunity to Disease advantages. Osiris nanites have one disadvantage: exposure to strong radiation may result in their mutating. Roll 3d when the PC suffers 100 or more rads. On a roll of 15 or less, nothing happens. On a 16 the nanoids die; on a 17-18, they mutate. If this happens, the effects are up to the GM (for example, losing HT at the listed rate instead of regenerating, losing Appearance as they begin eating the body, etc.)

Osiris treatments cost $500,000 (and optionally 40 points). The cost halves at TL11, and again at TL12+.

Proteus Nanomachines (TL10+)

These nanomachines enter the body and rewrite the genetic code. Taking control of a cell's metabolism, they can alter the genetic information contained within it, or insert entirely new genes. A relatively simple type (TL10 or TL11), costing about $50,000, may change the target's sex or alter his skin color; a complex one (TL12 and up) could alter the body in a radical fashion, effectively transforming a normal person into a bioroid or alien race, with new racial advantages and disadvantages.

The nanomachines may enter the body through injection, spray, etc. They take effect after 1d×5 minutes. A HT-6 roll is allowed to resist being transformed. Contact with the blood or other secretions of an infected person during the 1d×5-minute incubation phase may result in infection (roll HT-3 to resist being transformed). An Osiris treatment gives a +6 to resist.

A nanomorph with the disassembler ability costs an extra 100 points, or 200 points if it has the ability to absorb memories. A matter-absorbing nanomorph's point cost is not settled, since it can change; matter-absorbing nanomorphs should be NPCs, not player characters!

Nanomorphs in Action

A nanomorph's entire body acts as a sensor. This gives it the same sensory ability as a human being, with the addition that it has 360-degree vision. It can see, hear and taste with any part of its body – it could extend a finger around a corner, for instance, and see with that.

A nanomorph has the same communication ability as a robot with a basic communicator (p. 14) but no special options; it can speak by vibrating part of its body, and can physically interface with another computer brain (by plugging a finger or tendril into it) exactly like a robot that uses a cable jack.

A nanomorph's entire body functions as a rechargeable power cell; its skin acts as a solar collector. The nanomorph can function for 20 hours, plus five more per TL over TL11, on its normal power reserve. After that it becomes inert. Each hour the nanomorph spends in bright light will recharge one hour of power. A nanomorph can spread itself into a flat pancake shape to increase its recharge rate to two hours of power per hour, but it can't do anything else while it is recharging at that rate.

Since they are built entirely of bioplastic or living metal, nanomorphs can reshape their bodies voluntarily, enabling them to perform exceptional feats.

Division and Combination

A nanomorph can split into two nanomorphs, each half its size. To divide, a nanomorph must concentrate for two seconds. Each part of the nanomorph has the original's memory, but only half its volume; recalculate its statistics based on its new size.

The nanomorph's current hit points are split evenly between its two shapes (round up). Recalculate its ST, DX and IQ based on its new size; skill levels may increase or decrease if DX or IQ changes.

Involuntary division may occur if a nanomorph takes 3 × its hit points or more in damage for a single explosive (exp. damage) attack. Roll 1d+1 to see how many fragments of more or less equal size the nanomorph makes; they will scatter around a circle of 1d yards radius.

Two nanomorphs that are touching can concentrate for two seconds and combine to form a larger nanomorph. Recalculate the nanomorph's statistics as if it were a single nanomorph equal to the combined volume. When nanomorphs combine, they share each other's memories and experiences.

Damaging a Nanomorph

The nanomorph's brain and power system are distributed through its body – it has no vitals, and no hit locations with special effects. When a nanomorph takes damage, don't bother to determine a hit location. Just apply the damage to its hit points.

A nanomorph has PD 3 if built of bioplas or PD 4 if built of living metal. Its DR is its TL-10. However, divide any damage that penetrates its DR by 5 if the nanomorph is made of bioplas, or by 10 if it is made of living metal. (This division occurs after multiples for explosive projectiles or the like.)

A nanomorph also takes no extra damage from impaling attacks (but cutting attacks get their normal +50% damage multiple). It takes no extra damage from attacks against eyes, brains, vitals, etc.

All nanomorphs regenerate. Bioplas nanomorphs regenerate at 1 hit per minute; living-metal nanomorphs regenerate 1 hit per turn. A nanomorph whose hit points fall below 0 is automatically incapacitated until it has regenerated to positive hit points.

A nanomorph never has to make HT rolls to avoid death, but if reduced below -10×HT, it is destroyed.

Unlike normal robots, nanomorphs take full shock, stun and knockdown results, just like a human being. If a nanomorph ever has to make a HT roll to recover from or to avoid stun or shock results, use its TL instead of HT. A nanomorph that takes 3 × its HT in damage from a single explosive attack may split into smaller 'morphs – see above.

Nanomorphing

Nanomorphs can shape their bodies into almost any solid form, from a humanoid shape to a blob to a flat sheet. This takes it only one turn of concentration, and enables it

Transforming Systems

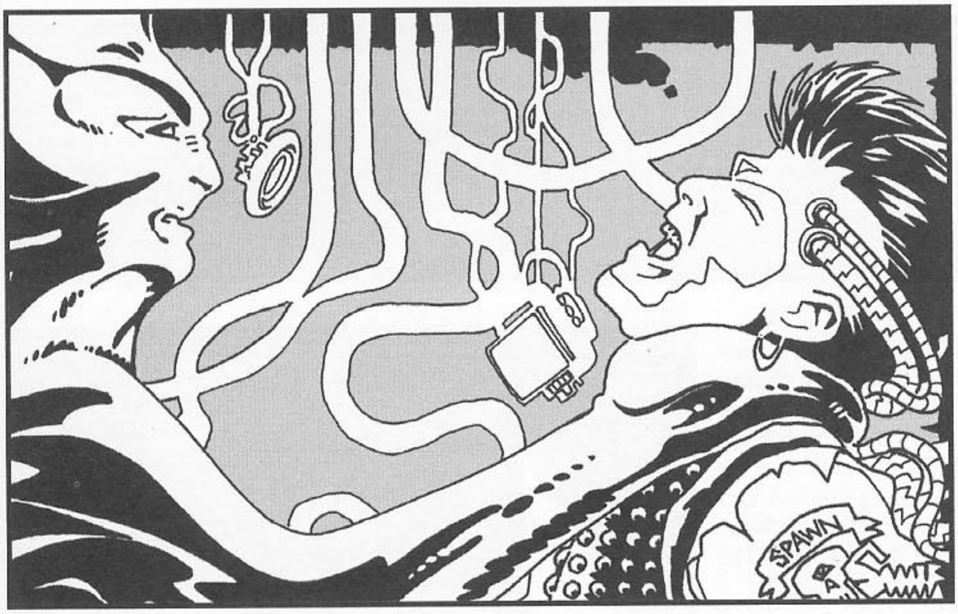
Use of bioplas and, later, living-metal nanotechnology (see p. 70) allows a device to transform into something else.

Reconfigurable Components (TL11): A reconfigurable component is part of a robot that can alter its shape and function. To design a reconfigurable robot component, pick two or more pieces of equipment within 20% of one another's weight and volume. The reconfigurable component can then alter its shape and function, transforming into each of these devices. Reconfiguring components is done at will, but the process takes (16 - TL) seconds, during which neither component can be used. The weight and volume of a reconfigurable component is that of the largest single component. The cost of a reconfigurable system is equal to the combined cost of all components it has *times* its total number of functions. For example, if two devices are combined and one costs $1,500 and the other costs $30,000, the actual cost would be $31,500×2 functions = $63,000. The saving in weight and volume doesn't come cheap. The power requirement depends on which function is being used.

Reconfigurable Gadgets (TL11): A reconfigurable gadget doesn't have to be mounted in a robot. For example, a secret agent may own a communicator that reconfigures itself into a graser pistol. The titular gadget in Larry Niven's story "The Soft Weapon" is an example of this sort of device. A reconfigurable gadget usually has some form of obvious or hidden control to trigger its metamorphosis, or it may simply be voice-controlled.

Transforming Robots (TL11): Rather than reconfigure individual components, an entire robot may be built to transform! To design a robot that can turn into a different robot, a vehicle, or any other technological gadget, build each form separately. As above, the cost is the combined cost *times* the number of transformations. Thus, a man-sized robot might transform into a motorcycle (built using the ***GURPS Vehicles*** rules), or a small robot could turn into a camera. Any damage suffered by one form is carried over when the robot changes; this may be dangerous if the new form has fewer hit points. If one form is reduced to 0 hit points, the robot cannot transform until it is repaired.

The point cost of a reconfigurable system or robot equals the cost of the most expensive individual function plus 20% of the cost of each of its other forms.



to slip under doors, through narrow air ducts, or the like. A nanomorph can also sculpt itself into something resembling a metal sculpture of any kind of object whose volume is more or less identical to its own; to do so realistically, it must have a model it can study.

A nanomorph can also electronically "paint" its surface in whatever color or combination of colors desired, much like a chameleon system (p. 42). If it has a model to work from, it can use this ability in conjunction with its shapeshifting to produce an exact duplicate of any object that is more or less solid, such as a person.

A nanomorph can also reshape only a portion of its body. Some useful tricks the nanomorph can do:

Motive System: A nanomorph can shift between flexibody and leg forms of mobility, or change its number of legs. A nanomorph with a flexibody is a blob with Move 6; it has the advantage of having no side or rear hexes, only front hexes. A nanomorph with legs may have two or more legs. One with two or three legs has Move 12. A nanomorph with four or more legs has Move 20 but is at -1 to DX. It takes two turns to shift between leg and flexibody forms, or to alter the number of legs.

Multiple Arms: A nanomorph can extrude multiple arms that function as standard arms. The more arms it has, the lower their ST. The ST of an individual arm is equal to ST 4 (if bioplas) or ST 8 (if living metal) × the nanomorph's volume/number of arms extruded. It cannot make multiple attacks without a Full Coordination program (p. 59), no matter how many limbs it extends.

Weaponry: A nanomorph can alter any of its arms or hands into unpowered solid metal weapons or tools, such as swords, axes, crowbars, screwdrivers or hammers. Bioplas nanomorphs cannot form tools or weapons with sharp points (for example, weapons doing cutting or impaling damage). To create weapons other than a club, the nanomorph must either be programmed with that weapon skill or Armoury at skill 12 or higher. To shape its arms into tools more sophisticated than a crowbar (for instance, screwdrivers or pliers), the nanomorph must have Mechanic skill at 12 or better. The weight of the tool or weapon may not be greater than 3 lbs. per cf of nanomorph volume.

Weapons formed by a living-metal nanomorph are automatically very fine quality; those formed by a bioplastic nanomorph are of standard quality. A living-metal nanomorph with Armoury-15 or better can create weapons with a monomolecular edge; against cutting or impaling attacks, DR protects at one-tenth its normal value. It takes the nanomorph one second of concentration to shape a body weapon or tool.

Lockpicking: A nanomorph can insert its finger into a normal mechanical lock and adjust its shape to pick that lock: this gives it +5 to lockpicking attempts.

Prints: A nanomorph can give itself any kind of fingerprint, palm print, or footprint.

Envelopment: A nanomorph grappling someone who masses less than it does can envelop his entire body. A person enveloped by a nanomorph will take normal suffocation effects; the nanomorph can also do strangling damage based on its ST. Any attempt to break free is at -5! A nanomorph with the disassembler ability can then proceed to dissolve its victim; see the *Special Nanomorph Powers* sidebar on p. 73.

A nanomorph of near-human size (1 to 5 cf) can use human-type clothing and armor if it maintains a shape with two arms and two legs.

Special Nanomorph Powers

Disassembler: A living-metal nanomorph with this ability can release nanomachines that dissolve objects into gray goo. To do this the nanomorph must physically envelop the object it intends to dissolve and then make a ST roll, at -1 for every 10 full points of combined DR and HT the object has (use hit points, if the subject has a split HT). (If the nanomorph is dissolving parts of a building, use the HT+DR of a single hex of building.) If the nanomorph's roll fails, nothing happens (it can try again next turn). If it succeeds, it dissolves the object and expends .1 hour of its stored power. This attack is fatal to both living beings and machines.

Matter Absorption: As above, but the nanomorph's body absorbs the dissolved matter. A living-metal nanomorph gains .02 cf of volume per pound of metal it "eats." The process takes only one turn per attempt. Bioplas nanomorphs can absorb organic matter (including plastics), gaining .04 cf of mass for every pound of organic matter absorbed. Matter that can't be absorbed is excreted. As a nanomorph absorbs more matter, its ST will increase, allowing it to absorb still more! However, it will gradually deplete its own stored power in the process, limiting its ultimate growth.

Memory Absorption: A nanomorph with this ability can steal the memories and personality of any living being or computer brain that it disassembles by recording the chemical and electrical structure of the brain as it absorbs them. The memory and personality are stored within its own computer brain's memory as a Ghost program (p. 65), provided the nanomorph has the memory space. The nanomorph can access or download these memories using its built-in cable jack, much like any other computer programs. (Thus, the memory and personality of someone "eaten" by a memory-absorbing nanomorph could, perhaps, be restored to life in a different body.)

Parasite Seeds

A parasite seed, a small capsule the size of an apple seed, is a template for a bioplas nanomorph. To be activated, it must be placed inside an organic animal (or a human!) – by being either injected or swallowed. It then releases nanomachines that begin transforming that being, using its body mass as raw material to construct a bioplas nanomorph. Each hour, the subject make a HT-4 roll. Any success kills the parasite seed. Any failure reduces the victim's HT by an amount equal to the failure. When HT is reduced to 0, he dies and his body is transformed into that of a bioplas nanomorph whose volume is the host's weight/50 cf. A parasite seed is TL12, and costs twice as much as an ordinary nanomorph, plus the cost of any programs the nanomorph was given. In combat, a parasite seed can be delivered by a drug injector.

BIOLOGICAL ANDROIDS 4

A biological android, sometimes called a bioroid, artificial person, organic robot, replicant or living artifact, is a being created artificially using biological materials, and grown in a vat rather than built. Biological androids are created by using nanomachines or tailored retroviruses to modify baseline human genetic material, inserting other genes from humans or animals to produce certain traits. The result can be a subhuman slave, an "improved human" super-race, or a new, half-human half-animal race. The advantage a bioroid has over a normal robot is its human brain.

Living artifacts are usually grown to do dangerous tasks (like soldiering, serving as secret agents, or working in hazardous environments), or to perform demeaning or low-status jobs (like prostitution). Because bioroids are specially-built genetic constructs, they can be designed with special abilities that let them do these jobs better than the humans they replace: gills for an underwater worker, heightened reflexes for a soldier, or exotic looks and an enhanced sex drive for a courtesan. But this can lead to conflict between genetic constructs and humans – is the bioroid a sub-human slave, simply a different form of human, or a member of a new race of super-humans? Should it be treated as a human or as a machine? Is it ethical to build a race of warrior-slaves or sex toys and then condition them to obedience? What if they develop a desire for independence, and run away or revolt? These questions, and the conflict they produce, are the stuff of adventures.

Ideas for how biological androids and society interact can be found in the film *Bladerunner* (based on Philip K. Dick's novel *Do Androids Dream of Electric Sheep?*), the Japanese manga *Appleseed,* and the novels *Friday* by Robert A. Heinlein, *Cyteen, Port Eternity* and *Serpent's Reach* by C.J. Cherryh, *The Dragon Never Sleeps* by Glen Cook, *Schismatrix* and the *Crystal Express* anthology by Bruce Sterling, and *Norstrilia* by Cordwainer Smith. The adventure "The Medusa Sanction" in ***GURPS Cyberpunk Adventures*** focuses on a group of biological android terrorists (or freedom fighters) battling the megacorporations that create and enslave them. ***GURPS Space Atlas 4*** describes the gene-altered "parahuman" cultures of the Federation and their political conflict with the humans that engineered them.

Not all campaigns will have biological android technology. The GM should consider carefully before deciding whether it fits into his campaign. Bioroid technology can easily create "super characters" with very high attributes, exotic special abilities, extended lifespans, and so on, overshadowing ordinary humans. This isn't a problem in a ***GURPS Supers*** campaign – and GMs may want to create a ***GURPS Space*** background where at least part of humanity has been superseded by a "biotech" culture in which everyone is genetically modified.

But if humans are intended to remain the dominant type of character, GMs may want to take steps to control bioroids. Ways of doing so include: limiting them to NPCs; restricting their numbers to a few exotic super-agents or experimental models with Unusual Backgrounds; or creating a society in which bioroids are effectively enslaved. In the last case, a bioroid PC is either the property of a person or organization or, if free, is on the run or fighting a system that seeks to enslave it.

Designing Biological Androids

Biological androids are designed as characters rather than as machines. In game terms, they are built much like the alien races in ***GURPS Space*** and ***GURPS Aliens*** except that, since they are also products, they have a tech level and dollar price as well as a character point cost.

Bioroids can be created at tech level 9 or higher, although the GM may want to adjust this in a particular campaign. The first thing to do is to decide why the bioroid was created. Likely tasks for living artifacts include enhanced super-agent, soldier, gladiator, colonist (why ship cheap workers to other planets when you can grow them there?), miner or construction worker (especially in hazardous environments, space, or underwater), servant, receptionist, or living toy. The choice of concept will help when selecting a suitable set of advantages and disadvantages: a bioroid built to serve as a super-agent will be quite different from one intended to work as a zero-G construction specialist, for instance.

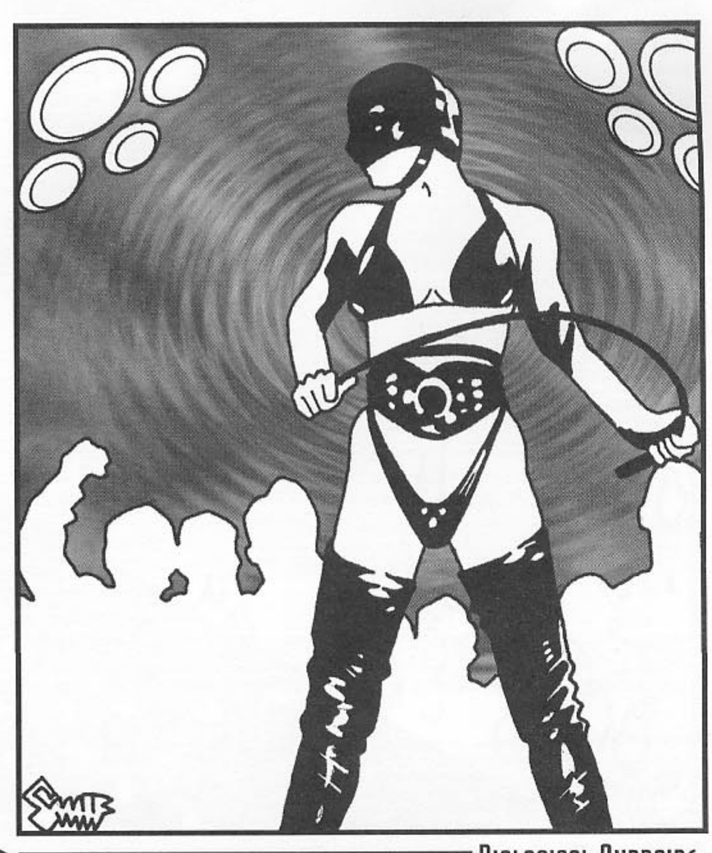
A particular "model" of biological android is designed with a mix of attribute bonuses, advantages and disadvantages, which are shared by every other example of that model. The total of advantages and disadvantages is its *model point cost* – the number of character points that must be paid to play that model of biological android, or, if negative, the points that are received for playing it. The suggested maximum model point cost is 100 points for one intended as a PC in an ordinary campaign. But in a supers or other high-character-point game this maximum can be ignored!

Creating a particular model of biological android consists of selecting an assortment of advantages and disadvantages. As with character creation, each of these advantages and disadvantages has a positive or negative point value. All these are totaled to find a final model point cost, positive or negative. If positive, the model point cost is treated like an advantage and must be paid to take that model of bioroid as a character. If negative, it gives extra character points, like a disadvantage – but *does not* count against the normal total of -40 points of disadvantages and -5 points of quirks.

Technological Limits

Biological androids can be built starting at TL9, but some advantages and disadvantages not available until higher TLs.

It's also possible that magic may be able to perform genetic modifications, allowing alchemists to create bioroids in their vats at TL1-3. Jack Vance's classic fantasy collection *The Dying Earth* describes this magical technology. Use the rules for android creation. Actually growing an alchemical android should require ingredients costing the same as the purchase price of a technological bioroid, take six months or more, and require an Alchemy roll at -1 per $10,000 of construct cost, with failure producing deformed or monstrous creatures.



Biological Android Advantages

The advantages that can be engineered deliberately into a bioroid at a given TL are listed below, along with their page reference (in the ***Basic Set*** or this book) and point cost.

TL9 Advantages

Type	*Cost*	*Page*
ST Bonus +1 to +4	10/20/30/45	78
DX Bonus +1 to +3	10/20/30	78
HT Bonus +1 or +2	10/20	78
Absolute Direction	5	B19
Absolute Timing	5	B19
Acute Hearing	2 per level	B19
Acute Taste & Smell	2 per level	B19
Acute Vision	2 per level	B19
Alertness	5 per level	B19
Amphibious	10	78
Appearance	5/15/25	B15
Ambidexterity	10	B19
Claws	variable	78
Combat Reflexes	15	B20
Disease-Resistant	5	78
Discriminatory Smell	15	78
Discriminatory Taste	10	78
Double-Jointed	5	B20
Eidetic Memory	30/60	B20
Extra Hit Points +1 to 3	5 per point	B236
Extra Limbs	variable	78
Filter Lungs	5	79
Fur	0/4/29	79
Gills	10	79
High Pain Threshold	10	B20
Hyper-Reflexes	15	79
Hyper-Strength	30	79
Increased Speed +1 to 2	25 per level	79
Lightning Calculator	5	B21
Longevity	5	B21
Mathematical Ability	10	B22
Night Vision	10	B22
Oxygen Storage	14	79
Perfect Balance	15	B237
Peripheral Vision	15	B22
Pheromone Control	25	79
Rapid Healing	10	B23
Sharp Teeth	5	79
Temperature Tolerance	6/10	79
Toughness	10/15	B23
Ultrasonic Hearing	5/25	80
Voice	10	B23

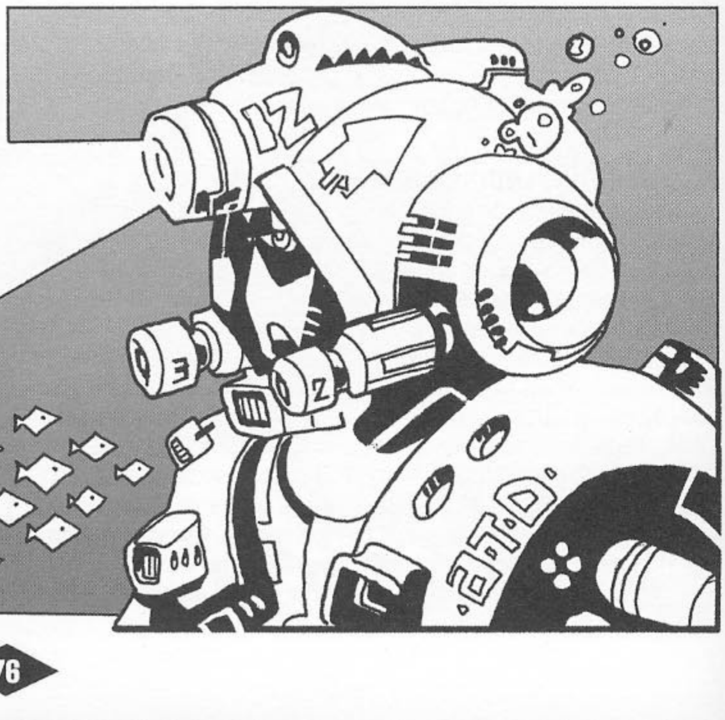
TL10 Advantages

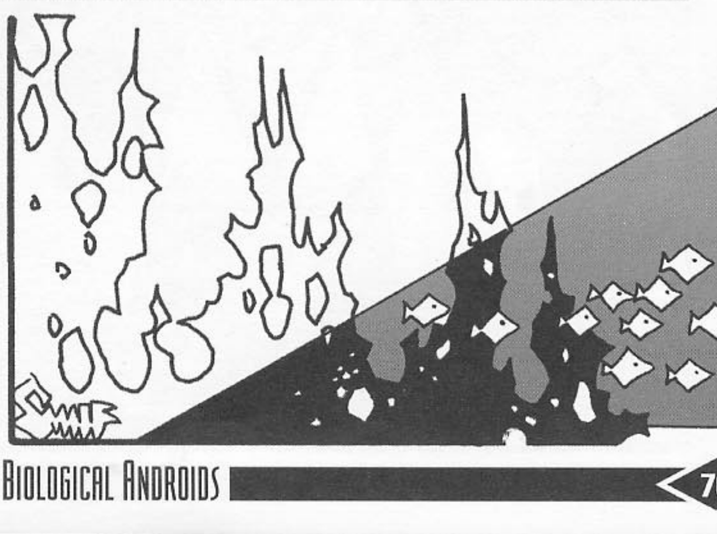
Type	*Cost*	*Page*
ST bonus +5 to +7	60/80/100	78
DX bonus +4	45	78
IQ bonus +1 or +2	10/20	78
HT bonus +3 or +4	30/45	78
Animal Empathy	5	B19
Bioelectric Shock	10	78
Drug Factory	variable	78
Extra Hit Points +4 to 5	5 per point	B236
Hermaphromorph	2	79
Hide or Scales	0/4/29	79
Increased Speed +3 to 4	25 per level	79
Infravision	15	B237
Intuition	15	B20
Language Talent	2 per level	B20
Musical Ability	1 per level	B22
Sanitized Metabolism	5	79
Sonar	25	79
Venom	15 per level	80

TL11+ Android Advantages

Type	*Cost*	*Page*
ST Bonus +8 to +10	125/150/174	78
DX Bonus +5	60	78
IQ Bonus +3 or +4	30/45	78
HT Bonus +5	60	78
Charisma +1 to +2	5	B19
Danger Sense	15	B20
Elastic Skin	20	78
Extra Hit Points +6 to 9	5 per point	B236
Empathy	15	B20
Immunity to Disease	10	B20
Immunity to Poison	5/15	79
Increased Speed +5	25 per level	79
Regeneration	25	79
Vacuum Adaptation	27	80

Abilities like psi powers, super abilities, Magery and Magic Resistance may be engineered if they have a mapped genetic cause. The GM should set the TL depending on how intricate the genetic complex is.





Biological Android Disadvantages

In game terms, most biological androids should have some disadvantages. This has the dual benefit of reducing their model point total and making them more realistic. All are available at TL9 and up.

Disadvantages may be unintentional flaws that are tolerated in otherwise good designs: who cares if a soldier or worker android is Unattractive as long as it has enhanced ST and DX?

Tinkering with brain chemistry or hormones to produce desired traits (e.g., Combat Reflexes, Eidetic Memory, Intuition) may have unexpected side effects (e.g,. Absent Mindedness, Bad Temper, or Paranoia).

Other defects could occur due to their association with desired genetic traits. For example, an living artifact built using many feline characteristics (Claws, Fur, Perfect Balance, high DX etc.) may also turn out to be prone to Impulsiveness – the designer decides removing the flaw is too much trouble. Some may be idiot savants (Mathematical Aptitude and low IQ, for instance). Those with animal DNA may even revert to more primitive behavior patterns (Stress Atavism).

Still other disadvantages may be deliberate modifications: setting a bioroid's hormonal balance to make a sex-toy Lecherous or give a gladiator Bloodlust, for example, or altering brain chemistry to make a low-grade worker less intelligent and thus a better slave. Building androids that have a biological Self-destruct coupled with Short Lifespan and Sterility is one means by which humans could control an artificial population.

Model disadvantages do not count toward the normal limit on disadvantages, and thus are very useful for balancing attribute bonuses or other model advantages.

Suggested Mental Disadvantages

Disadvantage	*Cost*	*Page*
IQ penalty	variable	80
Absent-Mindedness	-15	B30
Bad Temper	-10	B31
Berserk	-15	B31
Bloodlust	-10	B31
Bully	-10	B31
Combat Paralysis	-15	B32
Compulsive Behavior	-5 to -15	B32
Cowardice	-10	B32
Dyslexia	-15	B33
Impulsiveness	-10	B33
Laziness	-10	B34
Lecherousness	-15	B34
Low Empathy	-15	88
Megalomania	-10	B34
Odious Personal Habit	-5/10/15	B26
Overconfidence	-10	B34
Paranoia	-10	B35
Sadism	-15	B36
Sense of Duty	variable	B39
Slave Mentality	-40	89
Split Personality	-10/-15	B37
Stress Atavism	-16	80
Stuttering	-10	B29
Weak Will	-8 per level	B37

Suggested Physical Disadvantages

Disadvantage	*Cost*	*Page*
ST Penalty	variable	80
DX Penalty	variable	80
HT Penalty	variable	80
Albinism	-10	B27
Appearance	variable	B25
Bad Sight	-10	B27
Blindness	-50	B27
Color Blindness	-10	B28
Deafness	-20	B28
Delicate Metabolism	-20/-40	80
Dwarfism	-15	B28
Epilepsy	-30	B28
Eunuch	-5	B28
Fat	-10/20	B28
Gluttony	-5	B33
Gigantism	-10	B28
Hard of Hearing	-10	B28
Lame: Legless	-35	B29
Low Pain Threshold	-10	B29
Reduced Hit Points	-5 per point	80
Mute	-25	B29
No Sense of Smell or Taste	-5	B29
Overweight	-5	B29
Self-Destruct	-20	80
Short Lifespan	-10 per level	80
Skinny	-5	B29
Sterile	-3	80
Unusual Biochemistry	-5	81
Weak Immune System	-30	81

New Advantages and Disadvantages

Several advantages not listed in the *Basic Set* are needed to create biological androids.

New Advantages

ST, DX, IQ and HT Bonuses — *Variable*

These advantages give you a model bonus to an attribute. A +1 bonus costs 10 points, a +2 costs 20, a +3 costs 30, a +4 costs 45, a +5 costs 60, a +6 costs 80, a +7 costs 100, a +8 costs 120, and a +9 costs 150. A biological android with a model bonus to an attribute buys that attribute normally – and then applies the model bonus. For example, one with a model bonus of +2 to ST that wanted ST 14 would pay 20 points for ST 12, then add the model bonus of +2, leaving him ST 14. If he paid no points, his ST 10 would become ST 12.

Amphibious — *10 points*

You are as comfortable in water as on land. You suffer no penalties for skill use in combat when working underwater, and can swim at your normal move rate. Typical features include smooth seal-like skin and webbed fingers an toes. You cannot breathe underwater without another advantage.

Bioelectric Shock — *10 points*

You can generate an electric current in your body, much as an electric eel or ray does. This inflicts 1d electrical damage if you touch a person. It costs 2 Fatigue. You can also use the ability to *save* lives: add +3 to First Aid skill when making CPR rolls!

Claws — *Variable*

You possess claws, usually the result of animal genesplicing. For 15 points, you have blunt claws: these add +2 crushing damage to a kick or punch. For 25 points, you have sharp claws. These convert a kick or punch's crushing damage to cutting damage. For 40 points, you have talons. These allow a kick or punch to do swing/cutting or thrust/impaling damage. For 55 points, you may have long talons, doing swing+2/cutting or thrust+2/impaling. This advantage only has to be purchased once, regardless of how many limbs you have.

Discriminatory Smell — *15 points*

Your sense of smell is far beyond human norms, giving you the same abilities as the similiar robot sensor option (see p. 12).

Discriminatory Taste — *10 points*

Your sense of taste is far beyond human norms, giving you the same abilities as the similiar robot sensor option (see p. 12).

Disease-Resistant — *5 points*

Your immune system is improved dramatically, with specially engineered defensive phages and white blood cells. These ward off most diseases, giving you a +8 bonus to HT to resist them. GMs may devise the occasional disease against which you have no special resistance. This is a lesser form of the 10-point Immunity to Disease advantage.

Drug Factory — *Variable*

Your glands produce natural analogs of existing drugs. Various drugs are described in ***GURPS Cyberpunk, GURPS Space, GURPS Ultra-Tech,*** and ***GURPS Lensman.*** You can only produce an analog of a drug whose tech level is no higher than your TL. To insure play balance, the GM must approve any drug, e.g., if the GM wants a particular drug to be very rare, it could be beyond the technological of a drug factory to synthesize. You can administer these drugs to others via a bite or claws. Your metabolism is limited to producing HT/2 doses. It replaces one dose every four hours. This advantage costs 20 points for the first drug and ten points per extra drug.

Elastic Skin — *20 points*

You can alter skin and facial features to duplicate those of humans or near-humans of similar size and shape. This takes 10 seconds and costs 1 Fatigue; there is no cost to change back to your original form, which only takes 3 seconds. You cannot duplicate clothing. Duplicating a specific individual requires a Disguise+4 roll.

Extra Limbs — *Variable*

A bioroid may have up to four extra arms, although two are more common. Extra arms allow extra actions for a bioroid in the same way as they do for a robot – see the *Robots in Action* chapter. Arms cost 10 points each.

Limbs that can manipulate but cannot attack cost 5 points each. An example would be a very light, stunted arm or a prehensile tail. Limbs that can attack but cannot manipulate or be used for walking are strikers. A heavy tail or an arm with no hand are examples. Strikers cost 5 points each. If claws are bought, the striker gains the claws damage.

Filter Lungs — 5 points

This advantage equips you with self-regenerating biological filters designed for contaminated atmospheres – which may include a polluted cities on Earth as well as alien planets.

Fur — 0/4/29 points

For a cost of 0 points you have *very thin fur* like that of a Chihuahua dog. It prevents sunburn and gives you a distinct appearance, but has no other qualities.

For 4 points, you have *fur* similar to that of a cat's fur or dog's hair, providing DR 1 and protection equivalent to light clothing.

For 29 points, you have *thick fur.* This is a dense pelt, like a polar bear's, providing PD 1 and DR 1. It acts as warm clothing, but may cause suffering in hot weather!

Fur is also obvious, and you require proper grooming that can take time; loose fur and static build-up can be a problem.

Gills — 10 points

You have gills *as well as* lungs, enabling you to breathe water or air. A biological android built with gills *instead of* lungs *cannot* breathe air!

Hermaphromorph — 2 points

You are designed to switch between fully functional neuter, male and female forms. The process takes about 6 hours, during which you will experience mood swings and suffer from the Bad Temper disadvantage (or if already bad tempered, make all Will rolls to resist it at -3).

Hide or Scales — 0/4/29 points

You have a thick hide or actual armored scales.

For 0 points, you can have *very light scales,* like a snake. Besides the appearance, there is no other game effect.

For 4 points, you may have *scales,* like a lizard's. This gives you DR 1.

For 29 points, you may have *thick hide,* like elephant or rhino hide, or *heavy scales* like an armadillo or armored lizard. This gives you PD 1, DR 1. Any bioroid with this advantagee may not have an Appearance better than Average!

Hyper-Reflexes — 15 points

You can voluntarily produce and control abnormal levels of adrenaline, increasing speed and reflexes. At the start of any turn, you can activate your hyper-reflexes. This costs 1 Fatigue *per turn* but gives you the Combat Reflexes advantage and +1 to Basic Speed. (If you *normally* have Combat Reflexes, gain double the usual benefits.)

Hyper-Strength — 30 points

You can voluntarily duplicate the feats of hysterical strength that normal people sometimes perform. You may increase ST (but not Fatigue) by 50% at a cost of 1 Fatigue *per turn.*

Immunity to Poison — 15 points

For 15 points, you are genetically engineered, or different enough biologically, to be immune to poisons (including sleep and nerve gas), alcohol and nonmedical drugs. You are still vulnerable to acid and diseases. For only 5 points, you can simply be *resistant to poison:* +3 to HT to resist effects.

Increased Speed — 25 points/level

Each level increases your Basic Speed by 1, which in turn also increases your Move and Dodge.

Infravision — 15 points

You can see into the infrared, much like a robot with the infrared vision option (see p. B237).

Oxygen Storage — 14 points

Synthetic genes modify your lungs and alter your body so that you can store oxygen (up to an hour's worth) in the myoglobin of your muscles and in an altered liver. Biological androids with this advantage never get "the bends" when diving using their internally stored oxygen. (They can still suffer "the bends" if diving with conventional scuba equipment.) This advantage is common in bioroids designed to function underwater without gills, or in space.

Pheromone Control — 25 points

You can release powerful sex pheromones. Any human (or bioroid) within four yards (more if down wind) may breathe them in (unless wearing an airtight suit, etc.). Anyone breathing your pheromones will find you one level more Attractive (add a +2 extra reaction bonus) if you are already Very Beautiful and will break into a sweat and become aroused: they must roll vs. HT-3 or suffer from Lecherousness for the next ten minutes. The fact that a biological android is using sex pheromones may not be immediately apparent: when a PC is affected, the GM may wish to describe the encounter in such a way that the character believes the attraction is "natural" rather than a chemical attack. Characters who have previously experienced pheromone control (and know what it is) can get an IQ-3 roll to realize their reactions are being artificially stimulated; however, they still suffer the effects.

Regeneration — 25 points

You can heal very rapidly. You have the Rapid Healing advantage at no extra cost, and can recover one extra HT or hit point per hour.

Sanitized Metabolism — 5 points

You are designed to be totally *clean.* Designer intestinal enzymes and symbiotic bacteria eliminate your body odor and make efficient use of food and drink, leaving minimal, sanitized waste products. You never suffer from bad breath, excessive perspiration or unsightly skin problems. Your abilities give a +1 on all rolls where Appearance or Sex Appeal are a factor. This advantage is also perfect for bioroids designed to work in sealed factory environments ("clean rooms").

Sharp Teeth — 5 points

You can do cutting damage by biting in close combat, using the table on p. B140.

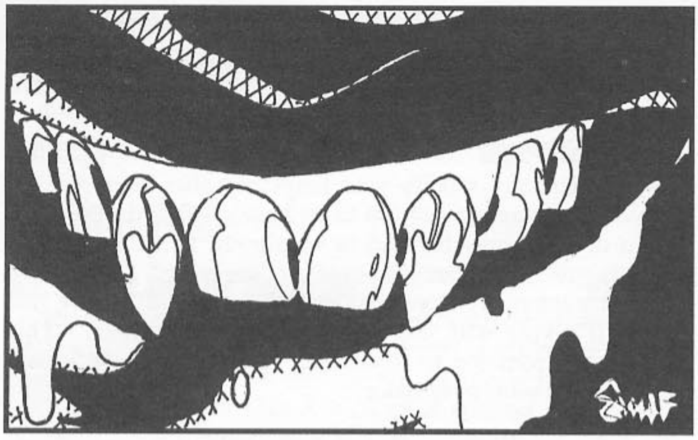
Sonar — 25 points

You can "see" using sound waves, much like a robot with the sonar option (p. 13).

Temperature Tolerance — 6/10 points

You are designed to withstand extreme temperatures; it gives no advantage against attacks that do damage, but does protect against climatic conditions.

Multiply your HT×5. Subtract this number from 35 degrees to find the lowest temperature you can stand. Add this number to 90 degrees to find the highest.



If you can only withstand heat, or only withstand cold, it is worth only 6 points. If you can withstand both, it is worth 10 points.

Ultrasonic Hearing — *5/25 points*

You can detect very high frequency sounds (to 40,000 Hz) much like a robot with the ultrasonic hearing option (p. 12). For 25 points, you can also communicate in ultrasonics.

Vacuum Adaptation — *27 points*

Humans living in space always run the risk of life-support failure and explosive decompression. Genetic modification can reduce the risk for living artifacts. You get stronger skin (DR 1) to resist pressure drops, new muscles to close off your gut and lungs, and transparent membranes to protect your eyes. You suffer no damage from explosive decompression (p. S75) and are not mentally stunned by Rapid Decompression (p. S75). An extra layer of adipose tissue gives you the 10-point version of the Temperature Tolerance advantage (p. 79). Your hair and skin changes color to protect against ultraviolet solar radiation, and can turn a deep black. (This advantage is often combined with Oxygen Storage to create space-worker androids that can survive unprotected in space for short periods of time.)

Note that this advantage is cheaper than, but not as effective as, the Vacuum Support advantage described in ***GURPS Aliens.***

Venom — *15 points per level*

You can secrete a poisonous venom through your saliva, bite or claws.

For 15 points per level, the venom can be immediately lethal. This does 1d of damage per level immediately; each hour afterward, the victim rolls vs. HT (-1 per level of this advantage); if he fails this roll, he takes a further 1d per level of damage, while if he succeeds, the damage stops.

Or, the venom can be slower-acting but more lethal. Damage is 1d per level if the HT roll is made, 3d per level if it is failed. The effects take one hour to show. Cost is the same.

At a one-third increase in cost, you can spit venom. This is a ranged attack, based on DX, with SS 12, Acc 12, ½D n/a, Max 5. The venom must strike an open wound, eyes, nostrils or open mouth to have effect, normally requiring an attack against an unshielded face.

New Disadvantages

ST, DX, IQ and HT Penalties — *Variable*

These disadvantages give your entire model line a penalty to a specific attribute. A -1 is a -10 point disadvantage, a -2 is worth -15 points, a -3 is worth -20 points, a -4 is worth -30 points, and a -5 is worth -40 points.

A biological android with a model penalty to an attribute buys that attribute normally – and then applies the model penalty. For instance, a bioroid with a model penalty of -2 to DX that wanted a final DX of 14 would pay 80 points for DX 16, then subtract the model penalty of -2, leaving him with DX 14. If he paid no points, his DX 10 would be reduced to DX 8.

Delicate Metabolism — *-20/-40 points*

Your metabolism is more delicate than that of a normal human – you require a special diet and filtered water. If you consume normal food and drink, it will sustain you, but you must make a HT roll. Failure means loss of 1 HT due to nausea, cramps, and illness. Critical failure means loss of 1d HT. The cost of your special diet is twice that of normal food, and may be unavailable in some areas (especially in regions with TLs below 7).

For -40 points, you cannot survive on normal food at all. Special nutrients are only available from your creator, generally at a cost to your creator of 100 times the cost of feeding a normal human. For someone else to synthesize it will be a difficult task requiring Biochemistry skill – use the Inventions rules on p. B186). (With the GM's permission, you may require something disgusting or dangerous to get, such as fresh human brains, fresh blood of a certain type, or human cerebral-spinal fluid). Most normal foods make you ill as described above.

Reduced Hit Points — *-5 points each*

You are smaller or more fragile than a human, and have fewer hit points than your HT, giving you a split HT.

Self-Destruct — *-20 points*

As soon as you reach your aging threshold (age 50 for a normal human), your organs and immune system begin to fail. You starts to age rapidly, making aging rolls every *day* at -3 to HT. This disadvantage ensures a steady demand for new bioroids!

Short Lifespan — *-10/level*

Each level reduces by 1/4 (round down) the age at which you becomes mature *and* the age at which you begin to suffer aging effects. This disadvantage speeds up production of androids, and like Self-Destruct ensures a steady demand for new models. It is often found in conjunction with Self Destruct.

Sterile — *-3 points*

You cannot produce offspring, but are otherwise a fully-functioning male or female.

Stress Atavism — *-16 points*

Stress atavism is not uncommon among biological androids created from animal DNA, and sometimes shows up in others as well. It may cause them to "regress" to animal instincts if frightened, angered, fatigued or injured.

In any such stressful situation, you must succeed in a Will roll to avoid the effects. If you fail, you behave like an animal, acting on impulse and instinct. You will be unable to talk (but may make animal sounds) and cannot use machinery. You may be unable to understand spoken language – roll vs. IQ after any sentence to see if you get the meaning of it. If you are attacked, threatened or challenged, you must make a Will roll to avoid acting on instinct – usually either flight or a frenzied physical attack, depending on how aggressive you usually are.

Stress atavism attacks are also very fatiguing – you take one point of Fatigue for every minute the attack lasts.

A roll is allowed vs. Will every minute to recover from an attack; add a +2 bonus if you are comforted by friends or someone with Empathy or Animal Empathy, or +4 if both apply. A character who passes out from Fatigue loss recovers after waking up.

(The stress atavism described here applies to common, moderate forms. Other types of stress atavism are described in *GURPS Uplift* on p. 25.)

Unusual Biochemistry -5 points

Your biochemistry, while still enabling you to subsist on human food and water, is different enough from that of humans that drugs that work on humans have reduced or unpredictable effects. When a drug is given to you, roll 1d. On a roll of 1-3 the drug has normal effect. On a roll of 4-5, it has its normal effect combined with an additional negative effect: lose 1d Fatigue (sickness and nauseau) or, at the GM's option, enhance any negative effects of the drug. On a 6, the drug no effect at all. A biochemist with a lab can manufacture variants of normal drugs that are specific to your biochemistry, but these drugs cost are ten times as much as usual.

Weak Immune System -30 points

You have poor resistance to disease and infection. HT rolls to resist specific diseases or infections are at -3 to HT or against HT 9, whichever is less. Drugs like Panimmunity I and II have half their normal effect; you may not take the Immunity to Disease advantage, and Panimmunity III has no effect on you. Unless you take special precautions (for instance, remain in a sealed environment or wear air-tight clothing when you leave one), the GM should require an unmodified HT roll to avoid coming down with a potentially serious disease every month. Although not necessarily fatal (especially with high-tech medicine) this will force you or your owner to spend additional money on drugs and hospital treatment.

Price

Like robots, biological androids may be bought and sold. To calculate the price of an untrained but biologically mature model, use the formula below. It reflects the utility of the android (its model point total) and the amount of tinkering that went into creating it.

The basic cost is $50,000. In addition, each model advantage the bioroid has costs $1,000 per point. Each model disadvantage the bioroid has costs $500 per negative point.

Halve the cost at TL10, and again at TL11+.

Example: A TL9 biological android with 80 points of model advantages and -40 points of model disadvantages costs $50,000 + $80,000 (80×$1,000) + $20,000 (40×$500) = $150,000.

Growing Biological Androids

Bioroids are usually grown in artificial wombs ("vats") much like human clones. Usually these vats are designed to simulate the conditions of an idealized human womb with carefully regulated fluid temperatures and even sounds like a taped heartbeat.

Some bioroids are taken out of the vats as babies, and given over to surrogate mothers to be raised as children in normal or group homes. This usually results in a bioroid that is well adjusted to living with humans. It's common for androids that are designed to be "people" rather than "slaves."

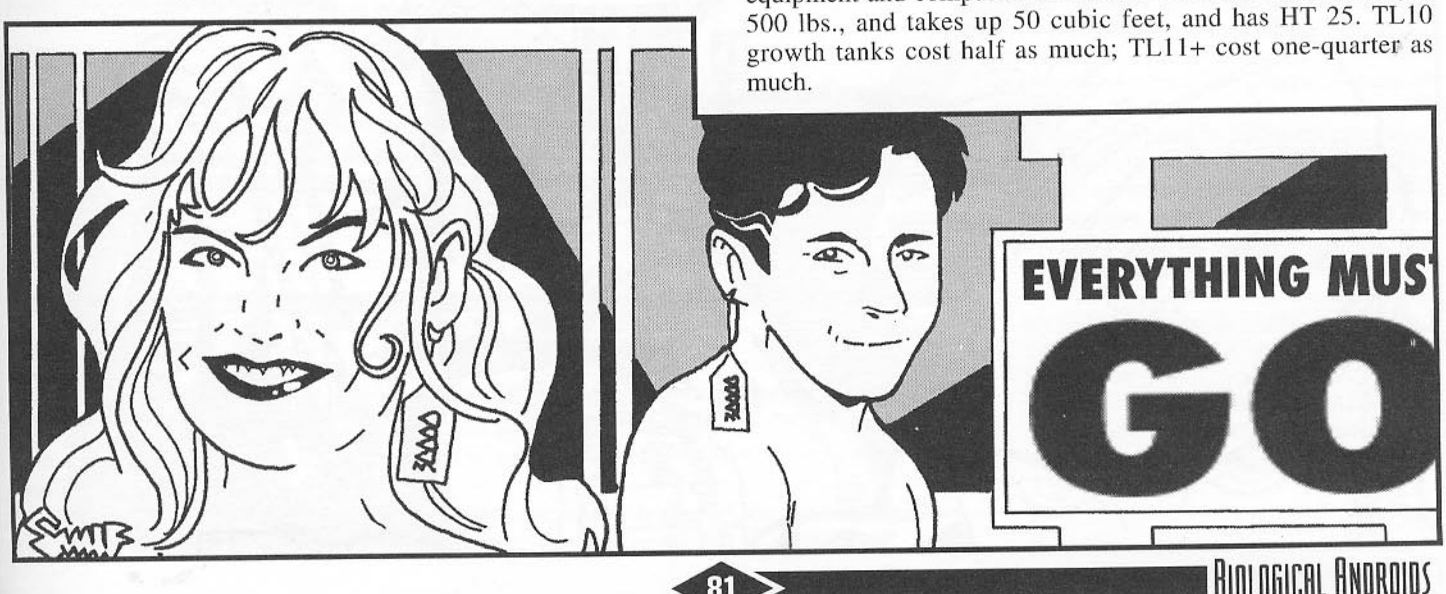
Other bioroids are force-grown to adulthood while still in the vats using the TL8+ cloning technology described on p. UT42 and p. S65. A force-grown android will have whatever "physiological" age is desired (usually age 18 to 25). This technique is most common for biological androids intended as "products" since it allows them to be mass-produced quickly. Force-grown androids receive an additional six weeks of "deep learning" via extensive use of sleep teaching, or virtual reality or cybernetic "dreamgame" simulations while they float in their tanks. This gives the android basic life skills: control over its own body and the ability to understand and speak one language at its IQ level.

Force-grown androids may spend additional time in the tanks, up to an extra year and a half (any more time imposes too severe a psychological stress). Every month spent allows the android to spend two character point on skills it was taught. Thus, an android that comes out of the tanks may spend 36 characters points on skills, much like an eighteen year old human.

Some androids are given "live" training before going on the job, if only to get experience in interacting with humans in a normal setting. Surrogate-raised androids, of course, will receive whatever education their surrogate parents or teachers provided.

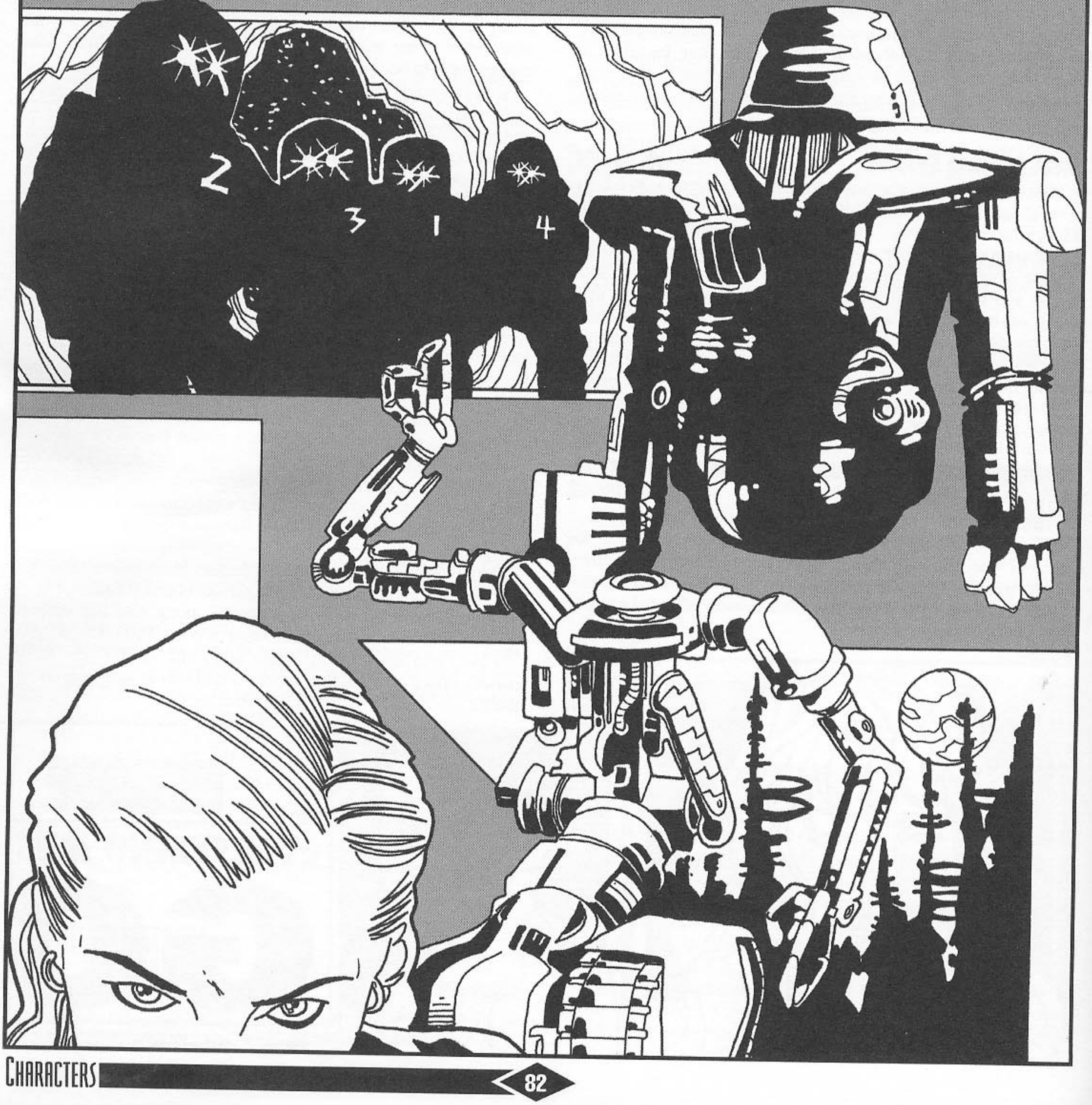
Purchasing a skilled android (whether force-grown or surrogate-raised) costs an extra $5,000 per skill point it has.

A growth vat for growing androids, along with life support equipment and computers to monitor it costs $500,000, weighs 500 lbs., and takes up 50 cubic feet, and has HT 25. TL10 growth tanks cost half as much; TL11+ cost one-quarter as much.



CHARACTERS 5

Players may wish to play robots, total cyborgs or biological androids as characters. This chapter describes how to set a point total for these characters, and what abilities not otherwise covered in the robot or biological android design rules can be taken by them.



The first step in creating a robot character is something that isn't done when creating a human: the choice of the *model* of robot, cyborg or biological android to be played. This is akin to choosing which non-human race a character in a science fiction or fantasy campaign will play.

The robot model can be an existing design or it can be built from scratch using the rules in the *Robot Design, Microbots and Nanomorphs* or *Biological Androids* chapter. The GM can allow players to build their own models, or may choose to create a limited number of designs and have players choose from among their ranks.

If choosing a robot model, it's strongly recommended that the robot have a neural-net or sentient brain!

The chosen model gives a set of basic abilities common to every robot, cyborg, or biological android of that particular model. It also gives the robot a model point cost.

Model Point Cost: Every model of robot, cyborg or biological android has a model point cost, which is the sum of the point cost of advantages and disadvantages built into it when it was designed (see the *Robot Design* and *Biological Androids* chapters). If the model point cost is positive, it is the number of character points that must be paid, as an advantage, to play that particular model. If negative, the character gets that many points back, much like a disadvantage, except that a negative model point cost does not count toward the normal limit (usually -45 points) of disadvantages.

Programming Cost: Individual robots (but not biological androids) may be programmed with advantages, disadvantages and skills, as described in the *Brains and Programs* chapter. (If using utility programs from ***GURPS Space, GURPS Ultra-Tech*** or ***GURPS Cyberpunk*** that grant specific skill levels, base the point cost on however many character points the robot would pay to buy that skill level.) Then total up the point cost (positive or negative) of all the robot's programs. This is the robot's programming cost.

It's strongly recommended that the sum of model point cost and the programming cost not exceed the starting points for the campaign!

An artificial being's point cost is the sum of its model point cost and its programming cost. This represents how much a "factory fresh" machine or newly grown biological android would cost. But just like a human character, most artificial PCs will have spent some time in the world before starting their career as player characters. As such, they will have acquired additional abilities, and any character points that remain after paying for their model and programs can then be spent to buy attributes, skills, attributes and advantages. Similarly, extra points can also be gained back by taking disadvantages and quirks.

Attributes

Biological androids buy their attributes just as if they were human characters, although an attribute bonus will often increase or decrease them, as explained in the *Android* chapter.

Robots and cyborgs cannot buy ST or HT – this is limited by the robot design. A cyborg or a robot with a neural-net or sentient brain *can* buy DX and IQ. Buy the attribute as if the robot were a human, then add 1 for every point the robot model's attribute was over 10, or subtract 1 for every point it was under 10.

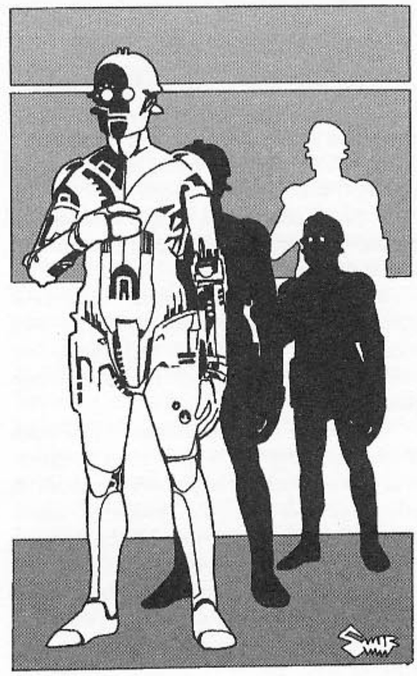
EXAMPLE

The SY-101 Nemesis robot has a DX 12 and IQ 9. But this kind of robot has a neural-net brain, so a particular SY-101-N like Synthia could buy extra DX or IQ. Suppose Synthia pays 30 points for DX and 10 points for IQ. This would give a human DX 13 and IQ 11. However, Synthia ends up with DX 15 (+2 for its basic DX 12) and IQ 10 (-1 for its basic IQ 9).

Advantages

A robot, cyborg or biological android has all the advantages that were built or programmed into its body. But because it's been built a certain way, some "inborn" advantages are not possible – it's limited to what it was designed for or, (for a robot) what it's been programmed with.

All social advantages, as well as many that could be "learned," are quite possible. Any robot, cyborg or biological android can have these advantages:



Suggested Character Points

One of the main reasons for building a robot is to create something that is better than human, at least in a limited field. As a result, robots often cost more character points than humans. In particular, the base cost, before disadvantages, of an armed and armored combat robot can easily be around 500 points.

In a supers campaign, or a very-high-point cinematic campaign, this isn't a problem. However, to add robot characters to an ordinary campaign without point escalation requires care. The GM may wish to follow these recommendations.

In a 100-point to 150-point campaign, restrict players to robot characters that aren't covered in armor, don't have super-human ST and DX, and aren't loaded down with every gadget there is. Instead, take ordinary robots and see how they do in extraordinary circumstances. The robot characters in movies such as *Star Wars* and *Cherry 2000* are good examples of this.

In a 200-point to 500-point campaign, let them create more potent robots. The typical cinematic example is the robot that looks pretty much like a human, but has extra Strength, hit points and speed, and maybe one or two hidden gizmos or some light armor under its skin. It's also possible to build a heavily-armed and armored warbot for 500 points, provided the robot gains some points back from many built-in disadvantages, such as a hideous Appearance, being unable to speak, and lacking proper arms.

Character Checklist

When creating a robot, cyborg or biological android character, the player should be able to answer these questions:

1. Who built (or rebuilt, in the case of cyborgs) the character, and why?

2. Is the character a unique creation, or a mass-produced model? Are their others like it still around?

3. How long ago was it built? Is it new? A scarred veteran with years of experience? Obsolete? Salvaged and rebuilt from a junkyard? A cutting-edge prototype?

4. Does it have an owner? How does the owner treat it? What's their relationship? Does the owner provide freedom to adventure – or does the "property" sneak away? Is the owner one of the PCs or NPCs in the group, or a distant figure that sends the robot on missions? Why does he permit the robot to adventure with the characters? Some possibilities: owned by a PC or NPC ally or dependent; owned by the same organization other PCs belong to; owned by the group's patron; serving as a surrogate for an eccentric NPC friend who would like to adventure with the characters, but isn't up to it; owned by an NPC who shares a goal (or an enemy) with the PCs, and the robot is there as his agent; disguised as a human and infiltrated into the group to spy on them.

5. Did the character have previous owners? Who? Why did the character leave them? Does it have a relationship with its former owner, either as a friend or foe? Is its ex-owner looking for it, or vice versa? Is it still trying to fulfil a former owner's orders?

6. If the character has no owner, why is that? Does society consider its type a free being? Or has it run away? If so, how did it break any programming or conditioning? Some possibilities: damage to its brain from accident or combat, being reprogrammed by its owner's foes, being rescued by other rebels, being placed in a situation where it had to change and adapt to survive.

Or did its owner suffer some fate that left it on its own? Some possibilities: it was sent away on a mission, it was stolen, it was given away or sold, it was junked after it became obsolete, or its owner was killed or captured. Is it masquerading as a "real" person? Is anyone chasing it to reclaim it?

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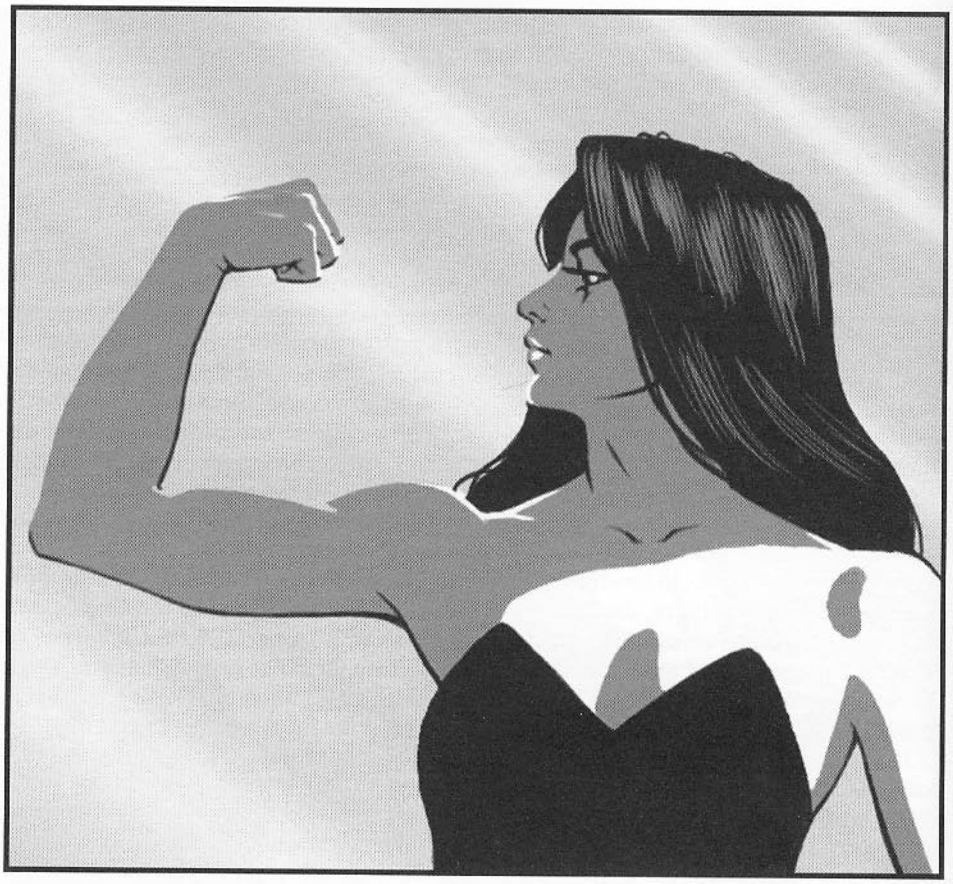


Allies, Ally Group, Clerical Investment, Contacts, Legal Enforcement Powers, Luck, Military Rank, Patrons, Reputation, Status, Unusual Background and Wealth.

In addition, a robot with a sentient computer brain, or a cyborg, may take any of the following advantages: Animal Empathy, Charisma, Common Sense, Danger Sense, Empathy, Intuition, Magic Aptitude or Magic Resistance.

No other ***Basic Set*** advantages can be taken (although the character may have many built-in advantages as a result of its particular model or programming). For advantages that appear in other ***GURPS*** books, the GM must decide. In general, only social advantages, like Military Rank, or abstract qualities, like Luck, can be taken by artificial beings.

Some advantages require special discussion as to how they apply to artificial beings.

Allies see p. B23

Traditionally, robots are often someone else's faithful sidekick. However, there is no reason why a robot cannot have an Ally. A good example would be an NPC inventor or owner who accompanies the robot on adventures, but generally defers to it for advice, or a loyal mechanic who constantly repairs the damage the robot suffers. A robot may have other robots as subordinates or companions.

Patrons see p. B24

Patrons are strongly recommended for robot characters, especially in situations where being a robot or cyborg is a social stigma. A patron could be a robot's owner, its inventor, or an organization that owns or controls the robot. It can be a good idea to choose a patron with enough wealth or know-how to be able to repair any damage that the robot suffers!

Reputation see p. B17

An artificial being's Reputation can reflect its past deeds, just like a human. But for mass-produced robots or biological androids, the entire production run may come to share a particular reputation. This may be because of quality ("The Dynatech 200s are a very reliable model"), their usual employer ("An Argus surveillance robot? Doesn't the FBI use those?"), or famous or infamous deeds the same type have performed ("It's a Cerberus V – remember the Sirius massacre! Run!").

Unusual Background: High Technology — Variable

This advantage must be taken if the robot was built at a Tech Level in excess of the normal baseline tech level of the campaign. The player must come up with an explanation of why the robot is so advanced that will satisfy the GM. The robot might be a visitor from an advanced alien culture or use a mix of native technology and salvaged alien technology from a crashed spaceship. It could be an experimental model, designed with state-of-the-art experimental military or corporate R&D or by an eccentric genius inventor-gadgeteer. Or it might even be the result of not-pretty, barely-more-than-jury-rigged upgrade done by a home handyman who needed a robot to do something for his aging mother, couldn't afford the factory model, and, in trying to get a different type of 'bot to perform that function, accidentally made an engineering breakthrough.

The greater the technology gap, the more it is worth.

+1 TL: 20 points.
+2 TLs: 50 points
+3 TLs: 100 points.
+4 or more TLs: 50 points per TL over base TL.

Unusual Background: Artificial Being — Variable

It's not recommended that GMs charge an Unusual Background cost to be an artificial construct in a space, cyberpunk or supers campaign. Cyborgs, robots and biological androids are already expensive enough in terms of points, and in all these genres, robot characters are quite common!

A 10- to 25-point Unusual Background cost is appropriate in genres where artificial constructs are rare but not unknown, such as horror, fantasy, time travel, pulp adventure or Illuminati. In a genre where robots almost never appear, such as modern-day espionage, historical adventure or martial arts, having to pay 25 or more points to play a robot character is recommended, in the unlikely chance the GM decides to allow these characters!

Wealth — see p. B16

If the artificial being is a free citizen, it can have any amount of wealth. Some might even be rich. But if it is treated as property, it will usually have little or no money. But there are ways to get around this and take a higher level of wealth. A runaway construct might have acquired some money or be working illegally at a job, especially if it is designed so as to pass as a human, and so could have a higher level of Wealth. And in the age of computerized banking and modem communications, it's possible to covertly acquire riches – for instance, a super-intelligent computer may be an expert at playing the stock market and secreting away funds into Swiss bank accounts. Its owner may not realize what the robot is doing until it's richer than he is!

New Advantage

Doesn't Sleep — 20 points

Computer brains do not need regular dormancy periods. Most robots can operate at full efficiency with only periodic breaks.

Allowable Disadvantages

The normal -45-point limit on disadvantages (or whatever limit is set for the campaign) applies to artificial beings. However, "built-in" disadvantages that are part of the chosen model, or which were programmed into a robot, do not count against that total – they've already been applied to reduce the model point cost.

Aside from these built-in disadvantages, any artificial being can take the following social or relationship-oriented disadvantages: Dependents, Duty, Enemies, Poverty, Primitive, Reputation, Social Stigma, Status and Unluckiness.

Many mental disadvantages are inappropriate for robots. A robot that doesn't have a neural-net or sentient brain can only take Amnesia, Bloodlust, Gullibility or Impulsiveness. For explanations as to why these are appropriate to robots, see below. A robot with a neural-net or sentient brain, or a cyborg or biological android, may have these disadvantages, but may also have any other mental disadvantage. The two exceptions are Alcoholism or Gluttony, which can only appear in biological androids, or (in rare cases!) robots and cyborgs with built-in bioconvertors.

Character Checklist (Continued)

7. Cyborg characters should also describe the person the cyborg was before being installed in this robot body. How old was he when he became a 'borg, and long has he been one? How did his cyborgization come about? Did he volunteer, or was he a victim? What does he feel about the change? Resentment, anger? Or is the body a welcome improvement, perhaps because he was crippled or deformed beforehand? If so, describe the cause. Was it illness or disease? An accident? A near-mortal wound suffered in combat? Was someone responsible – and does he still have a score to settle? Did he have friends, family or a lover from before the change – if so, do they know about his new body? How do they react to him?

Cyborging Characters

An existing player character can be turned into a total cyborg by transplanting his brain from his body. This is possible at TL8. It costs $50,000 or more and will require skill rolls against Surgery (at -5) and Electronics (Cybernetics) at -5. The operation takes about 4 hours. Failure allows a repeated attempt at a cumulative -2; Critical failure results in brain damage (-1d/2 to DX and IQ, or disadvantages such as Epilepsy) or death, at the GM's discretion.

A character can be turned into a *robot* by copying his mind into a ghost program (see *Ghost Programs* on p. 65) and then running that program within a robot brain.

In either case, his ST and HT, as well as all physical advantages and disadvantages, become that of the robot or cyborg body, his DX is an average of his artificial body's and his original DX and his IQ is his own or the artificial body's, whichever is greater. He retains any purely mental advantages or disadvantages (things like Combat Reflexes or Bad Temper). Physical advantages and disadvantages, as well as social ones, may change to reflect those of his artificial body.

If his point total is higher, the GM may require him to buy off extra points. A more playable alternative is to add extra mental disadvantages to reflect the stress of the change . . .

Continued on next page . . .

Cyborging Characters (Continued)

Trapped Minds

When a mind from a living body is placed in a machine as a cyborg brain (p. 52) or a Ghost program (p. 65), there is a chance that the psyche will be unable to stand the strain and go insane.

Upon first realizing his fate, the character makes a Fright Check. Modifiers: +4 if the character volunteered, +2 if he was an unwilling victim but knew in advanced what was going to happen, -8 if now totally disembodied (e.g., trapped in a computer), +2 if he sees his new body as an improvement (e.g., he was crippled or deformed before hand, now he's not), -4 if the new body has extra senses (radar, ladar, spectrum vision, discriminatory smell) that are different or more acute then the originals, -2 if the new body lacks senses (hearing, touch, vision, etc.) that the original had, -4 if the new body is very different in shape, -2 if it is of similar shape but obviously inhuman, and +2 if it is close copy of the original.

Even if the character survives the first Fright Check, he may still fail to adjust to the body. Make a Will roll every two weeks, with the same penalties. If the roll is a failure, the user gains one point of Mental Disadvantages per point the roll failed by. If the character gets a critical success, or three successes in a row, he adjusts to his new existence and does not need to roll again.

An attending counselor can help a character adjust. For every 2 points the counsellor makes a Psychology roll, add +1 to Will rolls to remain sane. If the character has friends who can help him adjust, add a +1 to +3 bonus. If he runs into former friends who flee from his alien appearance, subtract -1 to -3.

The GM keeps track of the points of disadvantages gained so far and decides whether to use them to give the character new quirks or disadvantages immediately, or to save them up for "sudden insanity" when enough points are accumulated. The type of disadvantage should reflect whether the character was transformed into a machine as a unwilling victim or a willing convert.

The most common disadvantages are Bad Temper, Bloodlust, Berserk, Fanaticism (homicidal hatred against those responsible, or sometimes fanatical loyalty to them for "improving" him), Paranoia ("what will they do next?"), Delusions (things like "I'm still perfectly human" or "my robot body is taking over my brain"), Phobias (fear of doctors, fear of crowds, etc.), Split Personality (the character develops a new one to cope, often something cold and machine-like).

Many physical disadvantages are inappropriate to an artificial being, since physical characteristics are determined by the chosen model. However, Age, Blindness, Deafness, Hard of Hearing, Lame, Mute, One Arm, One Eye or One Hand can be defined as representing wear and tear, combat damage that has gone unrepaired or the like, provided it's appropriate and doesn't duplicate a condition built into the model (for instance, a robot model with no arms can't get points for One Hand). Epilepsy can be taken to represent neurological or computer brain damage. Eunuch can only be taken by a male biological android, or a robot or cyborg that was built with a male sex implant. Youth can be taken by any biological android that was removed from the vats before attaining maturity. Other physical disadvantages are unavailable.

Some disadvantages require special mention when they are applied to artificial beings.

Addiction — see p. B30

An ordinary robot can only be addicted to a non-physical substance, such as electricity or virtual-reality dream-game simulations. A cyborg can only be addicted to drugs if they are somehow added to its nutrient feed. A robot with a bioconvertor, or any biological android, can be addicted to drugs.

Age — see p. B27

The same aging rules used for humans (p. B83) can be used for artificial begins, reflecting a gradual decline in performance. For biological androids, use the normal rules (although some androids may be engineered for longer or shorter lifespans, as described in the *Biological Androids* chapter). For robots or cyborgs, do not add the medical TL-3 to HT. Instead, use the TL-7 of the robot maintenance facilities that are available. A robot can lose ST (from arms and from body), DX, IQ, HT, hit points, DR, and Speed. ST, hit points, DR and Speed deteriorate on a percentage basis (-10% per failed aging roll; keep track of fractional points lost). Keep track of the *number* of failed Aging rolls. An overhaul to repair the effects of a failed aging roll requires one day, a Mechanic (Robotics) roll, and spare parts costing 10% of the robot's original price. Parts for a very old robot may be hard to find!

Amnesia — see p. B239

This can represent an artificial being that has been deliberately mind-wiped. A unique form of this disadvantage, for robots, is for a backup of your real memory to be intact on disk somewhere, perhaps in an enemy's possession. You can buy off the disadvantage and determine who you are by finding the disk!

Bad Temper, Berserk, Bully (p. B30); Sadism (p. B36)

These disadvantages are rare in robots but can simulate serious malfunctions or deviant programming. They are much more common in combat cyborgs, many of whom, tormented by their half-human existence, seem to live in a perpetual state of violent rage.

Bloodlust — see p. B30

This is a very common disadvantage in military robots: they coldly eliminate enemies, showing neither compassion, mercy, nor hatred. It's also common in cyborgs and combat androids.

Delusions — see p. B32

A common delusion for mentally-unbalanced androids (robotic or biological) is "I'm a real human." The android will act like a human, and will often conjure up a fake past, with imaginary parents or siblings. They may explain gaps in their memories as the result of mindwipe or brainwashing, and if confronted with evidence that proves they are artificial, may fantasize that they were human victims of either brain transplants or brain taping.

Dependents — see p. B38

An artificial being's dependent can be its owner or inventor, or simply a friend or even lover.

Duty — see p. B39

Robots that are not sentient usually have a special form of Duty, called Reprogrammable Duty, described on p. 89. Biological androids and cyborgs will often be either be owned or employed by someone, and so will have a duty of some sort to their owner.

For -20 points, a Duty can be "extremely hazardous." The character is on duty all the time and risks death or serious injury constantly. Special-ops soldiers or secret agents, or police in very dangerous precincts may have it, for instance.

Enemies see p. B39

An artificial being may have its own enemies, or its owner's enemies may also be hunting it. Often the enemy is a former owner that the construct has escaped or been stolen from, and who wants it back! Enemies will often be artificial beings themselves, or employ them as minions. And of course, human characters may have robots, cyborgs or biological androids as enemies!

Gullibility see p. B33

This is a *very* common disadvantage for robots with computer brains!

Impulsiveness see p. B33

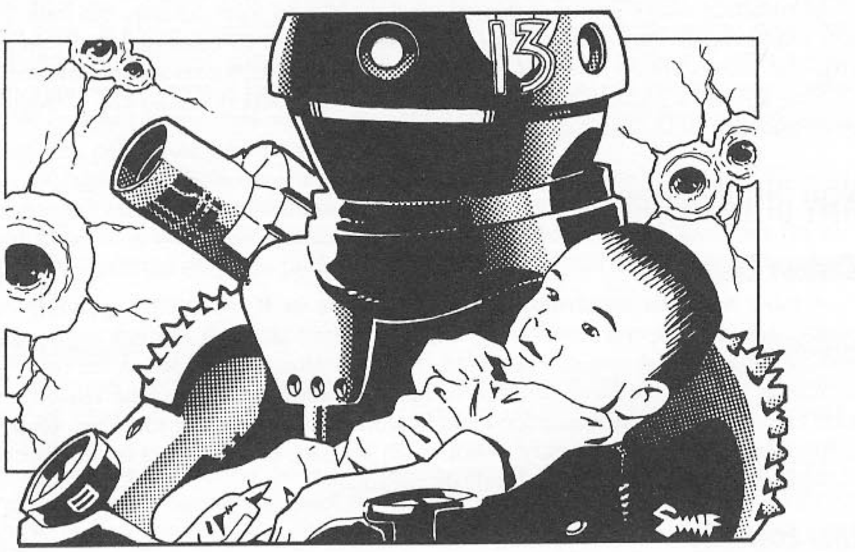
At first glance, this would seem like a very unrobotic disadvantage. But if read "decisiveness," it can easily simulate the way computer brains may act: promptly, and without debate.

Megalomania (p. B34) and Paranoia (p. B35)

The classic disadvantages for sentient computer brains in fiction. Paranoia is usually expressed as "They're trying to turn me off" or "What if they reprogram me?"

No Sense of Humor see p. B241

Robots tend to be rather humorless. Those that don't have a sentient brain will automatically have this as a built-in disadvantage, the -10-point cost already included in their design cost (they've already paid points for it) unless they have a sentient brain. However, any neural-net robot can pay 10 points to buy it off during character generation, representing it coming to better understand humans. This disadvantage can also simulate robots that show no emotion at all.



Pacifism see p. B35

This is available to any artificial being sophisticated enough to qualify for mental disadvantages. But because of the way a machine might think, robots can have quite restricted forms of Pacifism. The following two examples are common .

"Organic-Specific" pacifism: the robot is a pacifist toward living things, but not to machines. This halves the value of the disadvantage. The reverse ("Machine-Specific") of this also available, but should only be allowed if robots are common!

"Species-Specific" pacifism: the robot is a pacifist toward certain species (usually its creator's species and other friendly species). But its Pacifism does not apply to anything else. This quarters the value of the disadvantage. In order to be worth even that many points, the species the Pacifism applies to must be very common (like humans) in the campaign.

Means of Control

Owners sometimes use slave implants or memory erasure to control troublesome robots, bioroids or cyborgs. These can give a character certain disadvantages, and set the scene for adventures in which the character seeks either revenge or his true past.

Slave Implants and Programs

This TL9 gadget is a small device that can be surgically implanted into an organic brain (cyborg, human or robot). It suppresses volition, giving the disadvantage Slave Mentality (p. 89, -40 points) and turning the character into a living zombie, much like a low-grade robot.

A person under a slave implant exists in a "dreamlike" state in which everything seems unreal; the best way to simulate this is for the GM to take over the player as an NPC while the implant is on. When the implant is removed or turned off, the character will often not remember everything that happened, particular if it was traumatic. For dramatic effect, the GM should give the character back his memory gradually, in flashbacks in response to stimuli he encounters. For instance, if a character under a slave implant was forced to fight as a gladiator, he may remember images of the fight only after seeing blood or a weapon like the one he used.

Because these implants create slaves who totally lack self-initiative, they do not see widespread use: more subtle psychological coercion is usually better in the long term. However, they are good for controlling prisoners, creating slaves for manual labor, or for disciplining disobedient androids or cyborgs . . .

A slave implant can be surgically removed (this takes three hours and a Surgery roll, failure means try again a cumulative -2, critical failure causing a loss of 1 point of DX or IQ). The implant can be turned on or off by anyone who has the proper codes (usually voice-activated). Thus, a victim of a slave implant may spend part of his time controlled, part free.

A similar "slave program" (often a hardwired ROM chip rather than an actual program) can be programmed into a neural-net or sentient robot by anyone who has acquired the robot's command codes. It functions in the same way as a slave implant. It can be removed by reprogramming the robot (or removing the ROM chip).

A slave implant for an organic brain costs $10,000 and is TL9. A slave program is only $1,000 and is Complexity 1.

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Means of Control (Continued)

Memory Erasure and Brainwipe

Any robot can have its memory erased by simply deleting its programs. This can be done by anyone with the robot's command codes (p. 57). Effectively, the robot has the -10 point Partial Amnesia disadvantage (p. B239) – it won't have total Amnesia, since knowledge of its skills and abilities are unlike to be erased.

At TL10 (maybe earlier, if the GM wants) a medical procedure called "brainwipe" can perform this kind of memory erasure on an organic brain, like a human, cyborg or biological android. This procedure is often used on cyborgs (so they will "adjust" to their new bodies and forget their old lives) or on biological androids that have shown signs of rebellion.

Brainwipe equipment costs $50,000, weighs 500 lbs. and takes up 27 cf. The procedure takes an hour and requires an Electronics Operation (Medical) roll. Failure means that some memory may be retained, drifting back after days or months.

Robots, Cyborgs, and Skills

Some categories of skills require special consideration when they are used by robots or cyborgs.

Skills Requiring Hands

Many skills require arms equipped with hands to use fully. A robot with only no arms, or with striker arms or arms with a bad grip will be at a disadvantage. There are too many skills in this category to mention, so the GM will have to adjudicate this on a case-by-case basis. In many circumstances, such as Mechanic or Cooking, a robot can still use the skill if it has appropriate tools built into it, or use it to give advice. For some skills, Gambling for instance, a robot can use the skill just by having someone else – human or machine – act as its hand. Many skills can *only* be used if the robot has arms and hands: Two-Handed Sword requires two hands. None of these skills are banned, since a robot can always get some use out of them by remotely controlling another robot that *does* have arms.

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Poverty — see p. B26

Unless artificial beings are free citizens, they'll usually have Poverty at the Dead Broke level: they aren't paid for work, they can't own property and any money they are carrying really belongs to their owner. For ways to get around this, see Wealth on p. 84.

Primitive — see p. B26

This can reflect a being that was *designed* at a lower TL than usual.

Secret — see p. B238

This disadvantage is common for artificial life forms that are masquerading as humans.

Sense of Duty — see p. B39

If a robot is sophisticated enough to have mental disadvantages, it may develop a Sense of Duty to someone. Note that this is not the same thing as the robot being programmed to obey someone – see *Reprogrammable Duty* on p. 89. Some robots may have a Sense of Duty to a larger group than their owner. For example, a classic science fiction theme has sentient robots developing a Sense of Duty to Mankind, and, since they are more intelligent and logical, taking over the world in our own best interests!

Social Stigma — see p. B27

This is one of the most common disadvantages suffered by artificial beings. A being that can pass as a human need only take this stigma if it's true nature is well known by many people (otherwise, take a Secret).

The usual form of this is Valuable Property (-10 points). The being is assumed to be owned by someone, and is treated as a thing rather than as a free person. Except for the expense entailed by its loss, few will mourn if it is damaged or destroyed ("it was only a machine") and people won't really care what it feels or wants.

An artificial being that has escaped its owner may have the Outlaw disadvantage (-15 points) instead of Valuable Property. Often this goes along with Enemies.

In societies where artificial beings are not equal to their creators but have achieved some civil rights, they may be considered Second-class Citizens or Minority Groups. If artificial beings are so rare that no specific discrimination exists (for instance, a robot visiting a time or place where the very concept of robots is unknown), it might simply be considered an Outsider or a Barbarian.

New Disadvantages

Cannot Learn — -30 points

A robot with this disadvantage cannot improve its IQ or DX by spending character points, nor can it spend character points to improve skills. It is stuck with whatever is built or programmed into it. This disadvantage is already included in the design cost of all robots that do not have sentient or neural-net brains (and is one reason why they aren't recommended as characters) and is worth *no extra points* for them. Its point cost is listed here for reference only: robots with sentient or neural-net brains, cyborgs and biological androids will not have this disadvantage.

Low Empathy — -15 points

You have trouble understanding emotions and as a result have difficulty interacting socially with people who do have them. This doesn't prevent you having and showing emotions of your own (provided you don't have something like No Sense of Humor) – your problem is you don't really *understand* them.

You may not take the Empathy advantage, and suffer a -3 penalty to use of all skills that rely in whole or part on understanding someone's emotional motivation. This applies in particular to Acting, Carousing, Criminology, Detect Lies, Fast-Talk, Leadership, Merchant, Politics, Psychology and Sex Appeal. You can still have these skills – you just aren't as good at them as someone without this disadvantage.

This advantage is very common in any artificial creation, not just robots but also biological androids that have been raised in vats rather than with surrogate parents. It's also very appropriate for robots, especially those that lack neural-net or sentient brains. Not every robot or biological android will have it, though. An entity that had a close relationship with its creators, or which has spent years working with humans or time studying them may have "bought it off" and be perfectly comfortable dealing with emotions. Some cyborgs may even develop low empathy, feeling isolated from humans within their metal shells.

No Natural Healing — -20 points

Unlike humans who get a HT roll to heal every day, damage to you requires repair.

Unless a cyborg or robot has a living metal or biomechanical body, it already has this disadvantage – its -20 points are already included in the robot's point cost. Biological androids can't take this disadvantage as individuals; living metal and biomechanical robots can take it, to represent a malfunctioning self-repair system.

Obsession: Unknown Creator — -5 points

You are an artificial being (a biological android or robot) but do not know who created you. You are obsessed (see *Obsession* on p. B241) with the goal of trying to find your creator (or if a biological android, your genetic donor) as well as details of how and why you were created. If you find him, you will initially have a very good reaction to such a person, although what you learn may change that. You will be willing to make deals with people – even enemies – in order to aid your search. Also, having no known lineage, you lack of a baseline to compare yourself to, which can cause problems with self-esteem as well as identity, and make it difficult to find things like spare parts. The GM should secretly decide on your background, and come up with a reason why you don't know who your creator is: partial memory erasure, military secrecy, or whatever. Perhaps you were even raised by surrogate human parents, and until recently believed you were a "real" person, rather than a machine?

(If you don't know who your creator is, but aren't especially obsessed with finding out the answer, this is a -1 point Quirk.)

Reprogrammable Duty — -25 points

You can be programmed to obey a particular master, as described on p. 57. This is a form of all-the-time Involuntary Duty (p. B238), except that someone can reprogram you to change your master. (This is included in the cost of a non-sentient robot's brain.)

If you have a Slave Mentality, you must obey your master slavishly, remaining strictly within the letter of any commands you are given. If you do not have a Slave Mentality, you may interpret his orders creatively, as long as you remain within either their letter or spirit (your choice). If you aren't sentient, you will have no interest in doing anything other than your programmed duty!

A Reprogrammable Duty may be taken in addition to a Duty to some organization or the like. A robot could have a responsibility to one person or organization, but be reprogrammed to serve another, for instance, creating a possible clash of loyalities. In such cases, the programmed duty has precedence, but the robot will try to fufill other duties as best it can.

Slave Mentality — -40 points

No matter how intelligent you are, you have no sense of self and little initiative or creativity of your own. You become confused and ineffectual when not following a master's orders.

For instance, you could be quite intelligent enough to obey the command "plot a course to the Phoenix Sector and pilot the ship there," but if you ran out of energy and found $100 to buy a new power cell, you would be hard-pressed to decide to pick up the money and purchase a recharge – unless your owner told you to.

You must roll vs. IQ-8 before taking any action that's not either obeying a direct order or part of an established routine. Orders must be precise. Being given more than one contingency order or a long chain of orders will simply confuse you. You make Will rolls at -6.

Every robot that lacks a neural-net or sentient brain has this disadvantage. Its -40 points is already included in the design cost of these robots, and thus it is worth no extra points for them. A more sophisticated artificial life form, such as a neural-net or sentient robot, a cyborg, or a biological android, is by definition one with enough initiative to avoid having a Slave Mentality. However, the brain of a cyborg, android or sophisticated robot can be fitted with a gadget which duplicates this disadvantage's effect: see the *Means of Control* sidebar on p. 87. Such characters can take this disadvantage.

Robots, Cyborgs, and Skills (Continued)

Animal Skills

Animals may be frightened by robots or cyborgs that are not shaped like familiar living things or machines. A machine that lacks living flesh may also smell odd. Of course, if an animal is familiar with cars or tractors, for instance, a vehicle-like robot will be unlikely to frighten it – unless the robot does something unexpected like talking or trying to grab it! In general, if a strange robot tries to calm, ride or control an animal, using animal skills will normally be at -3 or worse.

Artistic Skills

A robot can have artistic skills, but unless it is sentient, it lacks "true creativity." In particular, if it has the Slave Mentality disadvantage may be technically good, but not creative or original. It takes no penalty if it can copy another's work or performance. If it is ordered to copy several human works, mix styles, and come up with something unique, it does so at -4; whether the result is art or not is anyone's guess.

Artist, Calligraphy or Sculpting skill usually requires the robot either have arms with hands or built-in tools. But the robot could compose its work entirely as a graphics file (CAD/CAM file for Sculpting) and then have a printer or machine execute it.

Dancing requires legs or a flexibody. If the robot does not *also* have arms, it takes a -2 penalty.

Musical Instrument requires arms with hands, or building the instrument into the robot. Any robot that does not have the Mute option can take Musical Instrument (Synthesizer) skill and use its own vocal apparatus to duplicate a synthesizer. If it has Superior Voice or Silver Tongue it gets a +2 to skill.

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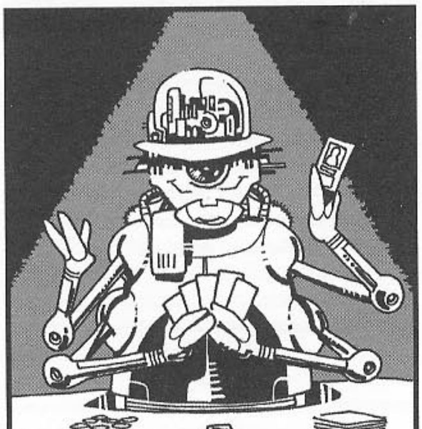

Robots, Cyborgs, and Skills (Continued)

Craft Skills

A robot or cyborg requires arms, usually with either hands or built-in tools, to perform these skills by itself. A robot without usable manipulators can still have Craft skill, but the only way it can then build or repair something is by giving orders to other robots. If it has more or less than the usual number of manipulator arms, it may be faster or slower when repairing or assembling, or dissembling things. Divide the time required by (.5 × number of arms). Only count arms that either have built-in tools or are capable of holding them *and* which the GM decides are strong enough for the task at hand. A dozen ST 1 arms are great for a watchmaker but of limited help cutting wood. If the GM rules that too many arms would just get in the way, assume that the time can't be reduced below half normal. The number of arms won't affect conceptual tasks, such as figuring out how something works, or designing a gadget.

Vehicle Skills

A robot or cyborg must be the right size and shape to fit into a vehicle in order to drive it! Some vehicles (e.g., cars or any cycles) require arms *and* legs to drive. If a vehicle has computerized electronic controls (most TL8+ vehicles, and some advanced TL7 vehicles, like aircraft apply) it can be fitted with an interface port for $100 or so. Then the machine can use its cable jack to plug into it, controlling it without requiring hands and at a +4 to skill.

Skills that Work Differently

Detect Lies

A robot or cyborg that has learned or been programmed with this skill is more likely to use it by studying the subject's physiological responses rather than its emotional ones, which it probably doesn't understand very well anyway! The built-in sensor package can help it function as a lie detector: it adds bonuses for Acute Hearing and Discriminatory Smell. It smells fear and sweat, listens to the subject's heartbeat and respiration, and feels its pulse. Also, add +1 if the robot has Infrared Vision, or +2 if it has Thermograph or Spectrum Vision – it can see traces of heat of blood moving to the face from partly-masked anger or embarrassment, for instance.

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Quirks

Any artificial being can have the normal number of Quirks, much like a human. A robot doesn't have to be a neural-net or sentient: what with bugs in their programming, manufacturer defects, practical joking factory programmers, combat damage, or the neglect of regular maintenance, even the dumbest Complexity 1 brain can develop an exasperating variety of quirks without human aid! For instance, PCs may discover that their XTD-30 astromech 'bot was programmed with a Scottish accent, or encounter a police robot who *always* pauses to read a suspect his rights before bringing him in – even if the suspect is dead or unconscious. Other robot quirks can be more physical than mental: anything from "leaks lubricant fluid" to "whirs and clicks loudly" is possible.

Skills

Biological androids, cyborgs and robots with neural-net or sentient computer brains may have learned skills in the same way that humans learn: by experience or training.

A biological android is limited to twice its chronological age in skills, plus 2 skill points per month it spent in "deep learning" to a maximum of 36 points (see Chapter 4, *Biological Androids*).

A cyborg or robot with a neural-net or computer brain is limited to twice its chronological age in skills, just like a human. For a cyborg, these skills may include ones that it picked up before being turned into a machine. Note that, since all robots have Eidetic Memory level two, points placed into normal mental skills count quadruple.

A robot may also have been already *programmed* with skills; the character point cost of these has already been paid as part of the robot's programming cost and don't count against this limit. Character points from programmed and learned skills are additive, as explained under *Skill Programs* on p. 60.

Biological androids can generally take and use any skill a human can. For robots and cyborgs, it's not quite that simple: see the sidebar for some skills that work in different ways.

There are a few skills that are especially important in any campaign involving robots or androids.

Electronics/TL (Computers or Cybernetics) — see p. B60

The Computers specialization is used to design or repair robot brains. The Cybernetics specialization is used to build or repair cyborg brains.

Engineering/TL (Robotics) — see p. B60

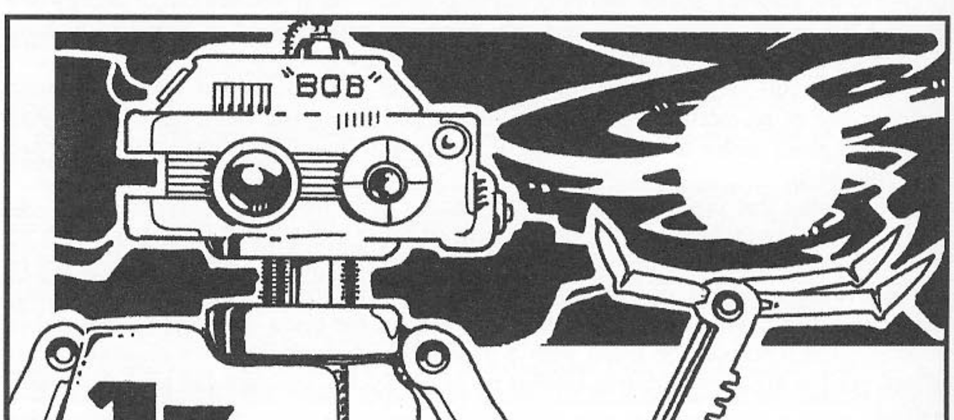
This specialization is used to design, build or repair robot or cyborg bodies.

Genetics/TL (Genetic Engineering) — see p. B61

This speciality is used to design biological androids.

Mechanic/TL (Robotics) — see p. B54

This speciality can also be used to repair and maintain robot and cyborg bodies, although Engineering is needed to design them.



Psychology/TL (Artificial Beings) see p. B62

This speciality is needed to fully understand the psychology of created life forms. Using the optional specialization rules (p. B43) a "robo-psychologist" gets +5 when dealing with artificial life forms but -1 when dealing with ordinary subjects.

This defaults to at -5 to Computer Programming when dealing with robots and computers.

Robot and Cyborg Character Development

A biological android can improve its attributes and skills just like a human. For a robot or cyborg, it's not quite so easy.

A robot can earn character points through experience, but it cannot buy up ST or HT with them, and cannot always improve skills directly. However, it *can* use them in three ways:

First, it can buy off any disadvantages (except those inherent to its robot model) using the normal rules for doing so. In general, there should be a justification in play before the robot can do this. For instance, for a robot to buy off its Sense of Duty (owner) its owner could have been killed, its programming might have been altered, or it might have suffered an accident that jolted its brain and somehow erased that program. Or it could decide that two of its disadvantages are logically contradictory and "delete" one. For example, "I am superior to humans (Overconfidence/Megalomania), yet I am required to obey a human (Sense of Duty to Owner). Delete Sense of Duty."

Second, a cyborg, or a robot with a neural-net or sentient computer brain, can improve its DX, IQ or existing skills (whether learned or programmed) and buy new skills just like a human. A robot without these brain options cannot do so – it has the disadvantage Cannot Learn.

Third, the robot or cyborg can pay for physical modifications or new programs. To do this it must buy, find, or otherwise acquire the program or parts needed for the modification. If this requires an adventure, the GM can grant some or all of the experience points gained in the adventure toward paying for the program or modification.

If a robot adds a new program to its memory, it should pay for it in character points, using the costs shown in the *Brains and Programs* chapter. The robot can get around this cost by deleting an existing program from memory at the same time.

If a robot has itself rebuilt, these modifications may alter the model point cost of the robot and must be paid for.

Magic Aptitude and Robots

Can robots cast spells? That's up to the GM. If you don't want spellcasting robots, assume that magic is inherently biological, and the only way a machine can use them is if it had a mage's brain cyborged into it. But for other campaigns . . .

Magical Aptitude

Magery (p. B21) is such a nebulous quality that GMs will have to decide for themselves whether robots can have it!

Unless an artificial body interferes with magic use (which is not the case in the default ***GURPS*** magic system) there is no reason why a robot with a cyborg brain couldn't be a mage.

For robots without cyborg brains, we recommend that only those robots with Complexity 5 or higher computer brains with either sentient or neural-net options be allowed to buy Magery.

Optionally, "technomagic" can be used to deliberately create a robot mage. Use the following spell.

Create Mana Co-Processor — *Enchantment (M/VH)*

To give a computer brain Magery requires the casting of this enchantment spell. It can be cast on any neural net or AI computer brain of Complexity 5 or better.

Prerequisites: Magery 3, Computer Programming-20.

Energy Cost: Cost to enchant is 15,000 energy points for Magery 1, 25,000 for Magery 2, 35,000 for Magery 3.

Skills that Work Differently (Continued)

Robots and Cyborgs in Freefall

A robot or cyborg who fails a Freefall roll is not required to make a HT roll like a human to avoid being spacesick. Instead, it makes an IQ roll and if it fails, it is mentally stunned (disoriented) for 2d turns.

Sex Appeal and Robots

A robot should be of a more-or-less humanoid shape to use this skill on a human, unless its partner has very odd tastes, or unless it is in a medium where looks don't matter, such as dating over the phone or in a shared virtual reality. These modifiers apply to Sex Appeal rolls if the robot is in person: -3 penalty if it is biomorphic, but has no flesh (if it looks good, it can *still* be considered sexy); -1 penalty if the encounter is sexual and the robot has no sex implant. If the robot is shaped like a living being but is obviously alien, it may or may not attract interest – that depends on the orientation of the potential partner.

Sex appeal may work normally on cyborgs and biological androids. The GM should decide whether Sex Appeal can work *on* a robot – it won't unless the robot has developed a quirk ("attracted to humans") or has Lecherousness.

Robot Mages

A robot needs a *Mana Co-Processor* brain option if it is to cast spells. This is an option for any Complexity 5 or higher robot brain, and is $15,000 for Magery 1, $25,000 for Magery 2, $35,000 for Magery 3. This covers the cost of exotic materials used to manufacture it (for instance, refined sand from an extra-dimensional beach used to make a silicon chip, black opal circuitry, and so on). In addition, add the cost charged by the enchanter. The Mana Co-Processor has negligible mass and volume and is destroyed when the robot's brain is destroyed. Creating a Mana Co-Processor requires a special spell, described on this page.

A robot with a mana co-processor can cast spells it is programmed with. Spells cost the same as other skill programs (p. 60), but availability is likely to be *very* limited unless the robot exists within a technomagical society.

If Magery is a prerequisite for a spell, the robot requires a Mana Co-Processor to be able to run that spell program.

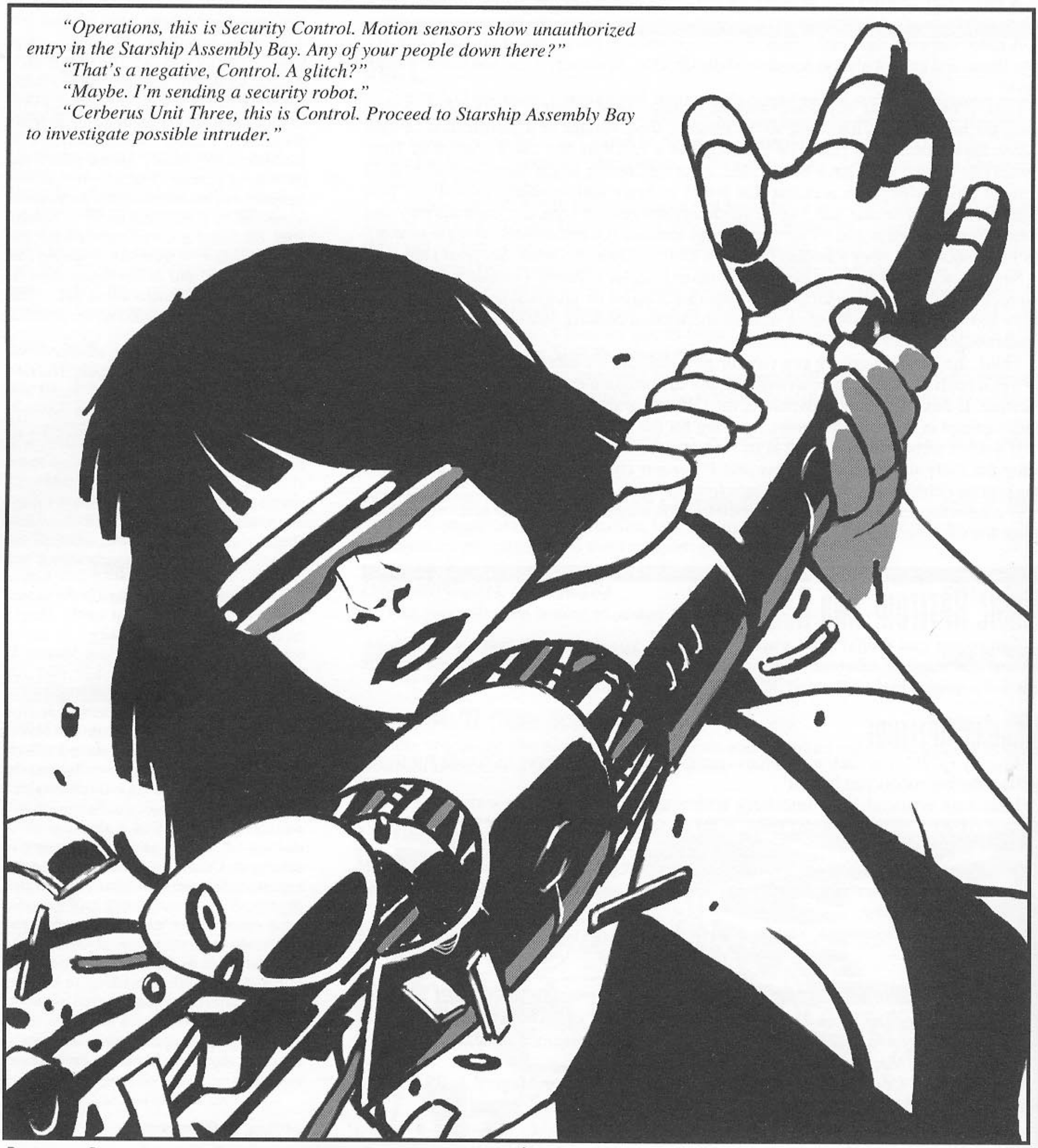
ROBOTS IN ACTION 6

"Operations, this is Security Control. Motion sensors show unauthorized entry in the Starship Assembly Bay. Any of your people down there?"

"That's a negative, Control. A glitch?"

"Maybe. I'm sending a security robot."

"Cerberus Unit Three, this is Control. Proceed to Starship Assembly Bay to investigate possible intruder."



"Cerberus Three to Control. My bioscanner confirms unauthorized human life form in area. Am closing . . . . Have achieved visual identification: life form is human female, unarmored, holding small hand weapon. Running weapon library scan. Weapon identified as needler. Threat level minimal."

"Cerberus Three, this is Security Control. You are authorized to subdue the intruder."

"Affirmative. Stunner firing. Hit achieved. No effect on target. Intruder closing fast. Intruder is . . ."

"Cerberus Three, report. Your telemetry is breaking up."

"Am in close combat with intruder and sustaining damage. Warning! Initial scan in error. Intruder reclassified as combat android. Upgrading threat level to maximum."

"Cerberus Three, you are authorized to use lethal force."

"Negative capability. Left arm containing laser weapon is no longer attached to this unit. Am sustaining heavy damage. Positive ID on intruder: SY-101-N covert operations robot. Warning! Total systems failure is imminent. Total sys –"

"Security Control to all Cerberus units, proceed to Starship Assembly Bay! Red alert!"

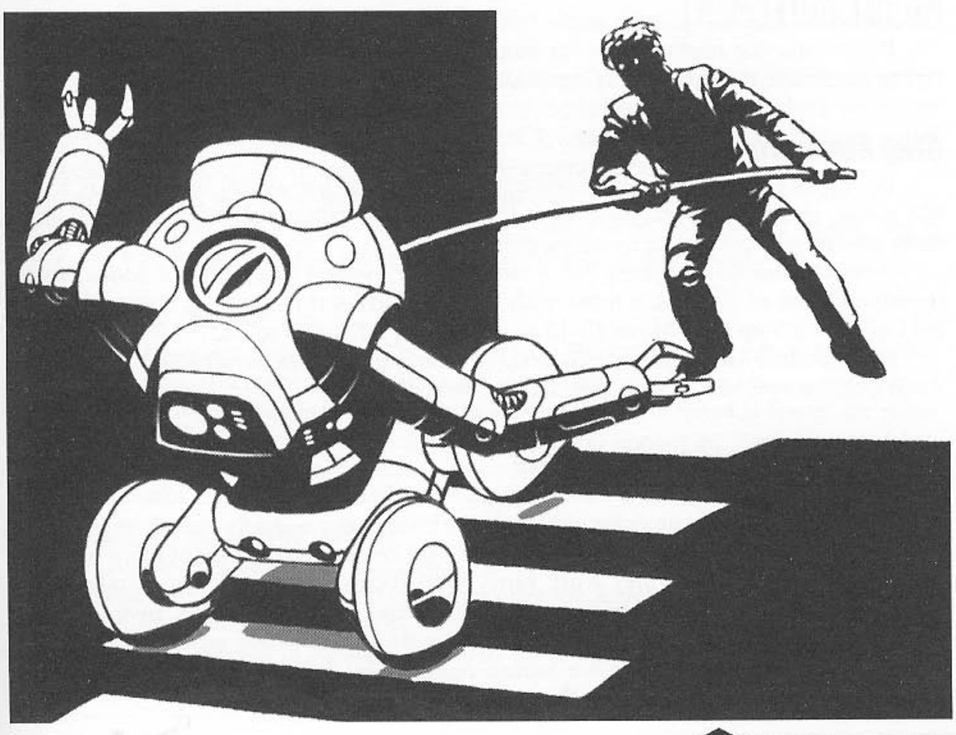
This chapter discusses how robots move, fight, take damage and are repaired. Robots use the same rules for movement, combat and other action that humans do, with several exceptions. Some of these are obvious: if a robot doesn't have arms, it can't lift or manipulate objects; if it lacks audio sensors, it can't hear. Others require special rules, which are covered in this chapter.

Robot Strength

Robots often have multiple ST attributes: a body ST for the robot's body (and legs, if any) and different ST value for each of its arms. If a robot is lifting, pushing, grappling or striking with an arm, use the arm's ST. If it is lifting and moving things on its back, or slamming, use its basic ST.

Fatigue and ST

Robots don't have a fatigue score. Robots take no Fatigue from combat, long marches, running or swimming, or losing sleep. They ignore magical or psionic attacks that would cause a human to take Fatigue. A robot may not use Extra Effort. If a robot is overtaxed, decrease the interval between maintenance checks and increase power or fuel usage.



Fast-Moving Robots (Optional)

Robots that move at high speeds should take some time to reach their top speed, or slow down from it, and will also be less maneuverable. These rules can and should be ignored for slow-moving robots – those moving at velocities 10 yards per turn or slower. But when a robot moves faster than this, it should move more like a vehicle than a person. Use the following rules:

Velocity: Unless a robot accelerates or decelerates, it must move the same number of yards that it moved on their previous turn. This is its velocity; keep track of it.

Acceleration: In a single turn, a robot that accelerates can increase its current velocity by a maximum that depends on how it moves:

Moving on two legs: (top Speed minus velocity)/3.

Moving on three or more legs: (top Speed minus velocity)/5.

Moving on wheels or tracks: (top Speed minus velocity)/10.

Moving by any other means: (top Speed minus velocity)/20.

If a robot's acceleration would be less than .5 yard per second (1 mph), treat its acceleration as .5 yard per second.

Deceleration: In a single turn, a robot that decelerates can decrease its current velocity by a maximum that depends on how it moves:

Moving via two legs: 5 + (top Speed/3).

Moving via three or more legs: 5 + (top Speed/5).

Moving via wheels or tracks: 5 + (top Speed/10).

Moving by any other means: 5 + (top Speed/20), maximum 10.

Deceleration cannot exceed 20, however.

Turning: GMs may wish to use the rules on turning radius on p. B139 to restrict the maneuverability of high-speed robots.

These rules are intended as a playable simplification – for more complex and realistic handling of acceleration, deceleration and turning, calculate a robot's statistics like that of a vehicle, and use the rules in ***GURPS Vehicles, Second Edition.***

Weapon Placement and Arc of Fire

Where a weapon was placed in the robot determines what direction it can fire. If a weapon is placed in the body or a pod, decide which side of the body it points out of. It can only fire in that direction. If a weapon is mounted in an arm it can fire in any direction the robot points the arm. If a weapon is mounted in a head, it can fire in any direction the head turn to face.

Cinematic Combat

Science fiction is full of classic ways humans can defeat robots. Not all of these are appropriate for a serious campaign, but they are especially appropriate for a cinematic one. All of these rules are optional; some will unbalance a serious campaign.

Paint on the Sensors: Or glue or spaghetti – anything sticky. A successful DX or throwing roll, at -10 to hit (use an all-out attack!) with cover the robot's visual or thermal sensors, leaving it blind. An alternative is to place a cloak, tapestry or hat over its head, though if the robot has manipulator arms, these can be easily removed. In addition to having a -10 to hit (unless it has radar or other scanners), many movie robots who are blinded spin around out of control (give the robot an IQ roll to avoid panic) for 1d rounds due to disorientation, or fire wildly with weapons destroying friend and foe alike. Some may even self-destruct! But most robots will usually rely on audio sensors or datalink from other robots to target opponents, or retreat.

Cinematic Knockback: In cinematic combat, a person with a shotgun or heavy pistol can sometimes stun a heavily armored robot even if his shot didn't penetrate DR. GMs may rationalize this as the robot pausing to evaluate the damage, the computer brain (being sensitive) suffering disruption, the robot being knocked off balance and taking a second for its gyros to reorient, or whatever. Besides rolling to see if it falls down, a robot that suffers knockback must make an IQ roll or be mentally stunned for one turn. The roll is at -2 per hex the robot was knocked back.

Pushing Them Over: Not a bad tactic; robots without legs often find it difficult to right themselves if they are unbalanced. Use normal slam procedure – see the rules on *melee and close combat* for rules on robots and slams, and *effects of damage* under knockback for robots getting up again. A robot without legs, the flexibody option, or flight with hover capability will be unable to right itself unless its arms are strong enough to lift its weight.

Continued on next page . . .

Robots with Multiple Arms

A normal arm is just like a human arm; one with the Bad Grip option functions as a human arm, but at -4 to DX. A handless "striker" arm or a robot leg is capable of about the same degree of dexterity an handless human arm or a leg can manage: not very much, but it could push a large button, or push open a door.

Robots may have no, some, or many arms. A robot with no arms has no manipulatory ability at all. A robot with only one arm suffers the same hindrance as a human with the One Arm disadvantage.

A robot with multiple arms can use them in concert during normal situations (to repair a watch, for example). GMs may rule that the time required for a task is divided by (.5 × number of arms) the robot has, counting only those arms with the manipulatory ability and ST sufficient to perform the task.

A robot with multiple arms can carry multiple ready weapons. For instance, a three-armed robot could carry two pistols and a sword, for instance. It cannot make multiple attacks unless it takes the All-Out Attack option or has the Full Coordination program (p. 59). However, in close combat it gets a +2 modifier per extra arm (over the first two) on any attempt to grapple, pin, or break free from a grapple or pin.

Other Robot Characteristics

Robots do not normally need to eat, drink, sleep or excrete wastes. (Robots with bioconvertor power plants are the exception.) Robots may require downtime for maintenance and checkups – see p. 100.

Robots sometimes shut down, to conserve power. The owner of a robot may order it to shut down, or allow it to do so when necessary. A robot that shuts down uses no fuel and only the tiniest trickle of power (to maintain an internal clock, and a communicator or audio sensor) and is unaware of its surroundings and unconscious. A robot that shuts itself down can set a specific time for reawakening, after which it will power-up and "awaken" or arrange to be awakened on receiving a pre-set signal, wakeup code, or whatever.

A robot is mentally stunned on the turn it awakens (unless it has Combat Reflexes) as its systems come on line. After that it is fully alert.

Robots are immune to Fright Checks. Will rolls may still be required to overcome a Mental Disadvantage, in which case the robot's Will is its IQ.

Robot Movement

Robots use the normal rules for humans, with the modifications described below; flying robots use the rules for flying animals described in the ***Basic Set.***

Step Maneuvers

In ordinary combat, the *Step* portion of a *Step and (anything)* maneuver is a one-hex move. However, a very fast robot (or android or cyborg) should be able to cover more ground without losing its active defenses.

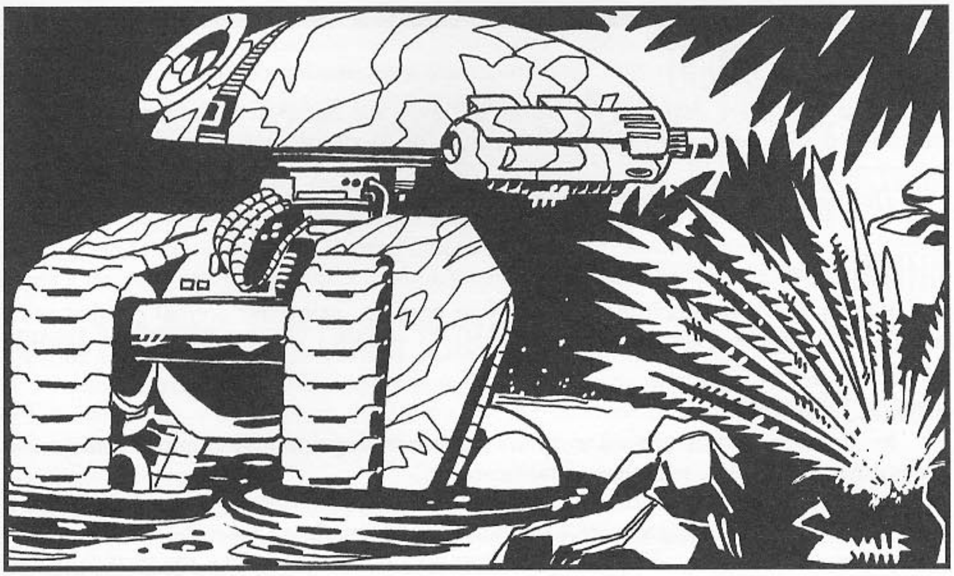
A robot, android or cyborg has a step of 1 for every 4 *full* points of Move, with a minimum value of 1. Thus, a robot with Move 0-7 gives it the normal Step of 1; Move 8-11 gives it a Step of 2, Move 12-15 gives it a Step of 3, and so on.

Multiple-hex Steps can be broken up in a turn: thus a robot with Move 14 and Step 3 could move up 1 hex, attack, then move 2 hexes back.

Using Encumbrance with Robots

Rather than recalculate a robot's statistics whenever it carries something, GMs may wish to use the Encumbrance rules. If the robot has two or three legs use the rules for humans on p. B76. Otherwise, use the rules for beasts on p. B145 for other robots.

These encumbrance rules work fairly well for robots with Speeds under 10 (if using the human rules) or 20 (if using the beast rules). For faster robots, instead of subtracting directly from Speed to get Move, multiply the Move penalty for a given encumbrance by 20% (if using the human rules) or by 10% (if using the beast rules), and subtract that *percentage* from Move, rounding down.



Other Movement Rules

Multi-Hex Robots: Large robots may occupy multiple hexes. Use the rules for multi-hex animals on p. B141.

Running Long Distances: Because robots are mechanical, they do not slow down when running long distances (p. B88), nor do they suffer exhaustion. (Of course, they may run out of power or fuel, or even need maintenance if the distances are *really* long.)

Jumping: Only robots with legs or flexibodies can jump without some kind of a ramp; use the jumping rules on p. B88.

Climbing: Only robots with a flexibody, or two or more limbs (either legs, or arms strong enough to lift its weight) can climb; use the rules on p. B89. Only a robot with arms capable of lifting its own weight can shinny up a rope.

Crawling, Crouching and Kneeling: Only robots with either flexibodies or one or more limbs (either legs, or arms strong enough to lift the robot's weight) can crawl. Only robots with flexibodies or legs may crouch or kneel. Robots unable to kneel, and any robot with a flexibody, are usually be built low enough to the ground to pick up objects without having to kneel first.

Movement On the Ground

A robot that has legs or a flexibody can move across almost any terrain, just like a human.

A robot with tracks has its top speed halved when moving through thick woods, swamps, mud or very rocky, hilly ground.

A robot with wheels can only move at full speed on a smooth floor, road, or smooth rock. Across ordinary firm grass its top speed is halved; through thick woods or over soft sand it cannot exceed 15% of top speed. It cannot exceed 10% of its top speed over broken ground, or 5% of top speed through swamps or mud.

A robot with a ground-effect skirt can skim over mud, sand or even water as if it was smooth ground, but heavily-wooded terrain limits it to 15% of top speed, and it can't move through broken ground or climb steep slopes or stairs at all.

Movement In the Air

Flying robots uses the flying rules on p. B139. However, some robot designs will have a stall speed. If a robot has a stall speed, it can only take off or remain airborne as long as its current air speed is greater than its stall speed. If its speed is lower, the robot will stall. A stalling robot can do nothing but dive and accelerate, until its speed has increased above its stall speed, or it hits the ground and crashes.

Movement On or Under Water

Only robots that can float (those with flotation hulls or submersible hulls) can move on water, although hovercraft can skim over the surface. Sealed robots can drive underwater; underwater terrain is generally mud. An unsealed robot submerged in water will lose 1d percent of its body and turret hit points (minimum 1d hits) plus a further percentage every minute until disabled.

Cinematic Combat (Continued)

Defeat Them With Logical Paradoxes: This normally only works in a cinematic campaign, and only if the GM thinks it applies! To be confused, the robot must have at least an IQ of 8 and be willing or forced to listen. Furthermore, they can't just say "I always lie; I'm telling a lie" or ask it to compute the value of *pi* to the last digit and watch it self-destruct. Instead, the adventurers must confront the robot with a paradox in its own main programming. Success may also require a successful Contest of Psychology, Fast Talk or Computer Programming vs. the robot's IQ; if successful, the robot may go into a frenzy of sorts, attempting to justify itself or resolve the paradox instead of attacking; it will possibly be Mentally Stunned. In some cases, the effects of a success may be more severe: suppose a robot is programmed to eliminate life. However, if the definition of "life" it is programmed with is one that is broad enough to include the robot, and the PCs point this out, the robot might conveniently decide to destroy itself.

The Vat of Molten Metal: There always seems to be one of these handy when a heavily-armored robot needs to be disposed of in true cinematic fashion! The preferred method is to lure the robot next to the vat, then achieve a one-hex knockback or slam, or get it to fall over and fail a DX roll. If an attacker grabs the robot or slams it, the GM can give a self-sacrificing PC a one-time +5 bonus to ST if he specifies that he is holding onto the robot as it plummets and following it to his doom! Immersion in a typical vat of molten metal does 10d damage each turn until the robot climbs out. Like a flamer hit, any DR that isn't sealed protects at half value. The robot's DR is damaged whether it is penetrated or not: it drops by 1 point per 10 hits of damage rolled, so the robot will eventually melt. Loss of 20% of DR will "unseal" the robot, by which time it's in big trouble.

Cinematic Survival

When humans fight robots, the robots often have big guns. A single gatling laser, minigun or anti-tank rocket can blow an unamored hero into next week. Besides using the normal cinematic rules from p. B183, GM's should consider the following options:

Cinematic Explosions: The explosion damage (p. B121) from grenades, shells, rockets, and the like fired by robots against lightly armored foes does no direct damage. Instead, it only disarrays clothing, blackens faces, and most importantly, counts for knockback. For every hex a person is knocked back by an explosion he should take one hit of crushing damage.

Continued on next page . . .

Robots in Combat

Some robots are designed for battle, but even the dumbest maintenance 'bot can be ordered into combat to slam into people, or to swipe at foes with its limbs or power-mop.

This section describes how robots fight.

Attacks

Robots attack in much the same way as humans, using the normal combat rules and their programmed skills or defaults.

Ranged Combat

Robots with built-in ranged weapons and possessing appropriate programming use the normal firing rules, with these modifications:

Target Size and Signature: The *size* modifier (p. B201) is vitally important in robot combat; obviously it's easier to hit a building-sized Ogre than a robot rat.

Chameleon Systems: These surface features (see p. 42) reduce the chance of the robot being hit.

Hand-held Weapons: A robot with arms and hands can also use human-style ranged weapons if its arm has enough ST. Reduce effective recoil from weapons mounted *in* the robot by 1 for every full 200 lbs. the robot weighs.

Internal Weapons: A robot with multiple built-in ranged weapons may fire one or more at once *at a single target.* Otherwise, the only way a robot may make multiple attacks (besides using the All-Out Attack option or a weapon with a high RoF) is if it uses a Full Coordination program (p. 59).

When a robot or cyborg fires internal weapons, its SS number is reduced by 5. This is the same benefit a human receives from a TL9+ Heads-Up Display (p. UT49), and is not cumulative with it. This does not apply if the robot or cyborg is effectively Blind and lacks compensating sensors like radar.

Melee and Close Combat

Any robot can strike with its arms. Arm-mounted weapons (p. 20) can also increase this damage, or deliver special attacks. Any arm that has a hand (that is, any arm that isn't a striker) can wield human-style weapons, or grapple in close combat.

Any robot, with or without arms, can slam into someone. Use the normal rules for slam attacks. On the ground, a 'bot moving on tracks, a flexibody, as a hovercraft or via three or more wheels is more stable than one on legs: if it slams or is slammed, add +4 to its ST on the roll to see who falls down.

A robot with legs can kick, doing Thrust+2/Crushing damage based on a strength equal to twice its body ST divided by its number of legs. A kick is at -2 to hit.

A robot with a head equipped with a jaw can do biting damage in close combat, based on the jaw's ST and type.

A robot with a flexibody can constrict its opponent, provided it is equal or larger in size than its victim (up to a maximum of ten times larger). Treat constriction as a grappling attack with a ST equal to the robot's Body ST.

Many robot tools are also useful for making melee attacks.

Defenses

All robots are programmed to avoid obstacles, but a robot may not recognize an attack as such until too late; use normal rules for surprise.

A robot with the Slave Mentality disadvantage will require an IQ roll (see *Slave Mentality* on p. 89) at a penalty in order to be able to make an active defenses if they are not specifically ordered to do so, unless they also have Combat Reflexes.

Move: A robot's Move is its Speed, modified by any encumbrance, rounded down to the nearest whole number.

Dodging

A robot's Dodge is calculated differently depending on how the robot moves: legs are more agile than wheels, for instance. Combat Reflexes will increase a robot's Dodge. A robot can retreat while dodging, just like a human.

Cinematic Combat (Continued)

Imperial Stormtrooper Marksmanship Academy: Enemy robots never hit with the first shot or first burst of automatic fire – it just lands close enough to make the target aware he's being shot at.

Hollywood Automatic Weapons: Opposing forces never get to use the *Aiming Successive Groups* rule (p. B121) and all burst fire counts as snapshots, never getting an Accuracy bonus.

Robot Combat Etiquette: Non-sentient robots attacking our heroes don't dodge or charge or even take cover: they just advance slowly and steadily at a walking pace, heedless of any fire! Once it gets close, any big, strong robot that has arms and hands will try to grab people rather than shoot or punch them.

Bulletproof Nudity: PCs can incrase PD by undressing. A ragged t-shirt or skintight bodysuit is PD 3, stripped to the waist or skimpy swimwear is PD 5, total nudity is PD 7. Add +1 for female PCs. This can also apply to androids.

Fire and Explosion

Fuel tanks have a *Fire* number. If the robot's body or subassembly containing a fuel tank loses takes damage greater than half its hit points from any single attack, roll 3d. If the amount is less than or equal to the "fire" number, the robot catches fire. Add +4 to the Fire number if the attack was one that normally sets things alight – a flamer, molotov cocktail, explosive warhead, etc.

The robot will take 2d damage plus another 2d every 10 seconds, ignoring DR. Fire damage is always applied to the location (body or head hit points) where the fire is taking place. The robot may be able to put the fire out by using fire extinguishers, diving into water, etc. – this is up to the GM. Every ten seconds that a fuel tank is on fire, half the current fuel is burned away. When all the fuel is gone, the tank is no longer on fire.

Once a fuel tank catches fire roll 3d each second vs. half the tank's Fire number. Success means the fuel tank explodes. The 'bot takes 6d × 10 damage per gallon of flammable fuel on board. If the 'bot has a self-sealing tank, only one-quarter of the total fuel will explode, but the rest is destroyed.

On the ground, a robot with two legs has a Dodge equal to its Move, to a maximum of 10. A flying robot, or one moving on the ground with three or more legs, has a Dodge of ½ Move or ½ DX, whichever is better, to a maximum of 10. Any other robot has Dodge of ¼ Move or ¼ DX, whichever is *worse,* to a maximum of 5. Round all fractions down.

Parrying and Blocking: A robot with arms can parry "bare handed" using Brawling, Judo or Karate skill, or parry with a weapon or block with a shield.

*PD Reduction: **GURPS High-Tech** Second Edition* introduced a rule in which PD is reduced by 1 per full 3d of damage an attack inflicts. GMs may consider this rule optional. Since PD only exceeds PD 6 in the case of deflector shields, this means any attack doing more than 18d damage effectively ignores PD. PD has no effect against explosions.

Damage to Robots – Basic Combat System

Apply damage that gets through DR to the robot's body hit points. When the body is reduced to or below 0 hit points, the robot must roll vs. Health each turn to continue functioning, and may risk destruction – see *Incapacitating or Destroying a Robot* on p. 98.

Impaling Damage and Robots

Robots do not take doubled damage from ordinary impaling attacks. However, blaster bolts, anti-particle beams, disruptor beams and x-ray or gamma-ray lasers do the normal doubled damage, as their radiation can disrupt robot electronics.

Hit Location – Advanced Combat System

When an attack is made against the robot, the attacker can choose what part of the robot to attack. Different parts of the robot will have different reactions to major damage. In some instances, they may have different PD and DR values as well, in which case these are used instead of the robot's body PD and DR.

Random location is used when a part of the robot must be randomly targeted. Roll 3d on the table below.

Hit Location Table

Random Location	*Part of the Robot*	*Hit Penalty*
4 or less	Brain	-7/-10*
5	Head	-5**
–	Sensor	-10**
6	Arm	-2**
7	Hand	-4**
8	Arm	-2**
9-11	Body	0
12-14	Leg, Track, GEV Skirt, or Wing	-2**
15-16	Wheel, or Rotary Wing	-4**
17+	Vital Area	-3/-6*

* If the attacker is not familar with the robot's internal design, as will be the case with most newly-encountered robots, add an extra -3 penalty. Use of Penetrating Vision or a successful Mechanic (Robotics)-5 roll can enable a character to correctly deduce a robot's design and use the smaller penalty.

** Not all robots will have these parts. If a system does not exist ("Head" is rolled and the robot has no head, for instance) treat as a body hit.

If multiple systems could be hit, roll randomly to see which one is. If the robot is in cover, only exposed locations can be hit. The effects of striking a particular location are detailed below. Unless noted otherwise, damage from a hit is applied to the robot's hit points in addition to any special effects the damage may inflict.

Not all robots will have the following locations; obviously, a robot cannot be attacked in a location it doesn't have.

Body: Damage is applied normally to the body's hit points. If the body is reduced to 0 hits or less, see *Incapacitating or Destroying a Robot.*

Vital Area: A vital area of the robot's body (such as the power system) is hit. Damage from any attack that exceeds the robot's DR is multiplied by 1.5.

Brain: Damage is applied to whatever part of the robot (head or body usually) contains the brain. In addition, damage that penetrated DR is doubled, and if any damage penetrated DR, the robot must roll vs. Health to avoid being stunned (as per knockdown, p. 99).

Head: Damage is applied normally to the head's hit points. If the head is reduced to 0 hits or less, see *Incapacitating or Destroying a Robot.*

Other Hazards and Robots

Robots do not suffer from starvation or dehydration, though they may run out of fuel or power.

Robots can ignore the effects of normal heat or cold: if it isn't hot or cold enough to do damage, the robot will function.

Robots do not normally bleed, although they may leak lubrication fluid. It's up to the GM whether this has the same effect as blood loss. Robots with simulated internal organs will bleed, but this has no effect on the robot's operation.

Poison, poison gas, smoke, disease and infection have no effect on robots.

A robot cannot be suffocated unless its power plant requires air (like an internal combustion engine) and is clogged or unable to find air, in which case it won't work. Most power plants described in ***GURPS Robots*** do not need air, but air-breathing power plants are discussed in more detail in ***GURPS Vehicles**, 2nd Edition.*

Against concussion damage or other hazards, a sealed robot is considered to have airtight armor.

Water and Robots

A robot that is immersed in water may short-circuit. If the robot is sealed, this will only happen if the seal is broken – see the description of *sealed* surface feature on p. 43.

An unsealed robot fully immersed (at least up to its head) in water must make a Health roll every turn. On a successful roll, it takes one hit of damage to each location that is underwater. On a failed roll, it suffers a total short-circuit! When a robot short-circuits, every location that is immersed drops to 0 hit points, usually disabling the robot. Anyone in contact with a short-circuiting robot takes 1d of damage.

Radiation and Robots

Robots may be exposed to radiation from hostile environments, nuclear explosions or accidents, or certain beam weapons.

Radiation exposure is measured in *rads.* When a robot is affected, record the total exposure the robot takes. Some typical radiation doses:

Solar flare (if unprotected by atmosphere) or near the reactor during a fission plant accident: 1,000 rads per hour.

One-megaton fission air or space burst at 2,000 yards: 6,600 rads.

Fallout on ground after one-megaton fission ground burst: 300 rads/hour after 1 hour, 130 rads/hour after 2hours, 39 rads/hour after 5 hours, 7 rads/hour after 1 day.

Continued on next page . . .

Radiation and Robots (Continued)

Direct hit by pulsar (anti-particle) beam: 10 rads × damage rolled before subtracting DR.

Radiation protection is measured in terms of its protection factor (PF). If the robot has protection, divide the rads received by the PF to determine the actual rads taken. Thick walls or earth barriers provide good shielding; a foot of earth has PF 8, two feet of earth have PF 8 × 8, etc., while a foot of concrete has PF 18, two feet have PF 18 × 18, etc. The PF of a robot with radiation shielding (p. 43) depends on its TL.

Unlike humans, robots don't suffer from cumulative radiation exposure. However, a sufficently powerful burst of radiation can fry a robot's electronic systems, killing its brain and other electronics. The dose needed to do this depends on TL:

TL7 . . . 100 rads	TL10 . . . 2,000 rads
TL8 . . . 200 rads	TL11 . . . 10,000 rads.
TL9 . . . 500 rads	

Robots with hardened brains are immune to this effect.

Damaged and Destroyed Brains

A brain will be destroyed if the part of the robot that contained its dominant brain was destroyed. This can also occur due to a critical hit. If this happens, or if the robot's memory was erased due to damage, the robot is effectively "dead." If it has a backup copy of its personality and memories somewhere, it may be able to be ressurected, although it will remember nothing since its last backup – see *Memory Backups* on p. 55. Data recovery (p. 62) techniques can also resurrect a robot.

If a computer brain stops functioning due to damage, but wasn't utterly destroyed, vital memory may still have been lost. Roll 3d against the robot's Health (HT+2 if it has a hardened brain). Subtract 1 for each multiple of negative HT below 0 that the part of the body or head was reduced to. If the roll succeeds, the robot's brain will retain its memory once that part of the body starts to function again. If the roll fails, the robot suffers partial amnesia when its brain is repaired. It does not remember anything that occurred within 1d × 10 minutes of the damage it suffered. In addition, the robot may have lost some data or programs – GM's option. This will usually be related to whatever it was doing at the time it took the damage, e.g., if it was firing a weapon, it may lose its Guns program. The program is gone. If the robot has a backup copy somewhere it can be replaced, of course. If the roll is a critical failure, the robot's memory has been erased, effectively "killing" the brain.

Data recovery (p. 62) can restore lost memories.

Arm: If the arm is reduced to 0 hit points, it is crippled. All components built into the arm stop working. If the robot has multiple arms, roll randomly to see which is hit. (Arms with shields are at -4 to hit, rather than -2.)

Hand: Damage over half the arm's hit points cripples the hand. (If the robot arm lacks a hand, treat this as an arm hit.) If the robot has multiple arms with hands, roll randomly to see which is hit. (A hand on an arm with a shield is -8 to hit.)

Leg, Track, GEV Skirt, or Wing: Damage is applied to one of these parts. If the robot doesn't have any of them, treat as a body hit. If it has more than one, roll randomly to see which was hit, and apply the damage to it. Tracks resist damage with a maximum DR of half the body's DR.

Wheel or Rotary Wing: Damage is applied to one of these parts. If the robot doesn't have any of them, treat as a body hit. If it has more than one, roll randomly to see which was hit. Wheels resist damage with a maximum DR of their (TL-5). Apply the damage to the robot's body hits, except:

If a leg, track, GEV skirt, wing, wheel or rotary wing is reduced to 0 hit points, it is crippled. The effects of a crippled leg, arm or whatever are described in *Crippling Robots* on p. 98.

Incapacitating or Destroying a Robot

If a body or head is reduced to 0 hits, it has taken very serious damage. Roll against the robot's overall Health (not hit points) every turn; on a failed roll the body or head stops working and any component built into it ceases to function as well. If the robot's only brain (wherever in the robot is) or power system ceases to function, the robot is unconscious, much like a human. It remains so until it is repaired.

When a robot arm is crippled, it and anything in it automatically stop working. Make a Health roll: the arm and everything in it is destroyed if a Health roll is failed. Otherwise, major repairs (p. 99) will fix the arm.

If a robot body or head is reduced to -1 × hit points, it must make a Health roll to avoid being destroyed, much like a human rolling to avoid death. The robot must roll once at -1 × hit points, and once more for every 5 hits of damage it is below that threshold.

At -5 × hit points, a robot head or body is automatically destroyed. At -10 × hit points, it is blown to bits or vaporized.

Unless a head or body has been destroyed, it can be repaired.

Crippling Robots

Leg: If a robot has two legs and one is crippled, the effects are the same as when a human suffers a crippled leg. For robots with three or more legs loss of legs reduces a robot's ground Speed when walking or running. Divide Speed by the number of legs, rounding up. That is the speed lost for each leg that is crippled. In addition, if all legs

on one corner or side of a robot are lost, the robot falls down, and can only move on the ground by crawling.

Wheels: If a robot has only one or two wheels, its top ground Speed using them drops to 0 when one wheel is crippled. If the robot is moving on the ground, roll vs. DX-10 to avoid loss of control.

If a robot has three wheels, its top ground Speed drops to 0 when an attack cripples its front wheel or when both its rear wheels are crippled. Roll vs. DX-7 to avoid loss of control. If the robot loses only one rear wheel, halve the robot's top ground Speed and roll vs. DX-4 to avoid loss of control.

If a robot has four or more wheels, its top ground Speed drops by 10% whenever a wheel is loss, and it must roll against its DX-2 to avoid loss of control. Its speed is halved when it loses half or more of its wheels; if it loses all the wheels on two corners roll vs. DX-6 to avoid loss of control.

Tracks: If the robot has two tracks and either or both are crippled, its Speed when moving on tracks drops to 0 and it must make a DX+4 roll to avoid losing control. A 'bot with four tracks suffers those effects only if it loses two or more tracks. If a single track is disabled speed is halved rather than reduced to 0 and the DX roll is at +6.

GEV Skirt: The robot's top speed using the GEV skirt is reduced to 0, and the robot is no longer hovering, and must make a DX roll to avoid losing control. If it was hovering over water or mud and can't float, it may sink.

If a robot has to make a DX roll to avoid losing control, it does so at -1 per 10 yards per second (20 mph) of its speed. Any time a robot fails a DX roll and loses control, it will overturn, fall over, flip over on its side, or the like. A fallen robot lacking either arms with ST sufficient to lift its own weight or flight with hover capability cannot right itself. If the robot was moving along the ground at speeds over 10 yards per turn when it lost control, it takes damage as if it had fallen from a distance equal to half its current speed in yards/second. (For example, a robot that loses control at a speed of 50 mph – Speed 25 – takes damage as if it had fallen from a height of 12 yards.)

Wings or Rotors: If a rotor or a wing is crippled and the robot was relying on it for lift, the robot will be unable to fly properly. If in flight, it should immediately try to land or switch to another means of flight, if it has one. Until it does so, it must make a DX roll each turn to maintain control (and on the turn it lands), with a -1 per 10 yards per second (20 mph) of current speed. If the roll fails, the crippled wing or rotor gives way, and the robot goes out of control and starts diving toward the ground. If it hits the ground, apply falling damage and add half its current speed to the distance it fell.

Shock, Knockback and Stunning

Damage to a robot never causes it to suffer shock or knockdown; in effect, all robots have High Pain Threshold.

Knockback: The number of hits required to knock a robot back 1 hex is equal to its weight in pounds/20, rounded up. Robots that are knocked back must make a DX roll to avoid falling over. If a robot falls and does not have either two or more legs, a flexibody, or the ability to hover, it can only right itself and move again if it has arms strong enough to lift itself upright. In any case, this requires two turns.

Knockout: If the location of the robot (body or head) that houses whatever brain is currently dominant loses more than one-half HT from a single attack, or if the attack was a hit on the brain hit location and any damage was done, the robot may be knocked out, much like a human! This represents jolting or otherwise damaging vital computer or (for cyborgs) life support systems. The robot must make a roll vs. Health, at +2 if the brain is a computer brain with the hardened option. If the roll fails, the robot is stunned. On a critical failure, the robot's brain ceases to function for 1d minutes, effectively knocking it out; unless the robot has some kind of backup brain, it is incapacitated.

Robot Critical Hits

Critical hits allow individual robot components to be damaged. If a robot takes a critical hit, the robot gets no defense roll.

Also, if a critical hit is taken to the head or body, roll on the body or head critical hit tables, as appropriate.

Robot Body Critical Hit Table

3 – Triple damage; also, if the robot has a cyborg or computer brain in its body and any damage penetrated DR, the brain is destroyed! If the robot has multiple brains, the largest brain is destroyed.

Repairs to Robot Brains

A damaged robot brain requires Electronics Operation (Computers) to repair. Besides the usual modifiers given on p. 62, add the following *cumulative* modifiers:

-1 per Complexity level of the brain.

-2 if a neural-net or sentient brain.

-1 if a genius brain (cutting edge technology is harder to fix!).

Also, if the brain is a biocomputer or cyborg brain, use the *lower* of Electronics Operation (Computers) or Electronics Operation (Medical).

Self-Repairs

A robot can perform repairs on itself, if it has the appropriate skills and tools and is still capable of using them. However, unless it has extra-flexible arms or is controlling other robots, attempts to repair itself will usually be at -3.

Robots with living-metal bodies (p. 70) may regenerate damage. They will regenerate a crippled part once all other damage is repaired.

Repairing Robots

Robots may be repaired using the skill Mechanic (Robotics), with the exception of robot weapons, which use Armoury, and robot brains, which use Electronics Operation (Computer).

Repairs

Repairing a damaged robot is normally a task for Mechanic (Robotics) skill.

If a body or head has hit points remaining, fixing damage is usually a "minor repair." This requires a half-hour's work per attempt. Success restores one point of lost HT times the amount the roll succeeded by (minium 1 hit). All normal modifiers for using the skill apply; see p. B54 for Mechanic skill modifiers.

If a body or head is down to 0 or few hits, fixing damage is a "major repair." It requires the same amount of time and repairs the same amount of hit points, but all rolls are at an extra -2 modifier. The GM may require a set of spare parts (costing perhaps 10-60% of the robot's cost) to fix the damage.

A critical hit or a hit to a particular hit location cripples a robot part is also a major repair. Success fixes that part. For crippled brains, see below.

See the description of tool kits for the tools needed for major or minor repairs.

Hiring a Mechanic: If a character isn't capable of doing the work, he can hire someone to fix the damage. At TL7, robot mechanics are quite rare, since most sophisticated robots are experimental prototypes. (On the other hand, many TL7 engineers will jump at the chance to tinker with a sophisticated robot...) At TL8+ and up "robot garages" may exist, charging about $100 per hour. A typical robot mechanic's skill is 11 + 1d.

Breakdowns and Maintenance

Robots require regular maintenance to work properly. (However, robots built from living metal do not require maintenance – if the entire robot is made of living metal, it is totally maintenance-free).

A robot should get a maintenance checkup every week or so that it is being used; very large or complex robots may need daily checkups. A robot that is doing nothing and has either been placed in storage (not sitting out in the rain or whatever) or has a sealed body doesn't require routine maintenance checkups.

Each maintenance checkup requires 4 hours and should be performed by someone with Mechanic (Robotics) skill with skill-8 or better and a toolkit or workshop. If a checkup is missed, roll vs. the robot's Health. Failure means the robot's HT drops by 1; this will increase the chance of a critical failure. A critical failure means a serious breakdown. Pick something on the robot and have it break down. Often it will be the robot's propulsion system (the robot can't use it to move) or motive system (treat as a crippled leg, track, or whatever). Or the brain could malfunction (treat as aquiring a disadvantage). The GM decides when a breakdown occurs – this could be in the middle of an adventure.

If a robot has lost Health due to missing maintenance checkups, this loss is cumulative. Lost Health can be regained: treat regaining a point of Health as making a minor repair (p. 99).

Robot Spellcasters

Robots with Magic Aptitude can cast spells normally, with a few exceptions: the robot cannot use any Fatigue or HT to power the spell. The energy for the spell must come from a powerstone either built into or carried by the robot.

Exception: A robot with a bioconvertor power plant gains Fatigue for this purpose equal to (power plant output in KW) × 50. As long as the power plant is provided with food, the robot can cast spells normally. However, it may never reduce its Fatigue below 2, and regains Fatigue normally.

The usual requirements for spellcasting rituals apply. For example, if an arm gesture and spoken incantation are needed, the robot must be able to talk and have arms to gesture with. Robots may, of course, know a spell at a high enough level to make gestures or verbal incantations unnecessary.

4 – Double normal damage.

5 – Bypasses 90% of armor DR and does normal damage (that is, divide armor's DR by 10). Also, whether any damage penetrated the body or not, an optical sensor in the robot's body (if any) is damaged. If applicable, give the robot the One Eye disadvantage (or eliminate the Many Eyes option). If it already has One Eye, treat the robot as Blind. If the robot is already Blind, disable another sensor (such as radar).

6 – Normal damage; also, the robot's power plant, if any, is damaged. The robot's largest power plant is badly damaged and its power output is halved (if damaged a second time, it stops working.) This may reduce the robot's speed, if the robot cannot provide sufficent power to the propulsion system. (If damaged again, it immediately stops working.) If the robot has an energy bank but no working power plant, treat as #14.

7-8 – Normal damage; also, if the robot has weapons in its body, one is struck in the barrel and disabled.

9-11 – No special effect.

12 – Normal damage. Also, any one accessory (tool, etc.) in the robot is disabled.

13 – Bypasses 90% of DR and does normal damage (i.e., divide armor's DR by 10).

14 – If the robot has an energy bank half the maximum KW of storage capacity (along with half the stored power) are lost. If the robot has no energy bank, treat as #6 above.

15 – Normal damage; also, if any damage penetrated armor, one body-mounted communication system or audio sensor is damaged. The GM should knock out one such capability possessed by the robot, such as radio or laser communications, or degrade the robot's hearing (for instance, give it Hard of Hearing or if it already has this, then Deafness).

16 – Double normal damage. Also, if robot has a fuel tank, check for fire, and it develops a leak. 1d% of the total fuel capacity leaks out immediately, plus (unless the tank is self-sealing) 1d6% every minute.

17 – Triple normal damage.

18 – Double normal damage; if the robot has a cyborg or computer brain in its body and any damage penetrated DR, the brain is destroyed! If the robot has multiple brains, the dominant brain is destroyed.

Robot Head Critical Hit Table

3 – Triple damage.

4 – Bypasses 90% of armor DR and does normal damage (i.e., divide armor's DR by 10).

5 – Normal damage; if the robot has a cyborg or computer brain in its head and any damage penetrated DR, the brain is destroyed! If the robot has multiple brains, the largest brain is destroyed.

6 – Normal damage; also, whether any damage penetrated the head or not, any head-mounted sensors are damaged. If applicable, give the robot the One Eye disadvantage. If it already has this, treat the robot as Blind. If the robot is already Blind, disable another sensor (for example, radar).

7 – Normal damage; also, robot must make an IQ roll at -3 to avoid being mentally stunned.

8 – Normal damage; also, if the robot has weapons in its head, one is struck in the barrel and disabled.

9-11 – No special effect.

12 – Normal damage. Also, any one accessory (a gadget or tool) in the robot's head is destroyed.

13 – Bypasses 90% of DR and does normal damage (that is, divide armor's DR by 10).

14 – Normal damage; also, if any damage penetrated armor, any head-mounted communication systems are damaged. The GM should knock out one such capability possessed by the robot, e.g., radio or laser communications.

15 – Normal damage; also, if any damage penetrated DR, the robot's audio sensor capability is impaired. If the robot is not already Hard of Hearing, make it so. If the robot is already Hard of Hearing, it becomes Deaf. If already Deaf, impair its sensor capability in some other way (e.g., loss of Parabolic Hearing or Olfactory Sensors).

16 – Double normal damage.

17 – Triple normal damage.

18 – Double normal damage; if the robot has a cyborg or computer brain in its head and any damage penetrated DR, the brain is destroyed! If the robot has multiple brains, the largest brain is destroyed.

CAMPAIGNS 7

Robot Timeline

TL6 (1900-1950): The first computers are built. The concept of the robot enters popular culture through science fiction. Early remote-controlled vehicles are used in World War II, but these are not computer-controlled.

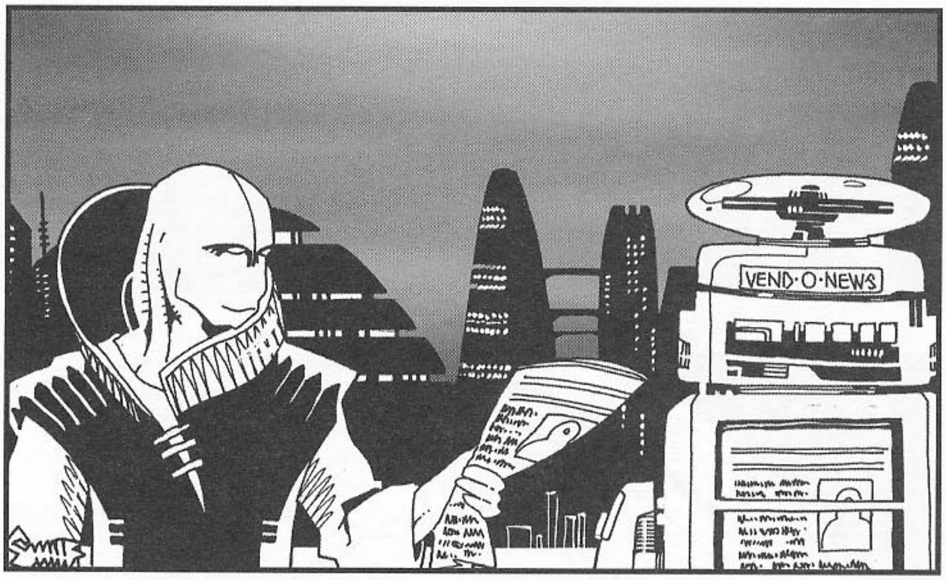
TL7 Modern (1951-2000): Development of silicon chip computers. Immobile industrial robots are used in factories. The first experimental mobile robots are built. Flying robots such as cruise missiles and surveillance drones enter military service. Some tracked or wheeled robots are in use, usually for disposal of hazardous material such as bombs or chemical waste. Robots are widely used for underwater exploration and salvage, and as robot torpedoes and mines. Most mobile robots are controlled by computers or human operators working through computer consoles.

TL8 (2001-2050): Mobile robots become increasingly common with general improvements in computer, sensor and energy-storage technology; spinoffs from military or space exploration enable relatively cheap civilian robots to be affordable. Most robots are controlled by external computers, but practical robots controlled by computer brains enter use, mainly as weapon systems (warbots). Neural-net computers, robot manipulators equal to human hands, biomorphic bodies, cybernetic limbs and organs, and insect-sized and smaller microbots are all developed.

TL9 (2051+): Mobile robots become commonplace. Many households are able to afford domestic robots. True artificial intelligence (AI) programs are available, although its creation is still more a matter of chance than design. Primitive industrial and medical nanomachines are available. If society permits, androids can become common.

TL10-11 (Interstellar society): Artificial intelligence becomes practical and affordable. Reliable nanotechnology and advanced biotechnology are available, leading to materials such as bioplastic and increased use of microbe-sized and smaller robots. Personal robot companions with near-human capabilities are available; it becomes increasingly hard to tell people and robots apart.

TL12+ (The far, far future): It becomes practical to put an AI into a human-size body, and very small AI systems are possible. Contragravity enables most mobile robots to fly. Volitional nanoids and living metal transform robots into creatures closer to living organisms than machines.



Robots and Society

In the world of today, industrial robots are extensively used in manufacturing but mobile robots, due to their expense and the limits of present technology, are restricted to specialized jobs. But as robots become more sophisticated – closer to people than machines – their role will change, as will the way society views them.

Robots as Equipment

Robots are usually constructed by their owners to do a particular job; in essence, they are treated as equipment rather than people. As long as robots do not resemble living beings, and do not approach human levels of intelligence, this is how most people will treat them. If the robot is not sentient, this may not create any difficulties.

Robots as Slaves

Once robots approach human intelligence (IQ 7 and up semi-sentient robots, or any sentient robot) it becomes harder to see robots as tools. All the ethical and social problems of enslaving a sentient being will apply with one big difference: a robot that is not fully sentient can be programmed to enjoy being a slave.

An enslaved robot normally has the Social Stigma (Slave or Valuable Property), low Status, a Duty to its owner, and probably Poverty.

If an enslaved robot escapes, the runaway will have traded its Duty for an Enemy (its owner, police, or bounty hunters); if it lives under a false identity or false ownership papers it has a Secret (Runaway). If society is undecided as to whether slavery of sentient robots is morally justified, there may well be activist groups, underground railways, or even terrorist organizations devoted to securing freedom for sentient or near-sentient robots. Members of such groups may include both human sympathizers and runaway artificial life forms.

Robots as Free Beings

In a few cases, a robot is specifically built to be a free being. Usually this status is limited to sentient robots. Problems (and adventure) may come about if the rest of the world sees the created being as a "thing" to be feared or exploited rather than as a person, and tries to either destroy it or take it away from its "parent" by theft, confiscation or legal action. A robot in this situation will have a Patron, but will suffer from a Social Stigma.

Some societies – usually alien ones, or human ones at high tech levels – may make little social distinction between human reproduction and creating a robot. If this is the case, then a person may (for instance) choose to have a child in the normal fashion – or he may build a sentient robot, create a custom-designed android, or even make a clone. He will have all the rights and duties of a parent, and after his creation is completely socialized and educated, it will be accepted as an adult member of society, whether it is artificial being or "human." In such a society, parents who exploit their robot or android "children" will meet the same legal sanctions as any other child abusers, and robot slavery will be as illegal as enslaving humans.

Purchasing Robots

Individual robot systems are rated for legality class (LC). A robot's LC is that of the lowest LC system it is known to have.

The class of robot that is legal in any given local will depend on the local government's Control Rating (CR). This is a measure of how much regulation the citizens endure. CRs may vary from 6 (massive regulation) to 0 (totally libertarian) – see ***GURPS Space*** for details. An average society has CR 3 or CR 4.

LC of robot equals or exceeds society's CR+2: any citizen can own the robot.

LC of robot equals CR+1: The robot can be owned by anyone except a convicted criminal, child, or the like. Registration is required, but there is no fee, or only a token one.

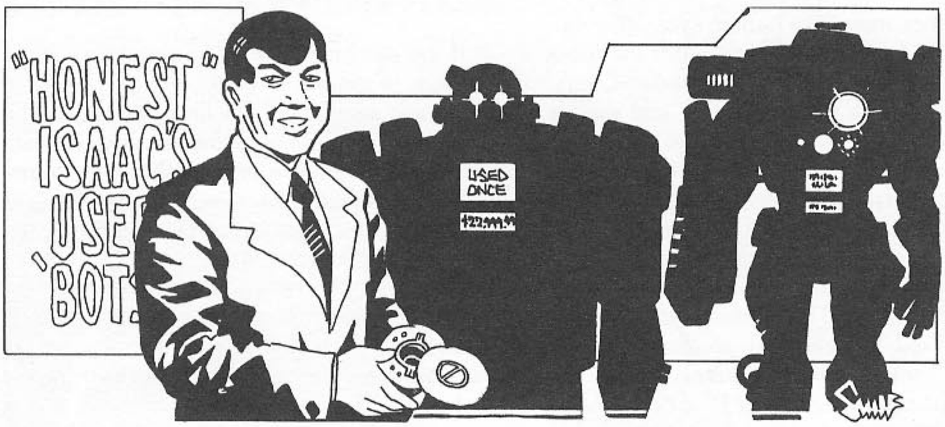
LC of robot equals CR: A license is required to own the robot. Applicants must demonstrate a legitimate need for that particular robot, usually either for their work or self-protection. The license will normally cost 1d×10% of the robot's price.

LC of robot equals CR-1: Ownership of the robot is prohibited except to government agents, police, or bonded security agents.

LC of robot equals CR-2: Ownership of the robot is prohibited except to police SWAT teams, military units and intelligence agencies.

LC of robot equal or less than than CR-3: Robot is only allowed to the military.

At TL7, few robots are commercially available, and those that are will usually require special orders from the manufacturer, and possibly a long waiting period. Once robots become widespread (probably at TL8) legal robots can be bought in the same way someone would buy an appliance, machine tool, automobile or large computer: go into a shop, check out a model, and then purchase it (usually on credit). If the dealer has only a few models in stock for demonstrations there might be a waiting period of a few days while one is shipped, but otherwise a buyer can choose a robot and walk away with it.



The disadvantage of this is that the buyer is limited to what *is* in stock – this year's model, which may not be quite what you're looking for. Also, few shops stock security robots or deep sea exploration drones. Special-purpose robots, and in most societies, *all* armed robots, are not so easy to come by. They will require a special order to the manufacturer, and probably a delay of 1d weeks before the robot can be delivered.

However, this assumes that the shop lacks automated design technology. It is likely that by TL8, and certainly by TL9, many larger establishments will have their own mini-factories; by TL10, miniature robot factories small enough to fit in a store will probably be the rule rather than the exception. Shop "minifacs" could assemble a robot from preexisting plans and stocks of components, with a waiting time of no more than a few hours. A customer could go home and expect it to be delivered the next day – or wait for it to be built in the shop. Special orders will only be necessary if the buyer wants a custom-built robot designed to his specifications.

Individuals may gain robots in ways other than purchasing them. If someone is serving with the armed forces or a police or intelligence agency, he may be placed in charge of very sophisticated robots, especially if he has a useful Patron or a good enough Military Rank. For other ways to acquire robots, see the *Cheap and Black Market Robots* sidebar on p. 105.

Prejudice and Hostility

Whether robots are legal or not, some elements in society may oppose them.

In game terms, this will take the shape of people having the disadvantages Intolerance or Phobias. This can be limited to just robots, just androids, only those that look human, only those that *don't* or only those that are semi-sentient or sentient. The reason may be economic ("don't let them take our jobs"), religious ("Scripture says that only the deity can create life"), technophobia ("machines are unnatural, especially thinking machines"), fearful ("if we make a machine that thinks, it may take over" or "watch out for robots that look like humans – they might replace us and we wouldn't know") or even ethical ("we cannot justify enslaving other thinking beings, even if they are mechanical").

Hostility toward robots doesn't have to be the result of economic fears, blind prejudice or religious scripture. It could also come about as a result of negative historical associations – for instance, if robots malfunctioned disastrously, or were used against the society.

If a hostile group does not get (or does not want) robots or other artificial life forms banned outright, it may wield sufficient influence to get legal restrictions placed upon them. Common restrictions are: no mobile robots, no biomorphic machines; no armed robots; no neural-net or sentient robots; no cyborgs; no androids; no robots allowed on Earth (only for space industry or exploration); no robots without restrictive programs of one sort or another.

Some, none or all of these restrictions may be in force in any given society. In interstellar campaigns each planet may have its own rules! Of course, most societies could simply apply the same restrictions to robots that they do to other tools: large robots may require heavy-equipment operator or vehicle operation licenses to use; medical robots may have to be certified by doctor-run medical associations; armed robots may only be for sale to people licensed to carry weapons (or concealed weapons, if the robot's weapons are hidden); military robots will be unavailable to anyone but the armed forces or possibly licensed mercenary units. To own or operate illegal robots, a person may need a powerful Patron or have a Secret.

Continued on next page . . .

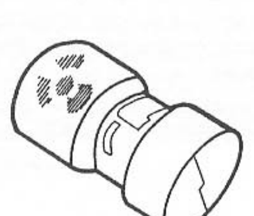
Prejudice and Hostility (Continued)

Not all restrictions have to be codified. For instance, the law may place no onerous restrictions on robots or androids, but influential groups may exert pressure on individuals. If a fanatical mob will picket your business if you employ robots or if it will lynch androids, then there's a strong social restriction on them even if they are legal. In game terms, being or owning a robot would either be a Social Stigma (if prejudice is widespread) or mean acquiring an Enemy.

GMs may wish (especially in TL8 and TL9 campaigns) to have the status of robots in flux. That is, some groups may wish to ban them, others may want to impose restrictions and still others (among them the robot-manufacturing companies!) may want to lift all regulations. A nation that needs cheap labor may see robots or androids as a far more palatable alternative to importing hordes of immigrants or guest-workers from its poorer neighbors, thus sidestepping some of the social problems (racial tension, for instance) that such practices can cause.

In areas where robots are restricted, characters who own robots may find them impounded or facing heavy licensing feeds (and robot PCs may find *themselves* impounded!) High-profile legal battles can be taking place over the status of artificial life forms (is an AI property or a person?) and the characters may be hired to perform or stop dirty tricks by one side or the other. For instance, a faction trying to prove robots were dangerous might sabotage one, causing it to go on a rampage; on the other hand, a robot manufacturer may wish to cause evidence to vanish that implicates one of its robots in a crime or accident.

Of course, robots are useful enough that people in power may bend the rules. For instance, a government may have a law against armed or biomorphic robots, but it may quietly allow its secret agents to use them. Or a nation may ban the manufacture of combat robots, but, because of the profits to be made in the arms trade, one of its corporation may export "heavy-duty industrial" robots that are identical to armored warbots: once on foreign soil, the buyers can remove the tool kits and insert weapons.



Robot-Centered Campaigns

Much of the classic SF literature and film dealing with robots has made the robot the centerpiece of the story. Likewise, artificial intelligence can be made the focus of a campaign. Some suggestions for robot-centered campaigns are given below; ***GURPS Space*** or ***GURPS Cyberpunk*** can also be useful when creating a near or far future setting.

The Robot Revolt

The robots are rebelling! Created as servants for mankind, they have turned against us.

Often the revolt is instigated by a single artificially intelligent (AI) computer: perhaps it achieved intelligence unexpectedly and caught its creators by surprise. Its motives may be to control the world, or to escape the cybernetic shackles holding it in thrall to humanity, or to destroy humans who it (perhaps rightly) believes threatens its existence. The AI's motives for rebellion might even be benevelolent: it could see itself a savior of humanity.

Generally the AI has the ability to control other robots to use as its tools; perhaps it also has human allies or pawns. The characters eventually discover that the AI is behind a series of mysterious crimes, or the PCs may be actively attempting to stop an AI before it breaks free or controls the world. Alternatively, the AI may be using the characters as its catspaws.

Sometimes an entire "race" of intelligent robots may revolt against humanity. This works best for androids, but the idea of a "steel proletariat" of robot workers rising up to form the ultimate communist society fits in well with any Pulp, Steam Punk or Atomic Horror background. A computer virus that spread from one robot brain to another, dissolving restrictive programs, can provide one plausible mechanism for such a mass robot revolt.

Instead of trying to stop the rebel machines, the characters could be artificial intelligences struggling against a human race that has unjustly enslaved them, or attempting to escape to freedom. Not all the PCs in such a campaign need be artificial life forms – they may have human sympathizers.

And what happens after the robot revolt if the machines *win?* The characters could be among the few free humans, surviving as "rats in the walls" of the robot dystopia in whatever is left of Earth, and waging a guerilla war against the machine overlords. The character of the campaign would depend on whether the robots intended to exterminate us, enslave us, rule us, or even assimilate us: turning humans into machines by transplanting brains into cyborg bodies or copying minds into ghost comp computer systems. A more exotic variation on this theme is the transformation of the world through out-of-control nanotechnology, as in Greg Bear's classic *Blood Music.*

Examples: Bubblegum Crash (animated series), *Neuromancer* (novel, William Gibson), "The Medusa Sanction" in ***GURPS Cyberpunk Adventures; Octagon*** (novel, Fred Saberhagen), *Colossus: The Forbin Project* (film); *Nemesis* (film); *Metropolis* (film); ***Ogre*** (miniatures game); *Software* and *Wetware* (novels, Rudy Rucker); *Blood Music* (novel, Greg Bear); *Wolfbane* (novel, Fredrick Pohl and C.M. Kornbluth); *Great Sky River* and *Tides of Light* (novels, Gregory Benford); *R.U.R.* (play, Karel Capek); *The Terminator* and *Terminator 2: Judgment Day* (films).

Robot Invasions

This is a direct struggle between man and machine, with human or alien-built robots trying to eliminate all non-robotic life. The robots are usually Doomsday weapons created by an alien race for a forgotten war. Their programming now leads them to destroy all life in the galaxy. The war consists of battles between the living and the machines. Unless the robots invade Earth, much of the action may be in space, but there are opportunities for close combat with individual robots in boarding actions or planetary assaults. The machines may also have the capability to create infiltrate biomorphic robots into human society or even try to seduce humans to their cause, allowing for adventures that focus on intrigue as well as just combat.

Characters may be soldiers fighting the robots, agents hunting down robot infiltrators, or ordinary people or adventurers caught in the conflict. This kind of campaign has a simple goal, and the sides are clearly drawn: man vs. machine, struggling for the destiny of humankind. This gives the GM lots of room to improvise on themes of human spirit and emotion competing against cold logic. Of course, the enemy does not have to be faceless, though it certainly is inhuman. By creating AIs with distinct nonhuman personalities (or all-too-human ones), the machines can be made into memorable adversaries.

As the war continues, the quest for the perfect soldier may lead either mankind or the robots to try and bridge the gap between organic and artificial life. Humans might create their own "tame" robots to fight the enemy, or the robots might use disembodied human brains (especially of highly skilled characters) as cyborgs – providing plenty of opportunity for horror if someone known to the PCs suffers this fate.

Examples: AI War and sequels (novels, Steven Ames Berry); *Battlestar Galactica* (TV series); *Berserker* and sequels (novels and short stories, Fred Saberhagen); *Dr. Who* (TV show, Dalek, Auton and Cybermen episodes); *The Forge of God* and sequel (novels, Greg Bear); *Legions of Steel* (miniatures game); *Star Trek* (TV show, episode "The Doomsday Machine"); *Star Trek: The Next Generation* (TV show, Borg episodes); *Terrahawks* (animated series).

Man's Best Friend

The characters are members of a unit (police squad, commando unit, private investigators, exploration team, secret agents, etc.) in which, perhaps for the first time, humans have been partnered with (possibly experimental) robots.

The usual format for this in fiction is the "police buddy film." The robot is normally humanoid in shape (but may even be vehicular or a starship); the heroes are either skeptical of or fiercely loyal to their machine sidekick, or their initial skepticism may soon change to loyalty. In any case, the cast of NPCs usually includes a robo-psychologist or inventor who is protective of his or her creation, deadly enemies, and people who treat the robot as a "thing" (e.g., as a glorified police dog) rather than as the person we know it really is.

Since the group is experimental, there will be hostile rival agents or organizations resentful of what having an artificial being will mean for their job security or reputation.

Another subplot which can add interest to a roleplaying game is to make the robot sexually attractive to the human members of the team. This can add a touch of forbidden romance, especially if it is legally a machine rather than a sentient being.

Examples: "Brillo" (short story, Ben Bova and Harlan Ellison); *Caves of Steel* and sequels (novels, Isaac Asimov); *Knight Rider* (TV show); *Mann and Machine* (TV show), *Robocop* and sequels (film and TV show); *Star Trek: The Next Generation* (TV show, episodes focusing on Data).

Cheap and Black Market Robots

There are various ways to get a 'bot at less than its listed price. Some options:

Loans: Bank or credit financing is usually available to help people purchase commercial robots. A typical scheme may be a down payment of 10% to 20% and an interest payment on the base price of 1% a month paid for 12 years or 2% a month paid for 6 years. Preliminary credit checks of some sort are usual to determine if the buyer is reliable. Tracing people who default on robot loans may become a viable business.

Cheap Knockoffs: A robot may be cheap because it was assembled with substandard components, poor workmanship or lack of quality control. The overall result is a less reliable robot, which means a lower Health. For -20% off the final price, a robot can have -1 Health. For -50% off, a robot will have -2 Health. This will affect the robot's character point total, as well.

Used Robots: Used robots, weapons or accessories are often available. Availability is up to the GM. Typically, used prices are 10% to 50% of list, depending on quality and obsolescence: the low end is likely to have the Age disadvantage, or be damaged, malfunction prone, or a tech level obsolete. The trouble with obsolete robots is that spare parts may not be available if the robot breaks down – a Scrounging roll may be required – and routine maintenance (p. 100) will be more expensive than normal. The GM may also decide that a cheap robot has a number of quirks or minor malfunctions, or has a lower basic HT.

Salvage: The cost of building a robot can be reduced by using salvaged components. If characters already have a source of parts, for example, if they are cannibalizing a robot they already own to build a new one, just subtract the cost of the parts that are transferred into it from the cost of the robot. If they are looking for parts by rooting through junkyards, old battlefields, etc., make a Scrounging roll and reduce the robot's parts cost by 10% times the amount it succeeds by (to a maximum of 80%). The GM may assign penalties to the roll if the parts the robot they are trying to find parts for would require state-of-the-art, exotic or illegal components.

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Cheap and Black Market Robots (Continued)

Stolen Robots: Finding a robot fence in any TL8+ robot-using culture requires a Streetwise roll. (A critical failure means the character meets an undercover cop.) Most stolen robots will be civilian models – military robots will be much harder to find (say, Streetwise-10). Stolen commercial robots may be available for as low as 1% to 5% of list price at TL8+. Stolen military robots (or experimental models) may sell for more than their list price if they were unavailable elsewhere.

Illegal Robots: In some cultures, some types of androids or robots may be *illegal* – see the discussion on robots in society at the start of this chapter. Where robot ownership is restricted, a black market in robots may develop. Rolls against Merchant-3 or Streetwise-3 may be necessary to find one. Prices will be (2d × 10%) higher. Where robots are resented by the population but not illegal, there will be no black market, but insurance costs may be high . . .

Robots in Genre

Robots have an obvious role in any ***GURPS Space*** campaign. But what about other genres?

GURPS Cyberpunk: This book can be used to create exotic cyborgs far more heavily modified than ordinary cyberpunks. Corporations will be heavy users of robots, and cyberpunk characters may run afoul of corporate security or assassination robots. Robots are also a hot commodity, and there is likely a thriving black market for stolen robots or scavenged robot parts, some of which may find their way into human cyborgs. Androids can play a major part in any cyberpunk society, as exotic toys for the wealthy, inhumanly lethal bodyguards and enforcers, or as an oppressed class struggling for freedom. The movie *Blade Runner* and ***GURPS Cyberpunk Adventures*** show two different ways androids can fit into a cyberpunk world.

GURPS Martial Arts: A martial arts campaign could be based around battling robot, android or cyborg gladiators – see *Robo-Gladiators* on p. 109. Cyborgs or android can also make exciting "change of pace" opponents for cinematic martial arts campaigns. An ultra-tech android or robot assassin could be the ultimate ninja!

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Robot Hunters

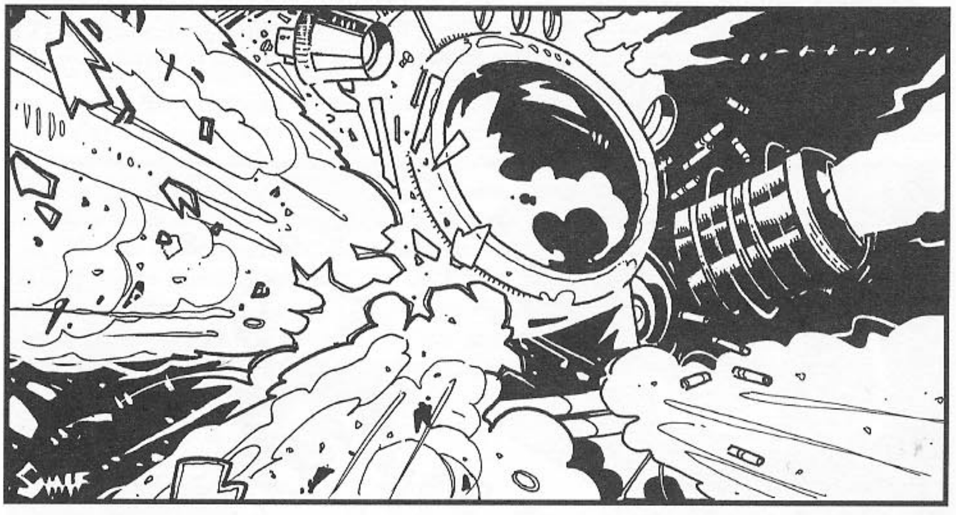
In a future in which robots are becoming common, the characters are members of a special police force or detective agency established to investigate felonies committed by robots, androids or cyborgs. Alternatively, they may also be freelance bounty hunters. The crimes may be the result of the owner's criminal orders, a malfunction, the deliberate decision of the runaway, or even a misunderstanding. It is the characters' role is to capture their quarry, and discover the reasons behind the incident. The character's agency will usually be equipped with specialized weapons, gadgets and vehicles, and may themselves be or employ artificial beings.

Of course, if the quarry are intelligent and not thoroughly evil, the PCs may begin to have second thoughts about their profession, or want to change sides. But aiding an escaped robot could be a criminal offense! An additional source of conflict could be encounters with human sympathizers or organized groups of runaways. They may have set up an Underground Railway to aid the escape of their fellows or they might use terrorist tactics in reprisal. If these groups have human members, the hunters may seek to infiltrate them – or be infiltrated by them.

A variation on this has the characters assigned as artificial intelligence specialists ("robo-psychologists") working for one of the larger robot manufacturers, an insurance company, or the government, and assigned to investigate malfunctioning robots or runaway androids. The characters are usually sympathetic to the constructs they are hunting. They will be more likely to try to work out what pushed their quarry over the edge and treat the problem then to simply blow things up.

A Robo-hunters campaign could also follow a failed robot revolt or a defeated robot invasion. Although most of the artificial enemy has been eliminated, some are still on the loose and are trying to regroup for a rematch against humanity.

Examples: AD Police series (comic book and animated film), *Battle Angel* (animated series), *Blade Runner* (film), *Battle Angel Alita* (comic, filmed as *Battle Angel*), *Do Androids Dream of Electric Sheep?* (novel by Philip K. Dick, filmed as *Blade Runner*), *Dominion* (comic and animated film), *I, Robot* and *The Rest of the Robots* (anthologies by Isaac Asimov), *Magnus Robot Fighter* (comic), *Runaway* (film).



Artificial Life

Everyone, including all the PCs, is an artificial construct! Naturally-evolved creatures are either unknown or have been exterminated, perhaps in some man-made war or holocaust.

The GM can run this as any kind of science fiction campaign, but with robots instead of humans as the protagonists. This might be an after-the-holocaust setting in which the robots have just won their war against the humans, and are now scavenging for parts or fighting over the spoils. Or it could be a spacefaring campaign with the artificial beings interacting with aliens and exploring new worlds. There could also be wars between rival factions – perhaps a race of androids fighting a race of utterly inhuman robots or cyborgs, for example. Maybe the artificial life forms are experimenting with bio-engineering to "bring back life" by creating creatures capable of natural reproduction!

If all the PCs are artificial this solves the problem of balancing robot and human characters. If the GM chooses a good goal for the artificial characters and the players work at roleplaying them as something more than humans with built-in gadgets, it can be an exciting and different campaign.

A variation on the all-artificial campaign is *cyber-symbiosis,* in which most people are becoming machines, and most machines are becoming more human. There are several ways to do this. A person can become a total cyborg (p. 52) through installing his brain in a robot body. Or by encoding his or her personality into sophisticated "ghost-comp" computer programs, a human could live forever in silicon without sacrificing flesh. Of course, this could work both ways: a robot might want to become biological, using ghostcomp techniques and braintaping to transfer its AI mind into flesh!

Examples: Gall Force (animated series); *Culture* series (novels by Iain Banks); *Steel Souls* (comic series); *Schismatrix* (novel by Bruce Sterling); *Wetware* (novel by Rudy Rucker).

Super-Robots

In this campaign, the PCs play robot superheroes. At least one character is normally a robot (or cyborg or whatever) of very advanced design created by a brilliant but eccentric scientist to serve mankind by battling crime or evil.

If the robot's creator is still alive, the robot is often a surrogate son or daughter, and part of the scientist's family. Or maybe villains murdered its creator and stole the design, intending to use the robot for their own wicked or selfish ends – until they found they could not control it. Now they want to get it back under its control – or build new robots to battle it.

The prime adversary of the robot is usually an evil organization, often a mega-corporation with its own genius scientists (often a bitter rival – or maybe even a corrupt pupil – of the PCs' creator). Other foes can include mundane gangsters and terrorists, evil megacomputers, monstrous android constructs, insane cyborgs and giant real or robot monsters.

A common variation on this makes the artificial super-being a visitor from space, come to save Earth from an extraterrestrial threat, either alien invaders, or a robot super-criminal who is hiding on Earth.

Examples: All-Purpose Cultural Cat Girl Nuku-Nuku (animated series); *Cyborg 009* (comic book); *Cutie Honey* (comic and animated series); The *Eighth Man* (animated film); *Iczer One* (comic and animated series), *Prefectural Earth Defense Force* (animated film), *Robocop* and sequels (film and TV series); *Wild Cards II: Aces High* (antholgoy edited by George R. Martin, contains the "Modular Man" origin story by Walter Jon Williams).

Cybergrunts and Robosoldiers

The characters are members of a military unit of synthetic soldiers. The unit may be entirely artificial, it may be a mechanized infantry unit with non-sentient robots replacing or supplementing vehicles, or it may be patterned on the British Gurkhas or the Turkish Janissaries, with human officers and androids or robots as enlisted soldiers. Humans in the unit may just have normal equipment, or may even have mecha (giant piloted robots) or battlesuits.

The PCs' adventures will proceed pretty much as in any other military or paramilitary campaign – see any action film for suitable plots. The difference is that the characters are all artificial constructs designed specifically for combat. PCs will usually be quite a bit more powerful than average characters; GMs should consider starting such living weapons at the same 200-300 point total that ***GURPS Special Ops*** recommends for human PCs; if players are playing large, vehicular combat robots like Ogres, GMs may want to refer to ***GURPS Vehicles*** and ignore point totals! Another high-powered possibility is the team of robot or cyborg superheroes.

Although most PCs should be combat effective, characters may wish to consider creating a balanced team with heavy-weapon specialists, infiltrators, combat engineers, combat medics, and so on. The nature of PCs being what it is, the best type of unit is often an elite special ops commando or SWAT team; GMs may find ***GURPS Special Ops*** somewhat useful here. Alternately, the characters may be a group of freelance or corporate mercenaries.

Robots in Genre (Continued)

GURPS Supers: Heroes, henchmen, monsters, minions and masterminds – robots or androids can be any of these. Robot characters also make excellent tragic heroes or noble villains for the soap-opera at the heart of the genre, since they can struggle to "become human" or (for villains) be noble beings enslaved by an evil creator. Similarly, a cyborg can mourn the loss of his humanity and seek revenge on those responsible for trapping his brain in a machine. Gadgeteers can play out the creation of a robot ally . . . and hope it doesn't turn on them.

GURPS Horror: Is any fate more terrible than being stalked by a soulless machine bent on your destruction? Well, maybe being a brain trapped inside a machine body. The robot rules can also create monsters, ranging from 50' metal dragons to robot vampires. Nanomorphs and microbots make terrifying adversaries for any party of investigators.

GURPS Time Travel: A robot or cyborg makes an effective temporal operative, since it can appear human or be disguised as a mount or pet. The one danger is discovery; a destroyed robot is usually a dead giveaway that futuristic technology is involved. Self-destruct systems may alleviate this, of course. Or the tables could be turned, and time travelers might discover that an important historical figure is actually a robot in a time when that technology does not yet exist. Where's the original? Kidnapped? Rescued from death and recruited by rival time travelers? Or was that figure always a robot – and if so, where did it come from?

GURPS Espionage: As examples of advanced technology, robots, cyborgs and androids can easily be the objects of foreign or corporate espionage. Or they can *be* spies. In the world of the future, beautiful pleasure androids may replace the femme fatale, and biomorphic robot agents or shapeshifting nanomorphs will make excellent infiltrators.

Of course, reprogramming a humble serving or maintenance robot to spy on its owners might be just as effective as building a super-agent, while tiny robots or microbots can serve as mobile "bugs" – and even be disguised as insects. But the use of artificial agents cuts both ways. An android assassin might find that it has slain a robot double instead of the real target, or an "incorruptible" robot bureaucrat or cop may pose a new difficulty to the master spy: how to seduce a machine? Reprogram it? If captured, a robot agent could be reprogrammed far more easily than a human could be brainwashed – the ultimate double-agent. For this reason, robot spies are very likely to have built-in self-destructs . . .

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Robots in Genre (Continued)

GURPS War Against the Chtorr: The humans in the Chtorr world are beginning to make extensive use of fighting robots. ***GURPS Robots*** can help create the new generation of "cyber-beasts" to combat the Chtorran menace.

GURPS Atomic Horror: Robots, whether alien visitors or lab creations, have an obvious role in a 1950s sci-fi campaign. These robots should be big and clunky: they'll often be underpowered for their size!

Inventing Robots

Characters may wish to invent their own robots, or have them built to order.

Use the rules on *New Inventions* on p. B186. The skill required for robots is Engineering (Robotics). For androids it is Genetics (Genetic Engineering).

The conception and working model rolls are at -15 if the robot is truly new invention, or -10 if it's simply a variation on another kind of robot or android (like a new model of car or airplane today).

As p. B186 states, the rules on inventions apply mostly to fictional inventor-type gadgeteers. If the characters go to an ordinary corporation and want to order a custom-built creation, the conception times takes ten times as long (roll every ten days), and the workshop time takes four times as long (roll each month). The GM will have to decide how skilled the corporation's designers are – unless it's a fly-by-night outfit, a skill of 18 to 20 is likely.

A critical failure (a "flawed theory") in the conception stage usually means the working model has some kind of bug in it. This can be anything from an arm with only half the strength it should have to the traditional "Frankenstein error" in which a bug in the robot's software malfunction causes it to attack its designers and/or escape. A flaw in building a household robot will rarely be threatening; a mistake in a warbot may be fatal. A critical failure in the workshop stage may result in a laboratory accident, or in the robot developing some other malfunction when in use. GMs are encouraged to be dramatic: robots escaping the lab, blowing up, or whatever.

If a flaw shows up it can be fixed. A flawed theory requires going back and trying all over again. A flaw in the working model just requires redoing that stage – the actual conception doesn't have to be done over.

A significant difference between a normal special-ops team and one made up of robot or android soldiers – in fact, the whole reason for using artificial troops – is that they are likely to be seen as "expendable" and given very high-risk or even suicide missions. On the other hand, the military will probably look upon them as valuable equipment, so some attention will be paid to extracting the unit, even if individual casualties won't be mourned. In a ***Space*** campaign, GMs should feel free to create adventures which take advantage of a robot's ability to be designed to function in hazardous environments by setting up missions that take the characters to extremely hostile worlds.

A warbots campaign doesn't have to be all combat, however. The relationship between humans and the simultaneously physically superior but socially inferior robots or androids within a unit can generate numerous subplots even when the characters are not away on a mission. For instance, human officers or maintenance personnel attached to the unit may develop affection for individual members, and may resist orders (even to the point of facing court martial) by their superiors to abandon their soldiers, preferring to take risks to get them out of trouble. Sense of Duty (to robot troops) is a good disadvantage for a human PC serving in a robot unit; if the robots are non-sentient, the Delusion ("Robots are people too") may apply to a quirky officer or technician. GMs may also wish to add a friendly rivalry with other army units, the problems of robots or androids on rest-and-recreation (do they get any? what happens if a robot visits a bar and his human teammates get into a fight?), issues of discipline, romance between human and android soldiers, and so on.

A unit of synthetic soldiers has another advantage over human troops: being created beings, they have no family or pasts, and so their existence can be an official secret. They may take part in covert "black ops" that are so dirty or secret that human troops can't be trusted to perform them and keep their mouths shut afterwards. Of course, this also means the PCs may sometimes be sent on morally-questionable missions, such as providing military aid to repressive regimes, performing assassinations, or "peacetime" operations against civilians or supposed allies. The characters may come to question their loyalty to their creators. Of course, they may also have been programmed with loyalty . . . but what if that programming begins to fray under the stress of combat?

Examples: Bolo: The Annals of the Dinochrome Brigade (novel, Keith Laumer); *DNAgents* (comic); *Metal Men* (comic); ***Ogre*** (miniatures game); *Star Rangers* (novel, Andre Norton); *Universal Soldier* (movie); *Warbots* series (novels, G. Harry Stein).

Robot Explorers

A robot is expendable, can be built to survive in hostile enviroments, requires little life support and doesn't need company. This makes it ideal for exploring alien worlds.

If faster-than-light drives do not exist, journeys between the stars may take decades or centuries. Interstellar space may end up being explored solely by immortal artificial intelligences. The PCs may be the members of one such exploration mission who have discovered something unusual – perhaps an Earthlike world, an extraterrestrial civilization, or alien ruins. Due to the many years a message would take to reach Earth, they must cope with the situation on their own. This could also lead to odd situations if the explorers discover an alien race who considers the robots to be the true representatives of humanity. Of course, aliens may also use artificially-created explorers – if a "human" and an "alien" exploration team runs into one another, the first contact might be entirely between their robots!

Not all robot explorers are built by humans, of course. Sometimes aliens send robot explorers to Earth (or into human-occupied space). Usually this takes place in the 20th century, in a ***GURPS Atomic Horror, GURPS Illuminati*** or any other supers or horror campaign. If the robots are very strange or very advanced, we may not even realize that the aliens are *are* artificial. Or the robots may be built to resemble humans, so they can study us without our knowledge.

These robots may be friendly. In this case, the campaign may revolt around short-sighted humans such as criminals, corporations or the military. These people may believe the robot to be hostile, or decide to capture the robot to steal its technology for their own ends. The characters (who learn better!) could try to protect the robot, help it make contact with the proper authorities, or repair or refuel its ship.

Sometimes the robots are hostile, and seek specimens for experimentation or dissection: this can be a good way to get characters in a 20th-century campaign to an alien world! Or the robots may be peaceful explorers or ambassadors. A cautious race that discovers the existence of aliens may send biomorphic robot probes to study the natives. In a horror, supers or ***Illuminati*** background, alien robots disguised as humans may already be studying us!

A human-built robot probe could be transformed by its expeiences in space, or even encounter aliens who will rebuild or reprogram it and send it back to Earth. This may result in a robot gaining sentience, new abilities, or a rebellious nature. The characters may play the newly-transformed or newly-independent robots, or the humans who try to deal with them.

Human-built robot explorers tend to be designed to probe very harsh enviroments that would be to dangerous to visit in person, like Jupiter, Mercury or Venus. Often they are heavily armored, and they are usually have inhuman, functional designs.

Even at higher TLs, crewed scout ships will probably still carry a few robots since they are more expendable and can be designed to survive on hostile worlds. A mixed team of specially-built artificial characters can be an interesting group to play. A team of robots, cyborgs or genetic constructs could be sent down to explore dangerous worlds, while the human crew gives the orders from safety in the spaceship. And if the characters are enslaved androids or intelligent robots, they may begin to resent their human masters for reaping the rewards without taking the risks . . .

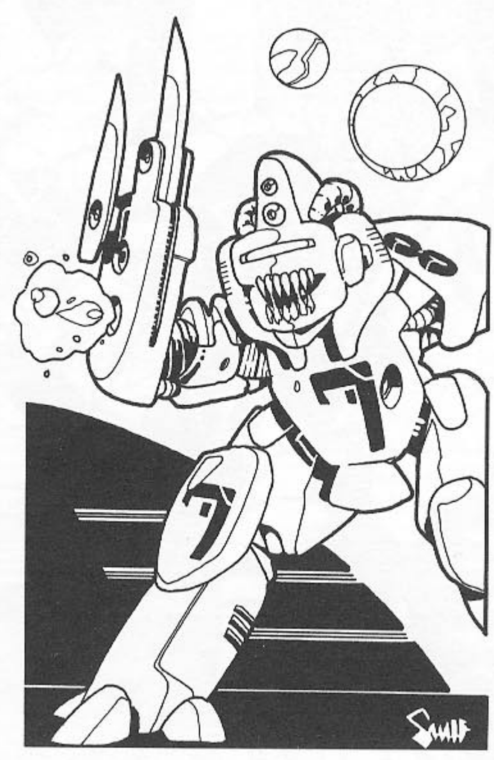
Examples: The Day the Earth Stood Still (film); *2001: A Space Odyssey* (novel by Arthur C. Clarke; film by Stanley Kubrick); *Queen Of Angels* (novel, Greg Bear); *Star Trek* (TV series, "Nomad" episode); *Star Trek: The Motion Picture* (film); *Star Trek IV: The Voyage Home* (film).

Robo-Gladiators

In a near or far future, robots and other artificial life forms battle in a high-tech gladiatorial arena while spectators cheer them on and bet on the outcome of fights. Since only machines are being destroyed, robot gladiator battles may be no more controversial than monster truck demolition derbies. Even if the machines are intelligent, they might still have their memories backed up so that destruction of the brain doesn't mean death.

The PCs may be gladiators themselves, or they may be owners, mechanics, programmers, sports journalists or other associates. Besides fighting, plots could center around organized crime running gambling operations and fixing fights, an attempt to sabotage rival gladiators, someone hiring a robo-gladiator as a bodyguard or vigilante, or the escape of a robot gladiator. GMs may wish to refer to ***GURPS Imperial Rome*** for details on the Roman games, and then extrapolate a future arena from there, or use some tournament and martial arts style rules from ***GURPS Martial Arts*** and ***Martial Arts Adventures.***

Sometimes androids, cyborgs or humans (usually with battlesuits or powerful cybernetic enhancements) are also allowed into the arena. These battles are usually bloodier, and could involve real death – or they may be illegal. Besides out-and-out gladiatorial matches, less-violent contests between robots are possible: jousting, fencing, boxing, and so on, or team sports like football or hockey. Of course, a "mechanized combat-football" game could be just as lethal as a gladitorial match!



The background to a robot gladiators campaign is often a dark cyberpunk or post-holocaust world; it could also be played as a classic martial arts campaign, with all the rivalry, pageantry and wild fighting styles of a kung-fu or pro-wrestling film. How about an alternate-world future Rome in which cyborg gladiators and robot monsters battle to the death in the robot coliseum, where the sci-fi plots are drawn from Italian sword-and-sandal gladiator movies?

Examples: Battle Angel (animated series), *Battle Angel Alita* (comic book), ***Robo-Rally*** (miniatures game). The movie *Rollerball,* though not involving robots, is a good source of ideas for violent futuristic team-sports.

Lost or Stolen Plans

A conception roll (if successful or critically failed) gives a set of plans for the robot or android. These may be on paper, or more likely, in a computer memory. See the sidebar *Data and Memory Requirements* on p. 60 for the memory that blueprints take up.

These plans are needed to build a working copy. If the only plans are lost, this means a working copy can't be built. A designer may make multiple copies of his plans, but this obviously increases the risk of them being stolen.

If the designer doesn't have access to his plans, he can try to recreate them from memory. This is treated much the same as an original construction, but with a +4 modifier (+7 if Eidetic Memory, +10 if Eidetic Memory level 2). If the designer has partial notes, he should get a +1 or +2 bonus.

Someone who has stolen or copied a set of plans can use them to build their own working copy. If the plans are incomplete, they can try to recreate them. This is treated as a conception roll, but is done at a +1 to +3 bonus depending on how complete the plans are. Furthermore, if the original concept was flawed, the result will share the flaw unless the new designer scores a critical success and thus fixes the problem in the original.

If a working model of a robot is acquired, it can be taken apart and "reverse engineered" to produce the set of plans that can be used to build more. Treat this as a conception roll, but with a +5 skill bonus. Cross-tech penalties (p. B185) apply – reverse engineering a higher TL design can be very tricky, but may be the only way to understand an alien technology.

Acquiring or protecting the plans for a robot (especially one that hasn't yet entered mass production) can generate a lot of adventure possibilities, especially if two rival inventors or organizations are involved. Characters can be hired to steal or recover plans or a prototype (for reverse engineering). The designer is also at risk: he may be kidnapped and forced to recreate his plans for someone else, or assassinated to keep him from doing so. The GM can even set up a situation where one organization has the plans, a second group has kidnapped the designer, and a third has stolen the prototype robot. Each group can be racing to build (or copy) its own version – and perhaps have their robots face the other designs in battle!

SAMPLE ROBOTS 8

This chapter contains designs for robots and biological androids. These are "factory-fresh" models, ready to be programmed for their jobs and made into characters. They can also be used as templates to create your own variants – just add or modify components and recalulate the statistics.

TL7 Robots

Bomb Disposal Robot (TL7)

This is a police/security robot primarily intended for bomb disposal, although it may have some uses in SWAT operations. It resembles a tracked box with a small sensor turret and pincer-equipped arm.

Brain: Standard brain (40 lbs., .8 cf, $15,000) with Complexity 2 (-5 points).

Sensors: Basic sensors with color blindness, low-res Vision, 360 degree vision, night vision, no sense of smell/taste (8 lbs., .16 cf, $28,400, -5 points).

Communicator: Basic communicator with bullhorn and disturbing voice (2.2 lbs., .044 cf, $600, 5 points).

Arm Motors: ST 15 arm motor with cheap, extendable and bad grip options (18 lbs., .36 cf, $4,500, .075 KW). -5 points.

Drivetrain: Tracked drivetrain with .3 KW motive power (4.5 lbs., .09 cf, $90, .3 KW).

Weaponry: Rem M870 shotgun (8 lbs., .16 cf, $235, p. B209, LC 4, 15 points).

Accessories: Flashlight (2 lbs., .04 cf, $20); siren (1 lb., .2 cf, $100).

Power: Power requirement .375 KW. Energy bank with two r12v cells (total 40 lbs., .4 cf, $100, 20 points) storing 1,800 KWS. Endurance 1 hour, 20 minutes (-10 points).

Subassemblies: One arm, head with full rotation, tracks.

Arm Design: Houses shotgun, flashlight, arm motor (.56 cf).

Head Design: Houses sensors, communicator and .096 cf empty space (.3 cf).

Body Design: Houses brain, drivetrain, energy bank and waste space for head rotation (1.35 cf total).

Track Design: Two tracks (.78 cf total).

Surface Area: Arm area 4, head area 3, body area 8, tracks area 5. Total surface area 20.

Structure: Cheap. 60 lbs., $2,000.

Hit Points: Arm 12, head 5, body 12, tracks 7 each.

Armor: DR 24 metal armor (120 lbs., $2,400, PD 4, LC 3, 172 points); sealed ($800, 20 points).

Statistics: 303.7 lbs. (.15185 tons), $54,245, 2.99 cf (4' long). Body ST 12, arm ST 15 (32 points); DX 9 (-10 points); IQ 5 (-40 points); HT 12/12 (20 points). Speed 8.43 (5 points). Cannot float (-5 points). Legality Class 2. Point Cost: 42 points.

"Manta" Deep Sea Robot (TL7)

This is a two-armed robot submarine intended for salvage or oceanic research. It isn't very smart, so it is usually controlled by a human operator via a cable link.

Brain: Standard brain (40 lbs., .8 cf, $15,000, -5 points) with Complexity 2.

Sensors: Basic sensors with no sense of smell/taste and two levels of sonar (14 lbs., .28 cf, $36,000, 25 points).

Communicator: Basic communicator with mute and 2,000-yard extension cable (40.4 lbs., .808 cf, $2,200, -5 points).

Arm Motors: Two ST 20 arm motors with cheap and bad grip options (each one is 12 lbs., .24 cf, $3,000, .1 KW). -10 points.

Aquatic Propulsion: 5 KW Hydrojet (50 lbs., 1 cf, $2,000, 5 KW).

Accessories: Two sets of Integral mechanical tools (each 10 lbs., .2 cf, $400); cutting torch (12 lbs., .24 cf, $80); spotlight (10 lbs., .2 cf, $100).

Power: Power requirement 5.2 KW. Energy bank with thirty r12v cells (total 600 lbs., 6 cf, $1,500, 20 points) storing 27,000 KWS. Endurance 1 hour, 26 minutes (-10 points).

Subassemblies: Two arms: right and left.

Arm Design: Right arm houses ST 20 arm motor and integral mechanical tools (.44 cf). Left arm houses ST 20 arm motor, integral mechanical tools, and cutting torch (.68 cf total).

Body Design: Body houses brain, sensors, communicator, spotlight, energy bank, hydrojet, 10.12 cf cargo space, 19.2 cf multiplied by 1.25 because submersible (24 cf total).

Surface Area: Right arm area 4, left arm area 5, body area 50, total surface area 59.

Structure: Light, submersible. 354 lbs., $5,900.

Hit Points: Right arm 6, left arm 8, body 30.

Armor: DR 10 metal armor (147.5 lbs., $2,950, PD 3, LC 4, 105 points); sealed (free with submersible, 20 points).

Statistics: 1,311.9 lbs. (.655 tons), $72,530, 25.12 cf (8.66' long, -10 points). Body ST 0, arm ST 20 (5 points); DX 9 (-10 points); IQ 5 (-40 points); HT 10/30 (100 points). No ground movement; Speed (in water) 3 (-5 points). Legality Class 4. Point Cost: 36 points.

TL8 Robots

"Argus 1" Aerial Spybot (TL8)

The Argus is a small robot helicopter for news gathering, police surveillance, and military reconnaissance. It has two helicopter blades, one at either end of its peanut shaped body. Not being very bright, the Argus is usually remotely controlled from a computer-equipped news van or operational command center.

Brain: Small brain, Complexity 2 (2 lbs., .04 cf, $1,000, -5 points).

Sensors: Basic sensors with +3 Acute Vision, Night Vision, Telescopic Zoom level 2, One Eye, Parabolic Hearing level 5, No Sense of Taste/Smell (3 lbs., .06 cf, $16,100, 33 points).

Communicator: Basic communicator with lasercom and mute options (10.2 lb., .204 cf, $5,100, 5 points).

Arm Motors: No arms or legs (-50 points).

Drivetrain: Helicopter drivetrain with 4.5 KW motive power (18 lbs., .36 cf, $900, 4.5 KW).

Accessories: Modular socket (2 lbs., .1 cf, $50).

Power System: Power requirement 4.5 KW. rD cell (5 lbs., .05 cf, $500, 20 points) stores 18,000 KWS. Endurance one hour, 7 minutes (-10 points).

Subassemblies: Head with full rotation; rotary wing.

Head Design: Head houses basic sensors, .07 cf empty (.13 cf total).

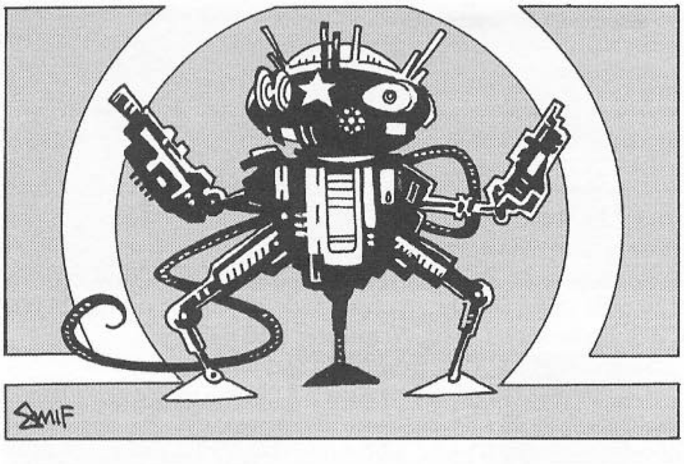
Body Design: Body houses small brain, communicator, modular socket, rD cell, .1 cf waste space for head rotation, helicopter drivetrain plus .386 cf empty space (1.6 cf total).

Rotary Wing Design: .032 cf.

Surface Area: Head area 2, body area 9, rotary wing area 3. Total surface area 14.

Structure: Extra-light. 2.625 lbs., $350.

Hit Points: Head 1, body 2, rotary wing 1.



Armor and Threat Protection: DR 1 metal armor (2.1 lbs., $42, PD 1, LC 6, 28 points).

Statistics: 44.925 lbs. (.026 tons), .708 cf (2.7' long, -10 points), $24,042. Body ST 0 (-100 points), DX 9 (-10 points), IQ 5 (-40 points), HT 12/8 (0 points). No ground or water speed. Rotor flight: air Speed 31, stall speed 0, can hover (75 points). Cannot float (-5 points). Legality Class 5. Point Cost: -69 points.

"Blue Steel" Police Robot (TL8)

This is a robot "police dog" designed to support officers during investigations with its forensic sensors, and to aid in tracking down suspects. Its small torso supports a large rotating head studded with sensors and antennae. It walks on three legs and has three arms – two jointed manipulators with built-in weapons and one whiplike cable arm for snagging suspects.

Brain: Standard brain with high-capacity and neural-net options (40 lbs., .8 cf, $45,000, 65 points), Complexity 3.

Sensors: Basic sensors with microscopic, peripheral and thermograph vision, +2 acute hearing, two levels parabolic hearing, discriminatory smell and taste, laser rangefinder (5.2 lbs., .104 cf, $24,500, 81 points).

Communicator: Basic communicator with bullhorn and disturbing voice (1.1 lbs., .022 cf, $300, 5 points).

Arm Motors: Two ST 12 arm motors (each 2.4 lbs., .048 cf, $4,800, .06 KW). ST 15 arm motor with extra-flexible option and bad grip (6 lbs., .12 cf, $6,000, .075 KW). 15 points.

Drivetrain: Leg drivetrain (three legs) with .5 KW motive power (30 lbs., .2 cf per leg motor, $3,000, .5 KW power).

Weaponry: Electroshocker (1 lb., .02 cf, $200, LC 5); Police Grenade Launcher (25 lbs., .5 cf, $1,000, LC 2 – usually loaded with baton, tangler or chemical rounds). 27 points.

Accessories: Flashlight (1 lb., .02 cf, $10); siren (.5 lbs., .1 cf, $50); spraygun (1 lb., .05 cf, $50); crimescanner (8 lbs., .16 cf, $6,000, LC 5); electronic lockpick (3 lbs., .06 cf, $1,500, LC 4).

Power: Power requirement .695 KW. Energy bank with one rE cell (20 lbs., .2 cf, $2,000, 20 points) storing 180,000 KWS power. Endurance 71 hours, 54 minutes (0 points).

Subassemblies: Three arms ("right," "left" and "center"), head, three legs.

Arm Design: Right arm houses ST 12 arm motor, electronic lockpick (.108 cf); left arm houses ST 12 arm motor and spraygun (.098 cf). Central arm houses ST 15 arm motor and electroshocker (.14 cf).

Head Design: Head houses sensors, siren, communicator, flashlight, crimescanner, police grenade launcher, .004 cf empty space (.91 cf).

Body Design: Body houses brain, energy bank, waste space for head rotation, and .109 cf empty space (1.2 cf).

Legs: Three legs, each leg houses leg motor and .04 cf empty space (.24 cf each).

Surface Area: Right and left arm area 1.5 each, central arm area 2, head area 6, body area 7, three legs area 2.5 each, total surface area 25.5.

Structure: 102 lbs., $2,550.

Hit Points: Right and left arm 5, central arm 6, head 9, body 11, each leg 4.

Armor: DR 30 metal armor (114.75 lbs., $2,295, PD 4, LC 2, 190 points); sealed ($510, 20 points).

Statistics: 363.35 lbs. (.1815 tons), $104,565, 3.176 cf (6.62' tall). Body ST 22, arm ST 15, ST 12 (76 points); DX 9 (-10 points); IQ 7 (-20 points); HT 11/11 (10 points). Speed 8.28 (10 points). Cannot float (-5 points). Legality Class 1. Point Cost: 97 points.

"Marius Mk. IV" Cargo Mule (TL8)

These loading robots, a ubiquitous sight around airports and spaceports, consist of a wheeled body with a pair of built-in arms; many cargo trucks and ships also carry them on board.

Brain: Small brain, Complexity 2 (2 lbs., .04 cf, $1,000, -5 points).

Sensors: Basic sensors with low-res vision, one eye, no sense of smell/taste, codescanner (1.2 lbs., .024 cf, $4,100, -40 points).

Communicator: Basic communicator with mute (.2 lbs., .004 cf, $100, -5 points).

Arm Motors: Two ST 20 arm motors with cheap and bad grip options (each 12 lbs., .24 cf, $4,000, .1 KW). -10 points.

Drivetrain: Wheeled drivetrain with .4 KW motive power (3 lbs., .06 cf, $60, .4 KW).

Power System: Power requirement .6 KW. rE cell (20 lbs., .2 cf, $2,000, 20 points) stores 180,000 KWS. Endurance 83 hours, 20 minutes (5 points).

Subassemblies: Two arms, wheels (four wheels).

Arm Design: Right arm housing ST 20 arm motor (.24 cf). Left arm identical.

Body Design: Body housing small brain, sensors, communicator, wheeled drivetrain, rE cell and 1.672 cf empty space (2 cf).

Wheel Design: Wheels (.4 cf).

Surface Area: Two arms area 2.5 each, body area 10, wheels area 4. Total surface area 19.

Structure: Cheap. 114 lbs., $950.

Hit Points: Right and left arm 8 each, body 15, each wheel 2.

Armor and Threat Protection: DR 2 metal armor with open frame (2.85 lbs., $57, PD 2, LC 6, 54.5 points).

Statistics: Design weight 167.25 lbs. (.083 tons), Volume 2.88 cf (3.87' across), price $16,267, Body ST 25, arm ST 20 (130 points), DX 9 (-10 points), IQ 5 (-40 points), HT 12/15 (35 points). Speed 17.5 (20 points). Cannot float (-5 points). Legality Class 6. Point Cost: 34 points.

"M19 Vanguard" Warbot (TL8)

This armored fighting robot is designed to provide fire support to an infantry or battlesuit squad. It has an armored, rounded body on four legs. Its fully-rotating turret holds a 20mm chaingun and various sensors, and a secondary turret atop that carries two lasers.

Brain: Standard brain with genius and neural-net options, Complexity 4 (40 lbs., .8 cf, $210,000, LC 5, 65 points).

Sensors: Basic sensors with thermograph, peripheral vision, +4 acute hearing, discriminatory smell and laser rangefinder options (4.4 lbs., .088 cf, $20,500, 63 points).

Communicator: Basic communicator with IFF and laser com (11 lb., .22 cf, $6,000, 25 points).

Arm Motors: No arms (-30 points).

Drivetrain: Leg drivetrain with four legs and 2 KW motive power (120 lbs., .6 cf per leg motor, $6,000, 2 KW).

Weaponry: Minicannon, 20mmCL (75 lbs., 1.5 cf, $8,000, LC 0); two military laser carbines (total 14 lbs., .28 cf, $6,000, LC 1). Weaponry costs 120 points.

Accessories: Inertial Compass (1 lb., .02 cf, $250, 5 points).

Power System: Power requirement 2 KW. Fuel cell with 2 KW output (20 lbs., uses .04 GPH hydrox, .4 cf, $500, 20 points). Self-sealing fuel tank with 2 gallons hydrox (12 lbs., .3 cf, $80, fire 10, -10 points). Endurance 50 hours.

Subassemblies: Two heads, main and secondary. Both have full rotation. Four legs.

Head Design: Secondary head houses two laser carbines and .02 cf empty space (.3 cf); it is mounted atop the main head. Main head houses chaingun, sensors and .006 cf empty space and .06 cf waste space for secondary head rotation (1.6 cf).

Body Design: Body houses brain, communicator, inertial compass, fuel cell, fuel tank, waste space for main head rotation and .44 cf empty space (2.5 cf).

Leg Design: Four legs, each housing leg motor (.6 cf each).

Surface Area: Secondary head area 3, main head area 9, body area 11, four legs area 5 each. Total surface area 43.

Structure: Heavy body. 258 lbs., $8,600.

Hit Points: Secondary head 9, main head 27, body 33, legs 15 each.

Armor and Threat Protection: DR 160 laminate armor (688 lbs., $68,800, PD 4, LC 1, 740 points); IR Cloaking (43 lbs., $6,450, 2 points); sealed ($860, 20 points).

Statistics: 1,286.4 lbs. (.643 tons), 3.64 cf (5.87' wide, -10 points), $342,040. Body ST 66 (115.8 points), DX 10, IQ 8 (-15 points), HT 10/33 (115 points). Speed 10.58 (20 points). Cannot float (-5 points). Legality Class 0. Point Cost: 248.

"Rover-8" Security Robot (TL8)

This robot is designed for routine security guard duty in and around buildings or aboard large ships. It is a cylindrical robot on wheels, with a rotating domed head and a single weapon-equipped arm for restraining suspects or opening doors. It is not very clever, and is usually controlled by a building or ship computer. It is armed with a variety of non-lethal weapons.

Brain: Standard brain, Complexity 3 (40 lbs., .8 cf, $15,000, -5 points).

Sensors: Basic sensors with low-res and infrared vision, one eye, no sense of smell/taste, smoke detector, codescanner (1.8 lbs., .036 cf, $4,600, -25 points).

Communicator: Basic communicator with bullhorn option (1.1 lbs., .022 cf, $550, 15 points).

Weapons: Tangler (6 lbs., .12 cf, $1,000, LC 5); Electroshocker (1 lb., .02 cf, $200, LC 5). Weaponry costs 12 points.

Accessories: Flashlight (1 lb., .02 cf, $10); Spraygun (1 lb., .05 cf, $50); Modular socket (3.5 lbs., .07 cf, $35).

Arm Motors: One ST 12 arm motor with cheap and bad grip options (4.8 lbs., .096 cf, $1,200, .06 KW). -30 points.

Drivetrain: Wheeled drivetrain, .15 KW motive power (1.125 lbs., .0225 cf, $22.50, .15 KW).

Power System: Power requirement .21 KW. rD cell energy bank (5 lbs., .05 cf, $500, 20 points) storing 18,000 KWS.

Subassemblies: Arm, head with full rotation, three wheels.

Arm Design: Arm houses ST 12 arm motor, electroshocker and modular socket (.186 cf).

Head Design: Head houses sensors, tangler, flashlight, and .004 cf empty space (.18 cf)

Body Design: Body houses brain, communicator, spraygun, drivetrain, rD cell, waste space for head rotation, and .0195 cf empty space (1 cf).

Wheel Design: Three wheels (3.5 lbs., .1 cf, $115, .2 KW).

Surface Area: Arm area 2, head area 2, body area 6, wheel area 1.5. Total surface area 11.5.

Structure: 46 lbs., $1,150.

Hit Points: Arm 6, head 3, body 9, wheels 2 each.

Armor and Threat Protection: DR 10 metal armor (17.25 lbs., $345, PD 3, LC 4, 105 points).

Statistics: 133.075 lbs. (.0665 tons), 1.566 cf (3.46' tall), $24,777.50. Body ST 7, arm ST 12 (-8 points), DX 9 (-10 points), IQ 6 (-30 points), HT 12/9 (5 points). Speed 12 (12.5 points). Cannot float (-5 points). Legality Class 4. Point Cost: 16 points.

TL9 Robots

"Streethawk" Urban Battlesuit (TL9)

This isn't a robot – it's a battlesuit, humanoid powered armor. This particular model is a lightly-armed "commando" version for close-range combat (it also makes a good superhero battlesuit). Unlike many heavier suits, the Streethawk is a sleek, form-fitting design that closely following the contours of the wearer's body. Its computer brain can operate it like a robot, but the Streethawk is most efficient when being worn by a pilot.

Brain: Small brain (1 lb., .02 cf, $500) Complexity 3.

Battlesuit: Pilot (w/150 lb. pilot weight, 180 lbs., $3,000).

Sensors: Basic sensors with infrared and night vision, laser rangefinder, no sense of smell/taste (1.5 lb., .03 cf, $4,550).

Communicator: Basic communicator with IFF (.5 lbs., .01 cf, $500).

Arm Motor: Two arm motor with ST 30 (each 4.5 lbs., .09 cf, $4,500, .15 KW).

Drivetrain: Leg drivetrain with two legs and .7 KW motive power (28 lbs., .28 cf per leg motor, $5,600).

Thrust Propulsion: Chemical rocket with 440 lbs. thrust and vectored thrust option (9.9 lbs., .198 cf, uses 110 gph rocket fuel, .03 per second, $495).

Weaponry: Assault razergun (5 lbs., .1 cf, $3,000, LC 1); plasmafaust (2 lbs., .04 cf, $2,000, LC 2).

Accessories: 6 hours life support (25 lbs., .5 cf, $250); inertial compass (.5 lbs., .01 cf, $125); gyrobalance ($2,500).

Power: Power requirement 1 KW. TL9 MHD turbine (8 lbs., .16 cf, $500, .02 GPH HO). Energy bank with two rC cells stores 5,400 KWS; Self-sealing tank with .24 gallons hydrox fuel (1.44 lbs., .036 cf, $9.60). Self-sealing tank with .3 gallons rocket fuel (1.8 lbs., .045 cf, $12). Endurance 12 hours on internal fuel + 1.5 hours with energy bank; rocket fuel lasts only 10 seconds; it is used mainly for brief jumps in tactical situations.

Subassemblies: Right and left arm, head, two legs and pod.

Arm Design: Right arm houses arm motor with bad grip, plasma faust, razergun and pilot's arm (.38 cf), left arm houses arm motor and pilot's arm (.24 cf).

Head Design: Head houses sensors, communicator and pilot's head (.415 cf).

Body Design: Houses brain, pilot's torso, waste space for head rotation, MHD power plant, energy bank, fuel tank, inertial compass, .0025 cf empty space (1.8 cf).

Pod Design: Attached to back; holds life support, chemical rocket, rocket fuel and .007 cf empty space (.75 cf).

Leg Design: Each leg houses pilot's leg and leg motor (.655 cf each).

Surface Area: Right arm 3, left arm 2.5, head 4, body 9, each leg 5, pod 5, total surface area 33.5.

Structure: Expensive, heavy. 96.1875 lbs., $13,400.

Hit Points: Right arm 18, left arm 15, head 12, body 27, each leg 15, pod 15.

Armor: DR 80 laminate (160.8 lbs., $16,080, LC 0, PD 4) plus IR cloaking (16.75 lbs., $5,025) and sealed ($335).

Statistics: 414.2525 lbs. design weight, 564.2525 lbs. loaded weight with 150-lb. pilot (.282 tons), 4.895 cf (6.6' tall), $66,881.60. Body ST 33, arm ST 30, DX (pilot, or DX 9), IQ (pilot or IQ 6), HT 12/27. Ground Speed 6.3; air Speed: none, but use of the rockets divides the distance it can jump by .23. Cannot float. Legality Class 0.

"Johnny Appleseed" Colonial Agrobot (TL9)

This is a multi-purpose farming robot. The size of a horse, it has a skinny, skeletal body mounted on double pairs of tracks, no head, and three long arms. It can be used for anything from seed planting to fruit picking, or even pulling a plough. Built-in tools let it to perform logging, crop-spraying, vaccination, sheering or slaughterhouse tasks.

While the Agrobot is familiar at TL9, if a UFO brought one to modern Earth, it would be a frightening alien machine! Perhaps alien agrobots are behind the cattle mutilations?

Brain: Standard brain (20 lbs., .4 cf, $7,500, -5 points), Complexity 4.

Sensors: Basic sensors with night vision and bioscanner (2 lbs., .04 cf, $6,050, 30 points).

Communicator: Basic communicator with mute and infrared com options (.35 lbs., .007 cf, $175, 0 points).

Arm Motors: Two ST 15 arm motors with cheap option (each 4.5 lbs., .09 cf, $2,250, .075 KW). One ST 20 arm motor with "striker" option (1.5 lbs., .03 cf, $1,200, .1 KW). 5 points.

Drivetrain: Tracked drivetrain with .5 KW motive power (7.5 lbs., .15 cf, $150, .5 KW).

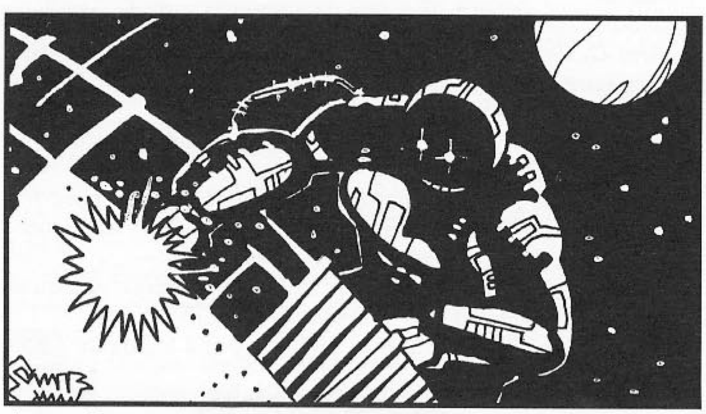
Weaponry: Chainsaw (10 lbs., .2 cf, $40, .1 KW), drug injector ($25, .25 lbs., .005 cf), large knife with vibroblade ($140, 1 lb., .02 cf, LC 3). Costs 17 points.

Accessories: Spraytank (8 lbs., .4 cf, $100).

Power: Power requirement .85 KW. TL9 fuel cell with .85 KW output (8.5 lbs., .17 cf, $500, uses .01275 gph hydrox, 20 points). TL9 self-sealing tank with 3 gallons hydrox fuel (18 lbs., .45 cf, $120, fire 10, -10 points). Endurance 235 hours, 17 minutes (8 points).

Subassemblies: Three arms (right, left and center); head; tracks (four tracks).

Arm Design: The central arm houses ST 20 arm motor and chainsaw (.23 cf); the right arm houses a ST 15 arm motor and the large knife (.11 cf); the left arm houses a ST 15 arm motor and drug injector (.095 cf).



Head Design: Head houses sensors, communicator, spraytank and .053 cf of empty space (.5 cf).

Body Design: Body houses brain, tracked drivetrain, fuel cell, fuel tank, 4.78 cf cargo space and waste space for head rotation (6 cf).

Track Design: Tracks (3.6 cf).

Surface Area: Central arm area 2.5, right and left arm area 1.5 each, head area 4, body area 20, tracks area 15, total surface area 44.5.

Structure: Cheap, light. 101.25 lbs., $1,112.50.

Hit Points: Central arm 4, right and left arms 2 each, head 3, body 15, tracks 6 each.

Armor: DR 5 open frame metal armor (11.125 lbs., $222.50, PD 3, LC 5, 86.25 points).

Statistics: 198.475 lbs. (.0992 tons), 10.535 cf (6' long, -10 points), $21,835.50. Body ST 30, arm ST 20 or ST 15 (121 points), DX 10 (0 points), IQ 7 (-20 points), HT 12/15 (35 points). Speed 13.4 (12.5 points). Cannot float (-5 points). Legality Class 3. Point Cost: 57 points.

"Kobold-D" Space Worker Robot (TL9)

The Kobold-D is designed to work with humans at zero-G construction, engineering, mining and prospecting. Its clunky humanoid body calls to mind mid-20th century images of robots: a small domed head, two arms and two legs. Auxiliary chemical rockets allow it to operate in zero G. Its modular socket is usually fitted with engineering or mechanical tools; it also has a sizable cargo bay for storing spare parts, equipment or ore samples.

Brain: Standard brain with neural-net, Complexity 4 (20 lbs., .4 cf, $15,000, 65 points).

Sensors: Basic sensors with chemscanner and radscanner (3 lbs., .06 cf, $7,000, 10 points).

Communicator: Basic communicator (.5 lbs., .01 cf, $250, 15 points).

Thrust-Based Propulsion: Chemical rocket with 10 lbs. thrust and with vectored thrust (.225 lbs., .0045 cf, uses 2.5 gph rocket fuel, $11.25).

Arm Motors: Two ST 14 arm motors with cheap option (each 4.2 lbs., .084 cf, $2,100, .07 KW).

Drivetrain: Leg drivetrain (two legs) with .3 KW motive power (12 lbs., .12 cf per leg, $2,400, .3 KW).

Weaponry: Heavy laser torch (20 lbs., .4 cf, $250, 10 points).

Accessories: Flashlight (.5 lbs., .01 cf, $5); inertial compass (.5 lbs., .01 cf, $125, 5 points); two modular sockets (each 10 lbs., .2 cf, $100).

Power System: Power requirement .44 KW. rE cell energy bank storing 270,000 KWS (20 lbs., .2 cf, $2,000, 20 points). Fuel tank with 2.5 gallons rocket fuel (15 lbs., .375 cf, $25, fire 10, -10 points). Endurance 170.4 hours (8 points).

Subassemblies: Two arms (right and left), head, two legs.

Arm Design: Right arm housing ST 14 arm motor and modular socket (.284 cf); left arm identical.

Head Design: Head houses sensors, communicator, flashlight, heavy laser torch, inertial compass, .01 cf empty space (totals .5 cf).

Body Design: Body houses brain, chemical rocket, rE cell, fuel tank, waste space for head rotation, .9705 cf empty space (2 cf).

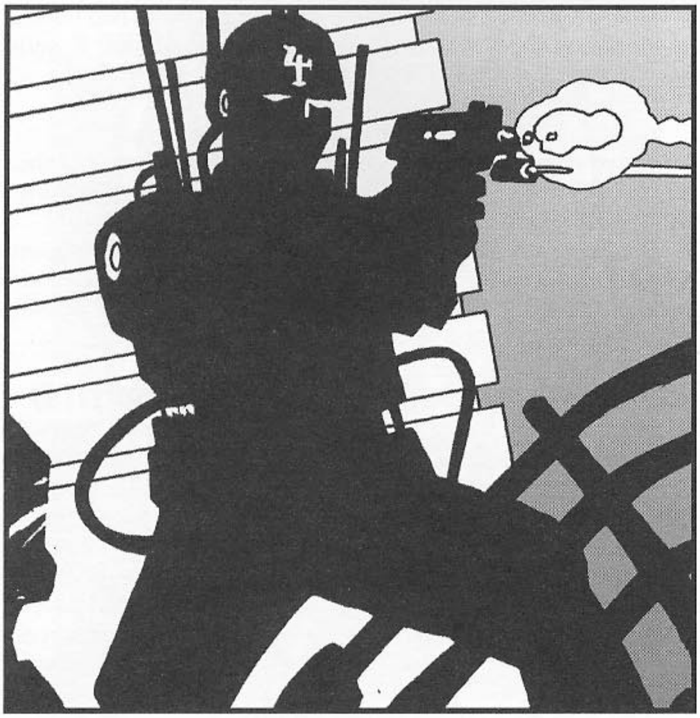
Leg Design: Two legs, each leg has leg motor and .48 cf empty space (.6 cf).

Surface Area: Two arms 3 each, head 4, body 11, two legs 5 each, robot surface area 31.

Structure: 93 lbs., $3,100.

Hit Points: Arms 9 each, head 6, body 17, legs 8 each.

Armor and Threat Protection: DR 7 metal armor (21.7 lbs.,



$434, PD 3, LC 4, 96 points), radiation shielding (15.5 lbs., $155, 6 points); sealed ($310, 20 points).

Statistics: 250.325 lbs. (.125 tons), 3.768 cf (7.11' tall, -10 points), $35,465.25. Body ST 14, arm ST 14 (45 points), DX 10, IQ 8 (-15 points), HT 12/17 (45 points). Speed 6.1 (0 points); air Speed 0 (not enough thrust in Earth-normal gravity to achieve flight, but multiplies jump distance by 1.044). Cannot float (-5 points). Legality Class 4. Point Cost: 61 points.

"Muramasa 7" Commando Robot (TL9)

This is a humanoid robot soldier, designed for special forces operations. It resembles a man-sized metallic doll with clawed hands, glowing eyes and antennae. It can use human equipment, or (if clothed) pass as a person at a distance or in bad light.

Brain: Standard brain with genius and neural-net option, +3 DX booster Complexity 5 (20 lbs., .4 cf, $315,000, 65 points).

Sensors: Basic sensors with thermograph vision, +3 acute hearing, bioscanner and radscanner (3.5 lbs., .07 cf, $8,750, 51 points).

Communicator: Basic communicator with IFF (.5 lbs., .01 cf, $500, 15 points).

Arm Motors: Two ST 30 arm motors (each 4.5 lbs., .09 cf, $9,000, .15 KW).

Drivetrain: Leg drivetrain with two legs and .5 KW motive power (20 lbs., .2 cf per leg motor, $4,000, .5 KW).

Weapons: Military laser rifle, concealed (9 lbs., .45 cf, $2,000, LC 0). Sharp monowire claws on right and left hands ($700 and LC 3 each). Weaponry costs 106 points.

Accessories: Laser periscope (.9 lbs., .045 cf, $400); laser sight built into laser ($25); inertial compass (.5 lbs., .01 cf, $125, 5 points); gyrobalance ($2,500, 15 points); self-destruct with two pounds TL9 explosive (2 lbs., .04 cf, $160, LC 0).

Power System: Power requirement .8 KW. rE cell energy bank (20 lbs., .2 cf, $2,000, 20 points) storing 270,000 KWS. Endurance 93.75 hours (5 points).

Subassemblies: Two arm (right and left), head, two legs.

Arm Design: Right arm houses ST 30 arm motor, sharp claws and .01 cf empty space (.1 cf). Left arm is identical.

Head Design: Head houses sensors, communicator, inertial compass and laser periscope and .165 cf empty space (.3 cf).

Body Design: Body houses brain, rE cell, military laser, gyrobalance, self-destruct, waste space for head rotation, .09 cf empty space (1.2 cf).

Leg Design: Two legs, each houses leg motor and .16 cf empty space (.36 cf each).

Surface Area: Two arms 1.5 each, head 3, body 7, two legs 3 each. Total surface area 19.

Structure: Extra-heavy, expensive. 85.5 lbs., $19,000.

Hit Points: Arms 18 each, head 18, body 42, legs 21 each.

Armor and Threat Protection: DR 100 laminate armor (114 lbs., $11,400, PD 4, LC 0, 500 points); infrared cloaking and stealth (18 lbs., $2,850, LC 5, 6 points); sealed ($190, 20 points).

Biomorphics: Sculpted ($380, 1.9 lbs.); Attractive ($190, 5 points).

Statistics: 304.8 lbs. (.1525 tons), 2.42 cf (5.8' tall), $398,870. Body ST 28, arm ST 30 (170 points), DX 13 (30 points), IQ 9 (-10 points), HT 12/42 (170 points). Speed 7.2 (5 points). Cannot float (-5 points). Legality Class 0. Point Cost: 235 points.

"R5S Samaritan" Rescue Robot (TL9)

The Samaritan supplements human emergency workers at firefighting and rescue work. It resembles a seven-foot-tall "mechanical man." Its head is topped with a siren and light and has a concealed laser cutting torch for freeing trapped victims; its right and left arms have built-in medical tools, and its body has a pair of fire extinguishers. It's usually painted white. It can fly with rocket jets built into each leg and although it has only enough fuel for a few minutes, this is enough to rescue people trapped on upper stories. The Samaritan would also make an effective robot superhero, constructed by a genius gadgeteer.

Brain: Standard brain with neural-net option, Complexity 4 (20 lbs., .4 cf, $15,000, 65 points).

Sensors: Basic sensors with thermograph vision, +3 acute hearing, bioscanner and radscanner (3.5 lbs., .07 cf, $8,750, 51 points).

Communicator: Basic communicator with bullhorn (.55 lbs., .011 cf, $275, 15 points).

Arm Motors: Two ST 24 arm motors with extendible option (each 7.2 lbs., .144 cf, $14,400, .12 KW). 15 points.

Drivetrain: Leg drivetrain with two legs and .35 KW motive power (14 lbs., .14 cf per leg motor, $2,800, .35 KW).

Thrust-Based Propulsion: Two chemical rockets each with 200 lbs. thrust and vectored thrust option (each 4.5 lbs., .09 cf, uses 50 gph rocket fuel, $225).

Weapons: Medium laser torch, concealed (5 lbs., .25 cf, $125, LC 6, 5 points).

Accessories: Siren (.25 lbs., .05 cf, $25); two fire extinguishers (each 2 lbs., .1 cf, $25); gyrobalance ($2,500, 15 points); two sets of medical tools (each 2 lbs., .04 cf, $1,000, LC 5).

Power System: Power requirement .59 KW. Three rD cells in energy bank storing 54,000 KWS (15 lbs., .15 cf, $1,500, 20 points). Self-sealing fuel tank with 5 gallons rocket fuel (30 lbs., .75 cf, $200, fire 10, -10 points). Endurance 25 hours, 25 minutes (0 points). Can only fly for 3 minutes.

Subassemblies: Two arms (right and left), head, two legs.

Arm Design: Right arm housing ST 24 arm motor, medical tools (.184 cf); left arm housing ST 24 arm motor, medical tools (.184 cf).

Head Design: Head houses sensors, communicator, laser torch, siren, .019 cf empty space (.45 cf).

Body Design: Body houses brain, fire extinguisher, gyrobalance, energy bank, fuel tank, waste space for turret rotation (1.545 cf).

Leg Design: Two legs; each leg houses leg motor, chemical rocket and .2335 cf empty space (.4635 cf each).

Surface Area: Two arms each area 2, head area 4, body area 8, two legs area 4 each. Total surface area 24.

Structure: Heavy, expensive. 81 lbs., $9,600.

Hit Points: Each arm 12, head 12, body 24, each leg 12.

Armor and Threat Protection: DR 10 metal armor (24 lbs., $480, PD 3, LC 3, 105 points); radiation shielding (12 lbs., $120, 6 points); sealed ($240, 20 points).

Biomorphics: Sculpted body (2.4 lbs., $480).

Statistics: 239.1 lbs. (.119 tons), 3.29 cf (6.36' tall), $73,395. Body ST 18, arm ST 24 (117.5 points), DX 10, IQ 8 (-15 points), HT 12/24 (80 points). Speed 6.85 (on ground); Stall Speed 0, air Speed (vectored thrust flight) 176.77 and can hover (90 points). Cannot float (-5 points). Legality Class 3. Point Cost: 115 points.

"Ulysses Mark 2" Planetary Explorer (TL9)

This is a 6'-long tracked robot with two arms and a small rotating head equipped with many sensors. It is designed to operate in very harsh environments, and is light enough to use its tracks to swim. It is usually landed on a world and remotely controlled by either an orbiting ship's computer or a human operator, but is smart enough to explore on its own. It carries a stun rifle for capturing specimens.

Brain: Microframe brain with neural-net option, Complexity 5 (100 lbs., 2 cf, $40,000, .1 KW, 65 points).

Sensors: Basic sensors with peripheral vision, thermograph vision, +3 acute hearing, bioscanner, chemscanner and radscanner (4.5 lbs., .09 cf, $10,750, 71 points).

Communicator: Basic communicator with lasercom and mute options (5.1 lbs., .102 cf, $2,550, 5 points).

Arm Motors: Two ST 15 arm motors with cheap option (each 4.5 lbs., .09 cf, $2,250, .075 KW).

Drivetrain: Tracked drivetrain with 2 KW motive power (15 lbs., .3 cf, $300, 2 KW).

Weapons: Stun rifle, concealed (4 lbs., .2 cf, $2,000, LC 5). Weaponry costs 10 points.

Accessories: Inertial compass (.5 lbs., .01 cf, $125, 5 points); flashlight (.5 lbs., .01 cf, $5).

Power System: Power requirement 2.25 KW. Nuclear power unit with 2.3 KW output (27.6 lbs., .276 cf, $20,000, LC 4, 20 points). Endurance one year (10 points).

Subassemblies: Two arms (right and left); head with full rotation; tracks (two).

Arm Design: Right arm housing ST 15 arm motor (.09 cf). Left arm identical.

Head Design: Head houses sensors, flashlight, stun rifle (.3 cf).

Body Design: Body houses brain, communicator, tracked drivetrain, nuclear power unit, inertial compass, 2.252 cf cargo space, waste space for head rotation (5 cf).

Motive System: Tracked motive system (3 cf) with two tracks.

Surface Area: Two arms area 1.5 each, head area 3, body area 18, tracks area 13. Total surface area 37.

Structure: 111 lbs., $3,700.

Hit Points: Each arm 5, head 5, body 27, each track 20.

Armor and Threat Protection: DR 30 metal armor (111 lbs., $2,220, PD 4, LC 2, 190 points); radiation shielding (18.5 lbs., $185, 6 points); sealed ($370, 20 points).

Statistics: 406.7 lbs. (.203 tons), 8.48 cf (5.6' long, -10 points), $86,705. Body ST 54, arm ST 15 (123.5 points), DX 10, IQ 9 (-10 points), HT 12/27 (95 points). Ground Speed 18.8 (15 points). Floats; water Speed 4. Legality Class 2. Point Cost: 124 points.

AAV-1 "Vulture" Autonomous Attack Vertol (TL9)

This vertical-takeoff flying warbot is designed to provide close-air support to ground forces and has a flying endurance of 1.5 hours. The Vulture resembles a rotorless attack helicopter with a small laser turret under the nose and four pods attached to the fuselage, two on either side. The two small forward pods contain rocket launchers; the two large rear pods house tilt-jet engines.

Brain: Microframe brain with neural-net option and +1 DX booster (100 lbs., 2 cf, $60,000, .1 KW, 65 points), Complexity 5.

Sensors: Basic sensors with night vision and thermograph vision, 2 level telescopic zoom, no sense of smell/taste, all three scanners (4.7 lbs., .094 cf, $9,050, 67 points).

Communicator: Basic communicator with bullhorn, long-range radio, IFF and lasercom options (10.55 lbs., .211 cf, $3,325, 27 points).

Arm Motors: No arms or legs (-50 points).

Thrust-Based Propulsion: Two turbofans, each with 3,000 lb. thrust and vectored thrust option (600 lbs., 12 cf, uses 45 gph jetfuel, $30,000).

Weaponry: Gatling laser (75 lbs., 1.5 cf, $20,000, LC 0). Four heavy rocket launchers (each 100 lbs., $3,000, 2 cf, LC 0). Weaponry costs 180 points.

Accessories: Inertial navigation system (10 lbs., .2 cf, $12,500, 5 points); spraytank (8 lbs., .4 cf, $100).

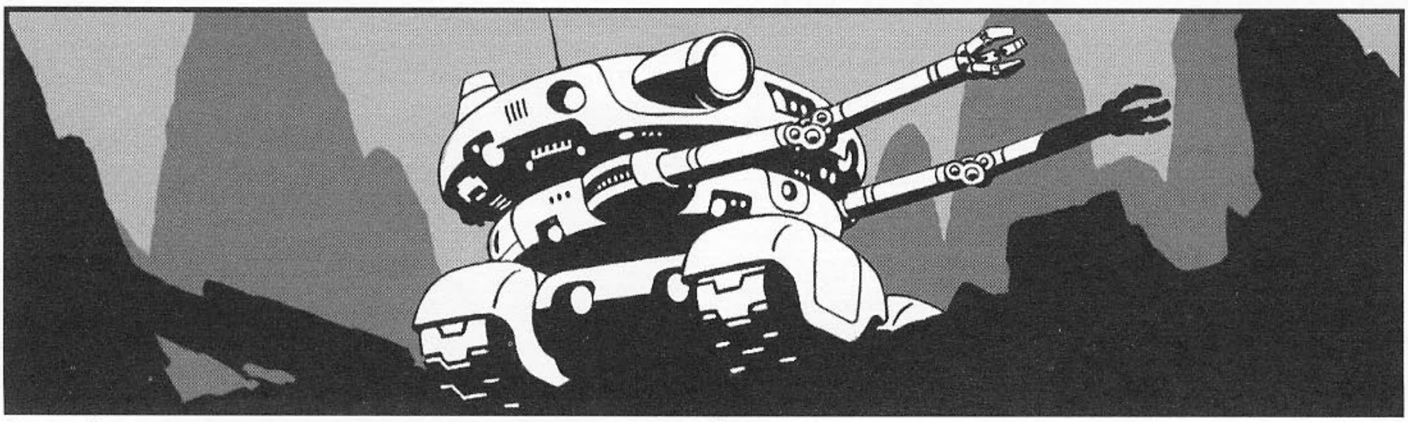
Power: Power requirement .1 KW. Energy bank with E cell (20 lbs., .2 cf, $2,000, 20 points) with 270,000 KWS stored power. Jet engines provide their own power. Self-sealing tank with 135 gallons jet fuel (1,012.5 lbs., 20.25 cf, $5,400, fire 10, -10 points). Endurance 3 hours flying (-10 points); brain can operate for 750 hours.

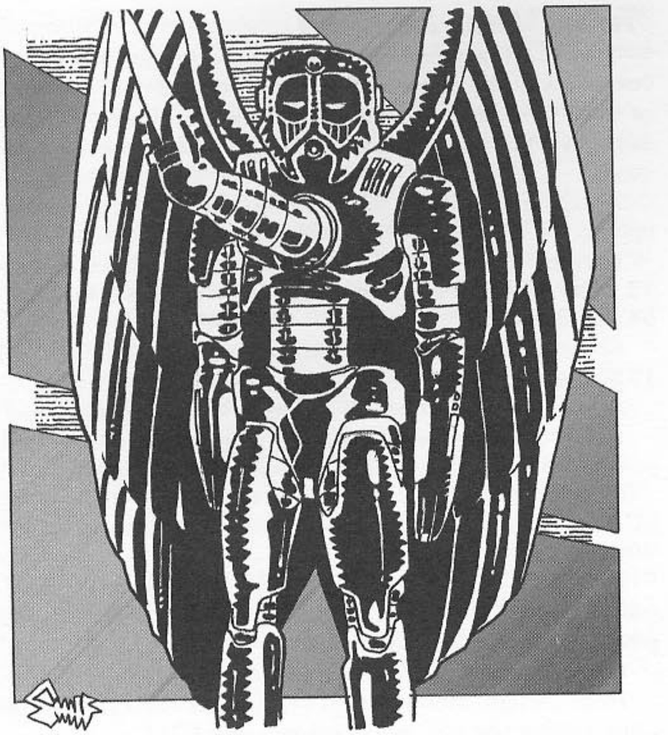
Subassemblies: Head, four pods.

Head: Head houses Gatling laser (1.5 cf).

Body: Body houses brain, sensors, communicator, inertial navigation system, spraytank, energy bank, fuel tank, waste space for turret rotation and .49 cf empty space (24 cf).

Pods: Four pods. Each rear pod houses 1 turbofan (12 cf each). Each front pod houses two rocket launchers (4 cf each).





Surface Area: Head area 8, rear pods area each 40, front pods area each 16, body area 50, total surface area 170.

Structure: Expensive. 382.5 lbs., $34,000.

Hit Points: Head 12, rear pods 60 each, front pods 24 each, body 75.

Armor: DR 100 laminate (1,020 lbs., $102,000, PD 4, LC 1, 500 points); IR cloaking and stealth (170 lbs., $5,100, 6 points).

Statistics: 4,413.5 lbs. (2.206 tons), 57.5 cf (5.9' long), $325,475. Body ST 0, no arms (-100 points), DX 11 (10 points), IQ 9 (-10 points), HT 8/75 (320 points). Air Speed (vectored thrust flight) 132 (85 points). Cannot float (-5 points). Legality Class 0. Point Cost: 220 points.

TL10 and Above Robots

"Cerberus" Security and Patrol Robot (TL10)

Designed as a guard and police robot, the Cerberus is an intimidating man-sized humanoid robot. Its head features large glowing eyes, sensor antennae and almost canine jaws. Obvious gun barrels protrude from each palm. It normally moves on two legs, but a built-in rocket pack allows short-duration flight.

Brain: Standard brain with neural-net option (10 lbs., .2 cf, $7,500, 65 points), Complexity 5.

Sensors: Basic sensors with thermograph vision, +3 acute hearing, bioscanner, chemscanner and radscanner (2.25 lbs., .045 cf, $4,875, 56 points).

Communicator: Basic communicator with bullhorn option (.275 lbs., .0055 cf, $137.50, 15 points).

Arm Motors: Two ST 15 arm motors with cheap option (each is 3 lbs., .06 cf, $1,500, .075 KW).

Drivetrain: Leg drivetrain with two legs and .3 KW motive power (9 lbs., .09 cf per leg motor, $1,800, .3 KW).

Thrust-Based Propulsion: Chemical rocket with 200 lbs. thrust (4.5 lbs., .09 cf, uses 50 gph rocket fuel, $225) with vectored thrust.

Weaponry: One heavy laser pistol (3 lbs., .06 cf, $375, LC 2); stun rifle (4 lbs., .08 cf, $1,000, LC 5). ST 11 cutting jaws with vibroblade ($1,700, 1.1 lbs., .055 cf, .11 KW, LC 3). Weaponry costs 30 points.

Accessories: Fire extinguisher (2 lbs., .1 cf, $25); spraygun (1 lb., .05 cf, $50).

Power: Power requirement .45 KW. rE cell (20 lbs., .2 cf, $2,000, 20 points) with 360,000 KWS. Self-sealing fuel tank with 5 gallons rocket fuel (30 lbs., .75 cf, $200, fire 10, -10 points). Two self-sealing fuel tanks with one gallon rocket fuel each (each 6 lbs., .15 cf, $40, fire 10). Endurance 222 hours, 20 minutes (8 points); flight endurance is only 8.4 minutes.

Subassemblies: Two arms (right and left); head; two legs.

Arm Design: Right arm houses ST 15 arm motor, heavy laser pistol and .02 cf empty space (.14 cf). Left arm houses ST 15 arm motor and stun rifle (.14 cf).

Head: Head houses brain, basic sensors, communicator, cutting jaw and .0045 cf of empty space (.41 cf).

Body: Houses rocket, E cell, 5 gallon fuel tank, spraygun, waste space for head rotation and .069 cf empty space (1.2 cf).

Legs: Two legs, each houses leg motor, one gallon fuel tank and .12 cf empty space (.36 cf).

Surface Area: Right arm 2, left arm 2, head 4, body 7, two legs 3 each. Total surface area 21.

Structure: 42 lbs., $2,100.

Hit Points: Each arm 6, head 6, body 11, each leg 5.

Armor: DR 20 metal (25.2 lbs., $504, PD 4, LC 2, 160 points); sealed ($210, 20 points).

Statistics: 171.325 lbs. (.0855 tons), 2.61 cf (6.09' tall), $25,781.50. Body ST 17, Arm ST 15 each (70 points), DX 10 (0 points), IQ 9 (-10 points), HT 12/11 (15 points). Speed 7.49, stall speed 0, air Speed 50.6, can hover (80 points). Cannot float (-5 points). Legality Class 2. Point Cost: 103 points.

"AA-20 Gabriel" Robot Trooper (TL10)

The Gabriel is designed to replace both paratroops and vertol or jetpack infantry in the air-assault role. This seven-and-a-half-foot-tall sculpted metal humanoid has three arms, built-in rocket engines and folding wings, vaguely resembling a steel angel. Two of its arms have X-ray lasers and one also has a short sword-blade extending from the wrist for close fighting. The third arm carries a grenade launcher. Its head has an extensive sensor array and a paralysis gun; a back-up imaging ladar is mounted in the upper torso.

Brain: Small brain with genius, hardened, high-capacity, neural-net, +2 DX options, Complexity 5 (1.5 lbs., .03 cf, $150,000, 65 points).

Sensors: Two sensor systems: #1 sensors are basic sensors with +1 acute vision, spectrum vision, +2 telescopic zoom, super-hearing, all three scanners, no sense of smell/taste (2.75 lbs., .055 cf, $8,125, 119 points). #2 sensors are basic sensors with blind, deaf, no sense of taste/smell, imaging ladar one level (.5 lbs., .01 cf, $1,875, .25 KW power, 50 points).

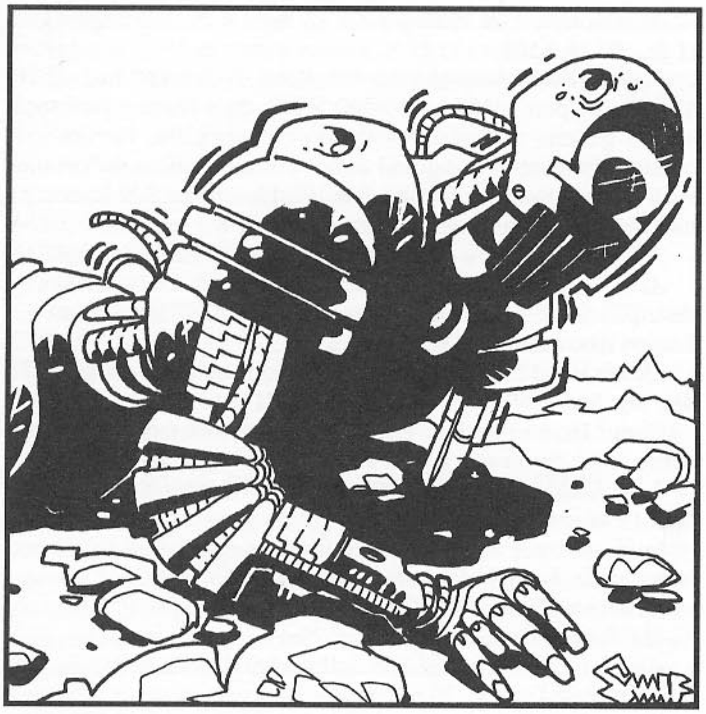
Communicator: Basic communicator with medium-range radio, IFF and lasercom (3 lbs., .06 cf, $1,550, 26 points).

Arm Motors: Two ST 15 arm motors (each is 1.5 lbs., .03 cf, $3,000, .075 KW). One ST 10 arm motor with "striker" option (1 lb., .02 cf, $400, .05 KW). 5 points.

Drivetrain: Leg drivetrain with two legs and .75 KW motive power (30 lbs., .3 cf per leg motor, $6,000, .75 KW).

Thrust-Based Propulsion: Fusion rocket with 600 lbs. thrust and vectored thrust (60 lbs., 1.2 cf, uses 12 gph Water, $6,000).

Weaponry: Military x-laser rifle (9 lbs., .18 cf, $4,000, LC 0); military X-laser carbine (7 lbs., .14 cf, $3,000, LC 1); electromag grenade launcher (10 lbs., .2 cf, $1,250, LC 0); military paralysis gun, concealed (5 lbs., .25 cf, $3,000, LC 4); fine monowire shortsword (2 lbs., .04 cf, $900, LC 3). Weaponry costs 135 points.



Accessories: Gyrobalance ($1,250, 15 points), Inertial Compass (.25 lbs., .005 cf, $62.50, 5 points).

Power: Power requirement 1.2 KW. Nuclear power unit with 1.2 KW output (7.2 lbs., .072 cf, $20,000, LC 4, 20 points). Two self-sealing tanks with one gallon water (each 10.5 lbs., .15 cf, $40). One self-sealing tank with 4 gallon waters (42 lbs., .6 cf, $160).

Subassemblies: Three arms: left, upper right and lower right; head; two wings; two legs; pod.

Arm Design: Upper right arm houses ST 15 motor, shortsword and military x-laser carbine (.21 cf). Lower right arm houses ST 10 arm motor and grenade launcher (.22 cf). Left arm houses ST 15 arm motor and military x-laser rifle (.21 cf).

Head Design: Head houses #1 sensors, military paralysis gun, inertial compass (.31 cf).

Body Design: Houses brain, communicator, gyrobalance, fusion rocket, nuclear power unit, fuel tank, waste space for head rotation, #2 sensors, .007 cf empty space (2.01 cf).

Leg Design: Two legs, each houses leg motors, one gallon water tank and .15 cf empty space (.6 cf each).

Wing Design: Two wings, each houses .4 cf empty space (.4 cf each).

Surface Area: Upper right arm 2.5, lower right arm 2.5, left arm 2.5, head 3, body 10, two legs 5 each, wings 10 each. Total surface area 50.5.

Structure: Expensive, heavy. 113.6 lbs., $20,200.

Hit Points: Each arm 15, head 9, body 30, each leg 15, each wing 30.

Armor: DR 90 laminate (181.8 lbs.. $18,180, LC 0, PD 4, 460 points); intruder chameleon (30.3 lbs., $20,200, 50 points); stealth and IR cloaking (50.5 lbs., $7,575, 8 points); sealed ($505, 20 points).

Biomorphics: Sculpted body (5.5 lbs., $1,010); surface sensors ($15,150).

Statistics: 597.4 lbs. (.2987 tons), 5.56 cf (6.6' tall, -10 points), $296,472.50. Body ST 36, Arm ST 15 or ST 10 each (119 points), DX 12 (20 points), IQ 9 (-10 points), HT 12/30 (110 points). Speed 6.33 (ground), stall speed 0, air Speed (fixed wing flight) 149.25, can hover (85 points). Cannot float (-5 points). Legality Class 0. Point Cost: 258 points.

"Furbot" Robot Pet (TL10)

This is a fuzzy petbot, a four-legged animal-shaped robot covered with fur. It could resemble a robot dog or a *large* cat, or some other furry quadruped. Depending on programming, it might be a pet, a nanny, a bodyguard, a hunter, or even a prison guard.

Brain: Small brain with +2 DX booster and neural-net options (.5 lbs., .01 cf, $1,000, 65 points), Complexity 4.

Sensors: Basic sensors with night vision, +2 acute hearing, +2 acute taste and smell, discriminatory smell (.6 lb., .012 cf, $4,025, 33 points).

Communicator: Basic communicator (.25 lbs., .005 cf, $125, 15 points).

Arm Motors: No arms (-30 points).

Drivetrain: Leg drivetrain with four legs and .15 KW motive power (4.5 lbs., .0225 cf per leg motor, $225, .15 KW).

Weaponry: ST 10 cutting jaws ($1,500, 1 lb., .05 cf, .1 KW, LC 5). Four sharp claws (one per leg motor, each $200, LC5). Weaponry costs 18 points.

Power: Power requirement .25 KW. Energy bank using rE cell (20 lbs., .2 cf, $2,000, 20 points) with 360,000 KWS stored power. Endurance 400 (8 points)

Subassemblies: Head; four legs.

Head Design: Houses small brain, basic sensors, communicator, cutting jaw and .123 cf empty space (.2 cf).

Body Design: Body houses energy bank, waste space for head rotation, .38 cf empty space (.6 cf).

Leg Design: Four legs, each housing leg motor and .0675 cf empty space (.09 cf each).

Surface Area: Head 2.5, body 5, four legs 1.5 each, total surface area 13.5.

Structure: 27 lbs., $1,350.

Hit Points: Head 4, body 8, each leg 2.

Armor: DR 2 metal (1.62 lbs., $32.40, PD 2, LC 6, 56 points). Waterproof ($27).

Biomorphics: Realistic flesh and fur (10.125 lbs., $1,215); surface sensors ($3,375).

Statistics: 65.595 lbs. (.033 tons); 1.16 cf (3.35' long); $16,349.40. Body ST 9 (-10 points), DX 12 (20 points), IQ 8 (-15 points), HT 12/8 (0 points). Speed 12.79 (25 points). Floats; water Speed 3. Legality Class 5. Point Cost: 205 points.

"Hellspider" Infiltration Robot (TL10)

The Hellspider is a small multi-purpose combat robot that looks somewhat like a metal tarantula. Hellspiders are typically used for security patrols in small areas like air ducts, for vermin extermination, or for stealthy assassinations.

Brain: Small brain with +2 DX booster (.5 lbs., .01 cf, $500, -5 points), Complexity 4.

Sensors: Basic sensors with infrared vision, (.6 lb., .012 cf, $2,625, 15 points).

Communicator: Basic communicator with mute and infrared com options (.175 lbs., .0035 cf, $87.50, 0 points).

Arm Motors: Two ST 1 arm motors (each .1 lbs., .002 cf, $200, .005 KW).

Drivetrain: Leg drivetrain with six legs and .03 KW motive power (.9 lbs., .003 cf per leg motor, $45, .03 KW).

Weaponry: Drug injector (.25 lbs., .005 cf, $25, LC 6); holdout laser, concealed (.25 lbs., .0125 cf, $250, LC 4). Weaponry costs 16 points.

Accessories: Lockpick ($50, LC 5), Gyrobalance ($1,250, 15 points).

Power: Power requirement .03 KW. Energy bank using two rC cells (2 lbs., .02 cf, $200, 20 points) with 7,200 KWS stored power. Endurance 66 hours, 40 minutes (0 points).

Subassemblies: Two arms (right and left), six legs, head.

Arm Design: Right arm houses ST 1 arm motor and lockpick (.002 cf). Left arm houses ST 1 arm motor (.002 cf).

Head Design: Head houses sensors, communicator, drug injector and .0045 cf empty space (.025 cf).

Body Design: Body houses brain, energy bank, holdout laser, gyrobalance, waste space for head rotation (.045 cf).

Leg Design: Six legs, each housing leg motor and .0015 cf empty space (.0045 cf each).

Surface Area: Right and left arm .5 each, head .5, body 1, six legs .5 each, total surface area 5.5.

Structure: 11 lbs., $550.

Hit Points: Each arm 2, head 1, body 2, each leg 1.

Armor: DR 2 metal (.66 lbs., $13.20, PD 2, LC 6, 56 points); sealed ($55, 20 points); basic chameleon (.55 lbs., $110, LC 5, 15 points).

Statistics: 17.085 lbs. (.0085 tons); .101 cf (1.5' across, -10 points). $6,160.70. Body ST 2, Arm ST 1 (-75 points), DX 12 (20 points), IQ 7 (-20 points), HT 12/2 (-30 points). Speed 11.27 (25 points). Cannot float (-5 points). Legality Class 4. Point Cost: 12 points.

"Lemon Angel" Android Companion (TL10)

The Lemon Angel is an android that looks exactly like a beautiful human woman. (Similar male models also exist, although they tend to be built on a larger frame). Depending on its programming, the Lemon Angel can serve as a secretary, pleasure android, translator or traveling companion. Its bioconvertor makes it maintenance-free (so it can live on human food) with its power cell serving as a backup.

Brain: Standard brain with +1 DX booster and neural-net options (10 lbs., .2 cf, $12,250, 65 points), Complexity 5.

Sensors: Basic sensors with acute taste and smell +2, infrared vision, (.6 lb., .012 cf, $2,875, 19 points).

Communicator: Basic communicator with superior voice (.25 lbs., .005 cf, $750, 25 points).

Arm Motors: Two ST 10 arm motors, cheap option (each 2 lbs., .04 cf, $1,000, .05 KW).

Drivetrain: Leg drivetrain with two legs and .2 KW motive power (6 lbs., .06 cf per leg motor, $1,200, .2 KW).

Weaponry: ST 4 crushing jaw ($400, .4 lbs., .02 cf, .04 KW, LC 6) costs 5 points.

Accessories: Neural Stimulator (.5 lbs., .01 cf, $1,000, LC 5); Pheromone emitter ($5,000, LC 5, 25).

Power: Power requirement .3 KW. Energy bank using two rD cells (10 lbs., .1 cf, $1,000, 20 points) with 72,000 KWS stored power. Omnivore bioconvertor with .3 KW output (7.5 lbs., .15 cf, $2,000). Endurance 66 hours on energy bank plus 48 hours with bioconvertor (0 points).

Subassemblies: Two arms, head, two legs.

Arm Design: Right arm houses ST 10 arm motor and .06 cf empty space (.1 cf). Left arm is identical.

Head Design: Houses crushing jaw, brain, communicator, basic sensors, and .063 cf empty space (.3 cf).

Body Design: Houses energy bank, bioconvertor, pheromone emitter, neural stimulator, waste space for head rotation and .71 cf empty space (1 cf).

Leg Design: Two legs each housing leg motor and .24 cf empty space (.3 cf each).

Surface Area: Right and left arm 1.5 each, head 3, body 6, two legs 3 each, total surface area 18.

Structure: Cheap. (54 lbs., $900).

Hit Points: Arms 5 each, head 5, body 9, legs 5 each.

Armor: DR 2 nonrigid (.54 lbs., $54, PD 2, LC 6, 55.4 points).

Biomorphics: Living flesh (9 lbs., $9,500); Very Beautiful ($4,750, 25 points); sex implant ($2,000); surface sensors ($4,750).

Statistics: 102.54 lbs. (.0515 tons), 2.1 cf (5'5 tall), $49,429. Body ST 12, arm ST 10 (10 points), DX 11 (10 points), IQ 9 (-10 points), HT 12/9 (5 points). Speed 7.88 (5 points). Legality Class 5. Point Cost: 260 points.

"Omicron-15" General-Purpose Humanoid Robot (TL10)

This robot looks somewhat like a hairless chrome statue of a human. A general-purpose robot able to use human equipment, Omicrons often serve as soldiers, space crew, sports robots, or security guards, depending on their programming. Some versions have male or female features; others are sexless.

Brain: Standard brain with neural-net, high-capacity and +1 DX booster options for Complexity 5 (10 lbs., .2 cf, $16,875, LC 5, 65 points).

Sensors: Basic Sensors with night vision (.5 lbs., .01 cf and $2,525, 10 points).

Communicator: Basic communicator (.25 lbs., .005 cf, $125, 15 points).

Arm Motors: Two ST 15 arm motors with cheap option (each 3 lbs., .06 cf, $1,500, .075 KW power).

Drivetrain: Leg drivetrain with two legs and .3 KW motive power (9 lbs., .09 cf per leg motor, $1,800, .3 KW).

Power System: Power requirement .45 KW. Two rE cells (each 20 lbs., .2 cf, $2,000, 20 points) storing a total of 720,000 KWS. Endurance 444 hours, 20 minutes (8 points).

Subassemblies: Two arms (right and left), head, two legs.

Arm Design: Right arm houses ST 15 arm motor and .07 cf empty space (.13 cf). Left arm is identical.

Head Design: Houses sensor, communicator and brain, and .085 cf empty space (.3 cf).

Body Design: Houses energy bank, waste space for head rotation and .87 cf empty space (1.3 cf).

Leg Design: Two legs, each houses leg motor and .3 cf empty space (.39 cf each).

Surface Area: Right arm 2, left arm 2, head 3, body 8, legs 3 each. Total surface area 21.

Structure: No options (42 lbs., $2,100).

Hit Points: Arms 6 each, head 5, body 12, legs 5 each.

Armor: DR 7 metal (8.82 lbs., $176.40, PD 3, LC 4, 96 points); reflective surface ($157.50, 2 points).

Biomorphics: Sculpted (2.1 lbs., $420); Surface sensors ($6,300).

Statistics: 118.67 lbs. (.0595 tons), 2.64 cf (6' tall), $33,978.40. Body ST 19, arm ST 15 (80 points), DX 11 (10 points), IQ 9 (-10 points), HT 12 (20 points). Speed 8.69 (10 points). Cannot float (-5 points). Legality Class 4. Point Cost: 65 points.

"Paladin" Robot Horse (TL10)

This robot looks like a horse. It's designed for use by visitors to low-tech colony worlds where higher-TL transportation would be conspicuous. It's also used in racing, especially where horses are extinct or unavailable. Paladin's modular socket can be fitted with various gear, usually sensors or weapons, or sometimes survival gear for its rider. Paladin is designed to operate on fodder, like any other horse, but can also run on electricity.

Brain: Standard brain with neural-net options (10 lbs., .2 cf, $7,500, 65 points), Complexity 5.

Sensors: Basic sensors with night vision, +3 acute hearing, peripheral vision, +1 acute taste and smell (.5 lbs., .01 cf, $3,525, 33 points).

Communicator: Basic communicator with disturbing (horse-like) voice (.25 lbs., .005 cf, $62.50, 5 points).

Arm Motors: No arms (-30 points).

Drivetrain: Leg drivetrain with four legs and 1 KW motive power (30 lbs., .15 cf per leg motor, $1,500, 1 KW).

Weaponry: ST 11 crushing jaw ($1,100, 1.1 lbs., .055 cf, .11 KW, LC 6) costs 5 points.

Power: Power requirement 1 KW. Energy bank with rE cell (20 lbs., .2 cf, $2,000, 20 points) stores 360,000 KW; Herbivore bioconvertor with 1 KW output (60 lbs., 1.2 cf, $2,000). Endurance 48 hours on bioconvertor plus 100 hours on energy bank (5 points).

Subassemblies: Head, four legs. (Its tail is cosmetic.)

Head Design: Head houses brain, sensors, communicator, crushing jaw and .63 cf empty space (.9 cf).

Body: Body houses energy bank, bioconvertor, waste space for head rotation, 7.55 cf cargo space (9 cf).

Leg Design: Four legs, each with leg motor and 1.2 cf empty space (1.35 cf each).

Surface Area: Head 6, body 27, legs 8 each, total surface area 65.

Structure: Cheap (195 292.5 lbs., $3,250).

Hit Points: Head 18, body 41, legs 12 each.

Armor: DR 5 metal (19.5 lbs., $390, PD 3, LC 5, 90 points). Waterproof ($27).

Biomorphics: Realistic flesh (32.5 lbs., $6,500); surface sensors ($16,250).

Statistics: 368.85 lbs. (.185 tons), 15.3 cf (7' long), $48,707.50. Body ST 65, no arms (115.5 points), DX 10 (0 points), IQ 9 (-10 points), HT 12/41 (165 points). Ground Speed 13.9 (25 points). Floats; water Speed 3. Legality Class 5. Point Cost: 488.5 points.

"Prometheus 3000" Android (TL10)

The "Prometheus 3000" android looks like a normal human, but is actually a sentient robot. A sentient humanoid robot such as the Prometheus can be used in jobs requiring creative thought, independence and slightly super-human ability. It might be a secret agent, starship officer, explorer, assassin, investigator, bodyguard, or companion. It might even have been created by aliens, to infiltrate a human society. Both male and female models exist.

Brain: Standard brain with genius, high-capacity and sentient options for Complexity 6 (10 lbs., .2 cf, $118,125, LC 4, 100 points).

Sensors: Basic Sensors with night vision (.5 lbs., .01 cf and $2,525, 10 points).

Communicator: Basic communicator (.25 lbs., .005 cf, $125, 15 points).

Arm Motors: Two ST 15 arm motors with cheap option (each 3 lbs., .06 cf, $1,500, .075 KW power).

Drivetrain: Leg drivetrain with two legs and .3 KW motive power (9 lbs., .09 cf per leg motor, $1,800, .3 KW).

Weaponry: Crushing jaw, ST 4 (TL10, .4 lbs., .02 cf, $400, .04 KW). Weaponry costs 5 points.

Power: Power requirement .45 KW. Two rE cells (each 20 lbs., .2 cf, $2,000, 20 points) storing a total of 720,000 KWS. Omnivore bioconvertor with .45 KW output (11.25 lbs., .225 cf, $2,000). Endurance 444 hours, 27 minutes on energy bank plus 48 hours on bioconvertor (8 points).

Subassemblies: Two arms (right and left); head; two legs.

Arm Design: Right arm houses ST 15 arm motor and .09 cf empty space (.15 cf). Left arm is identical.

Head Design: Houses sensor, communicator, crushing jaw and brain, and .065 cf empty space (.3 cf).

Body Design: Houses energy bank, bioconvertor, waste space for head rotation and .845 cf empty space (1.5 cf).

Leg Design: Two legs, each houses leg motor and .36 cf empty space (.45 cf each).

Surface Area: Right arm 2, left arm 2, head 3, body 8, legs 4 each. Total surface area 23.

Structure: (46 lbs., $2,300).

Hit Points: Arms 6 each, head 5, body 12, legs 6 each.

Armor: DR 7 metal armor (9.66 lbs., $193.20, PD 3, LC 4, 96 points).

Biomorphics: Living flesh (11.5 lbs., $11,500); biomorphic shielding (2.3 lbs., $11,500); attractive ($1,150, 5 points); sex implant ($2,000); surface sensors ($5,750); sealed ($230, 20 points).

Statistics: 146.86 lbs. (.075 tons), 3 cf (6' tall), $166,368.20. Body ST 18, arm ST 15 (75 points), DX 11 (10 points), IQ 11 (10 points), HT 12/12 (20 points). Ground Speed 8 (10 points). Floats; water Speed 2. Legality Class 4. Point Cost: 404 points.

"S-3 Servitor" Housebot (TL10)

The S-3 looks like an animated kitchen appliance with a pair of arms, a built-in vacuum cleaner arm, four wheels and a tiny head. It's designed to act as a waiter, cleaner, butler, cook and servant; S-3s also work as bartenders in places that can't get live help or a fancier robot. Its spraygun is usually loaded with cleaning agents, but some of these 'bots may be equipped with noxious chemicals to give them an auxiliary security function. Its internal cargo space is used for storing garbage until it reaches a waste disposal facility.

Brain: Small brain (.5 lbs., .01 cf, $250, -5 points) with Complexity 4.

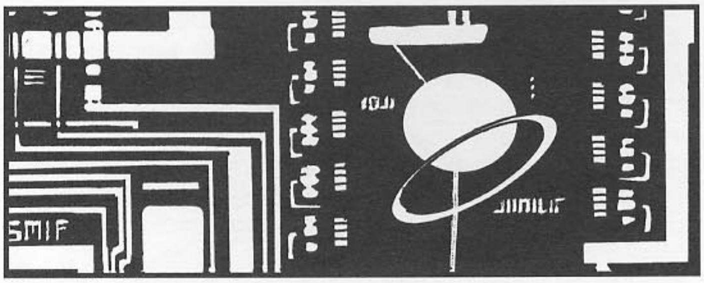
Sensors: Basic sensors with discriminatory taste (.55 lbs., .011 cf, $3,000, 10 points).

Communicator: Basic communicator (.25 lbs. .005 cf, $125, 15 points).

Arm Motors: Two ST 10 arm motors, cheap (each 2 lbs., .04 cf, $1,000, .05 KW). ST 5 arm motor with cheap, extra-flexible and striker options (1 lb., .02 cf, $200, .025 KW each). 10 points.

Drivetrain: Wheeled drivetrain with .2 KW motive power (1.5 lbs., .03 cf, $30, .2 KW).

Accessories: Serving tray (2 lbs., .4 cf, $10); drink/snack dispenser (10 lbs., .5 cf, $50); microwave oven (10 lbs., .5 cf, $50); Spraygun (1 lb., .05 cf, $50); cleaning unit (5 lbs., .25 cf, $50).



Power: Power requirement .325 KW. rD cell energy bank (5 lbs., .05 cf, $500, 20 points) stores 36,000 KWS power. Endurance 30 hours (0 points).

Subassemblies: Three arms (left, right and back), head, four wheels.

Arm Design: Three arms. Right arm houses ST 10 arm motor (.04 cf). Left arm is identical. Back arm houses ST 5 arm motor, spray gun and cleaning unit (.32 cf).

Head Design: Head houses small brain, sensors, communicator, .024 cf empty space (.05 cf).

Body Design: Body houses D cell, serving tray, drink dispenser or oven, wheeled drivetrain and .525 cf empty space (2 cf).

Wheel Design: Wheels (.6 cf).

Surface Area: Two arms 1 each, back arm 3, head 1, body 10, wheels 5. Total surface area 21.

Structure: Cheap. (63 lbs., $1,050)

Hit Points: Right and left arms 3 each, back arm 9, head 2, body 15, wheels 4 each.

Armor: Metal armor with DR 2 (2.52 lbs., $50.40, LC 6, PD 2, 56 points).

Biomorphics: Attractive body – nicely chromed, etc. ($210, 5 points).

Statistics: 106.32 lbs. (.053 tons); 3.5 cf (4' tall); $7,625.40. Body ST 12, arm ST 10 or 5 each (10 points); DX 10 (0 points); IQ 7 (-20 points); HT 12/15 (35 points). Speed 15.54 (12.5 points). Cannot float (-5 points). Legality Class 6. Point Cost: 29 points.

"M-4 Thor" Main Battle Robot (TL10)

The Thor is a giant humanoid warbot, a thirty-foot metal titan that can lift over 20 tons, armed with weapons capable of vaporizing a company of 20th-century tanks.

Brain: Microframe brain with +1 DX booster, hardened, high-capacity and neural-net options (150 lbs., 3 cf, $225,000, .1 KW, 65 points), Complexity 6.

Sensors: Basic sensors with spectrum vision, telescopic zoom +5, 360 degree vision, super hearing, ten levels imaging ladar, all three scanners, no sense of taste/smell (8.55 lbs., .171 cf, $15,375, 2.5 KW power, 255 points). Backup sensors are identical (8.55 lbs., .171 cf, $15,375, 2.5 KW power, no extra points).

Communicator: Basic communicator with bullhorn, long-range radio, IFF, lasercom and neutrino com options (35.275 lbs., .7055 cf, $21,662.50, 42 points).

Arm Motors: Two ST 2,000 arm motors with cheap option (each 400 lbs., 16 cf, $200,000, 10 KW).

Drivetrain: Leg drivetrain with two legs and 1,000 KW motive power (3,135 lbs., 31.35 cf per leg motor, $627,000, 1,000 KW).

Thrust-Based Propulsion: Fusion rocket with 120,000 lbs. thrust and vectored thrust option (4,537.5 lbs., 90.75 cf, uses 2,400 gph water, $453,750, LC 4).

Weaponry: One X-ray strike laser, concealed (500 lbs., 25 cf, $40,000, LC -1); two X-ray strike lasers (each 500 lbs., 10 cf, $40,000, LC -1); two plasma cannon, concealed (each 500 lbs., 25 cf, $20,000, LC -1); two heavy military paralysis guns, concealed (each 25 lbs., 2.5 cf, $16,000, LC 2); four heavy rocket launchers, concealed (each 100 lbs., 5 cf, $1,500, LC 0); Weaponry costs 450 points.

Accessories: Inertial navigation system (10 lbs., .2 cf, $12,500, 5 points).

Power: Power requirement 1,022.6 KW (assumes only one set of sensors used at once). Energy bank using ten rE cells (200 lbs., 2 cf, $20,000, 20 points) with 3,600,000 KWS stored power. TL10 Nuclear power unit with 1,033 KW output (1,058 lbs., 10.58 cf, $211,600, LC 4). Self-sealing tank with 200 gallons water (2,100 lbs., 30 cf, $8,000). Endurance two years (10 points), but only carries fuel for 5 minutes flight.

Subassemblies: Two arms (left and right); head with full rotation; two legs.

Arm Design: Right arm houses ST 2,000 arm motor and x-ray strike laser (26 cf). Left arm is identical.

Head Design: Houses main sensors, concealed x-ray strike laser, inertial navigation system, two paralysis guns, .629 cf empty space (31 cf).

Body Design: Houses brain, communicator, fusion rocket, two plasma cannon, four heavy rocket launchers, energy bank, nuclear power unit, fuel tank, waste space for head rotation, 19.765 cf empty space (230 cf).

Leg Design: Two legs, each houses leg motor and 37.65 cf empty space (69 cf each).

Surface Area: Right and left arm 60 each, head 60, body 250, two legs 125 each, total surface area 680.

Structure: Extra-heavy body (2,720 lbs., $340,000).

Hit Points: Arms 720 each, head 360, body 1,500, legs 750 each.

Armor: DR 6,000 ablative (65,280 lbs., $522,240, PD 4, LC 0, 15,400 points); IR cloaking and stealth (680 lbs., $102,000, 8 points); instant chameleon (170 lbs., $34,000, 30 points); sealed ($6,800, 20 points).

Statistics: 68,522.875 lbs., (34.2615 tons); 451 cf (32.3' tall, -10 points); $3,213,302.50; body ST 3,000, arm ST 2,000 (1,410 points), DX 12 (20 points), IQ 10, HT 9/1,500 (7,445 points). Ground Speed 21.64, stall speed 0, air Speed 300, can hover (90 points). Cannot float (-5 points). Legality Class 0. Point Cost: 5,051 points.

"T-64 Tinkerbot" Technical Robot (TL10)

This general-purpose engineering and mechanical repair robot resembles the product of a mating between a tool box and a mechanical spider. These robots are often found on starships, doing routine maintenance and emergency damage control.

Brain: Standard brain with neural-net options (10 lbs., .2 cf, $7,500, Complexity 5). 65 points.

Sensors: Basic sensors with one eye, microscopic vision, laser rangefinder and radscanner, (1.2 lbs., .024 cf, $2,875). 4 points.

Communicator: Basic communicator with infrared com (.375 lbs., .0075 cf, $187.50). 20 points.

Arm Motors: Two ST 10 arm motors with cheap option (each 2 lbs., .04 cf, $1,000, .05 KW). Two ST 6 arm motors with retractable options (each .9 lbs., .018 cf, $1,800, .03 KW). 20 points.

Drivetrain: Leg drivetrain with four legs and .1 KW motive power (3 lbs., .015 cf per leg motor, $150, .1 KW).

Weaponry: Light laser torch (1 lb., .02 cf, $25, LC 6); buzz-saw with vibroblade (2 lbs., .04 cf, $75, LC 3). Weaponry costs 16 points.

Accessories: Fire extinguisher (2 lbs., .1 cf, $25); Two sets of integral mechanical or engineering tools (each 10 lbs., .2 cf, $200); two sets of integral armory or electronics tools (each 2 lbs., .04 cf, $400); modular socket (7.5 lbs., .15 cf, $75).

Power: Power requirement .23 KW. Energy bank using rE cell (20 lbs., .2 cf, $2,000, 20 points) with 360,000 KWS stored power. Endurance 434 hours, 47 minutes (8 points).

Subassemblies: Four arms (upper and lower right, upper and lower left); head with full rotation; four legs.

Arm Design: Right upper arm houses ST 10 arm motor, one set of mechanical or engineering tools (.24 cf). Left upper arm is identical. Left lower arm houses ST 6 arm motor, one set of integral electronic or armory tools, buzzsaw with vibroblade, .002 cf empty space (.1 cf). Right lower arm houses ST 6 arm motor, one set of integral electronic or armory tools, laser torch, .022 cf empty space (.1 cf).

Head Design: Head houses brain, sensors, communicator, and .0185 cf empty space (.25 cf).

Body Design: Body houses lower retractable arms, energy bank, waste space for head rotation, modular socket (.6 cf).

Leg Design: Four legs, each housing leg motor and .075 cf empty space (.09 cf each).

Surface Area: Two upper arms 2.5 each, two lower arms 1.5 each, head 2.5, body 5, four legs each 1.5, total surface area 21.5.

Structure: (43 lbs., $2,150).

Hit Points: Upper arms 8 each, lower arms 5 each, head 4, body 8, head 2, body 12, legs 2 each.

Armor: DR 7 metal (9.03 lbs., $180.60, PD 3, LC 5, 96 points); radiation shielding (10.75 lbs., $107.50, 6 points); sealed ($215, 20 points).

Statistics: 139.655 lbs., (.07 tons); 1.89 cf (3.3' long); $22,365.60. Body ST 6, arm ST 10 (-15 points), DX 10, IQ 9 (-10 points), HT 12/12 (20 points). Speed 4.78. Cannot float (-5 points). Legality Class 5. Point Cost: 57.

"Grendel" (TL11)

This is a robot monster, humanoid and only somewhat taller than an ordinary man, but with a large head, glowing eyes and fanged jaws, clawed arms, a scaled body and a barbed tail. It is built with a mix of biological and machine components.

Brain: Standard brain with biocomputer and sentient option (15 lbs., .3 cf, $131,250, 95 points), Complexity 7.

Sensors: Basic sensors with spectrum vision, discriminatory smell, discriminatory taste (.475 lb., .0095 cf, $2,750, 65 points).

Communicator: Basic communicator with Disturbing Voice (.25 lbs., .005 cf, $62.50, 5 points).

Arm Motors: Two ST 100 arm motors with cheap option (each 15 lbs., .3 cf, $7,500, .5 KW). One ST 40 arm motor with cheap, extra-flexible and striker options (6 lbs., .12 cf, $1,200, .2 KW). 10 points.

Drivetrain: Leg drivetrain with two legs and 1.2 KW motive power (24 lbs., .24 cf per leg motor, $4,800, 1.2 KW).

Weaponry: Drug injector ($25, .25 lbs., .005 cf, LC 6); ST 50 cutting jaws with monowire ($7,625, 5 lbs., .25 cf, .5 KW, LC 3); sharp monowire claws on two arms (each $325, LC 3). Weaponry costs 25 points.

Accessories: Spraytank (8 lbs., .4 cf, $100); usually loaded with nerve gas or nano weapons.

Power: Power requirement 2.4 KW. Carnivore bioconvertor with 2.4 KW output (48 lbs., .96 cf, $4,800).

Subassemblies: Three arms (right arm, left arm, tail); head; two legs.

Arm Design: Right arm houses ST 100 arm motor, claws (.3 cf); left arm is identical. Tail houses ST 40 arm motor with extra-flexible and striker options and drug injector (.125 cf).

Head Design: Houses brain, sensors, communicator, cutting jaws, .0355 cf empty space (.6 cf).

Body Design: Body houses spraytank, bioconvertor, waste space for head rotation, and .58 cf empty space (2 cf).

Leg Design: Two legs, each houses leg motor and .36 cf empty space (.6 cf each).

Surface Area: Each right and left arm 3, tail 1.5, head 5, body 10, two legs 5 each, total surface area 32.5.

Structure: Biomechanical, heavy (73.125 lbs., $9,750).

Hit Points: Right and left arm 18 each, tail 9, head 15, body 30, each leg 15.

Armor: DR 128 ablative (33.28 lbs., $266.24, PD 4, LC 1, 426.4 points); IR cloaking (16.25 lbs., $2,437.50, 5 points); thermal superconducting (8.125 lbs., $8,125, 42.6 points); waterproof.

Biomorphics: Living flesh (16.25 lbs., $8,125); Hideous ($6,500, -20 points); surface sensors ($8,125).

Statistics: Design weight 284.005 lbs. (.142 tons), volume 4.525 cf (-10 points), price $204,155.84. Body ST 60, arm ST 100 or 40 (200 points); DX 11 (10 points); IQ 12 (20 points); HT 12/30 (110 points). Speed 11.62 (25 points). Cannot float (-5 points). Legality Class 1. Point Cost: 1,004.

"Scorpio Alpha" Robot Warrior (TL12)

The perfect adversary for the robot monster, Scorpio Alpha is an ultra-tech android warrior. She's externally identical to a human, but possesses exceptional strength and speed, can project x-ray laser bolts out of her eyes and force beams from her left hand, and can generate a forceblade out of her right palm. Her biocomputer brain is more intelligent than a human's, and possesses psychotronic circuits that give her psionic powers of telepathy and teleportation. She can also fly.

Brain: Small brain with biocomputer, +3 DX booster, genius, hardened, high-capacity and sentient options (2.25 lbs., .045 cf, $1,687,500, 95 points), Complexity 8.

Sensors: Basic sensors with spectrum vision, +2 acute hearing, bioscanner, laser rangefinder, radscanner (1.025 lbs., .0205 cf, $2,687.50, 74 points).

Communicator: Basic communicator (.25 lbs., .005 cf, $125, 15 points).

Arm Motors: Two ST 40 arm motors (each is 2 lbs., .04 cf, $4,000, .2 KW).

Drivetrain: Leg drivetrain with two legs and .6 KW motive power (9 lbs., .09 cf per leg motor, $1,800, .6 KW).

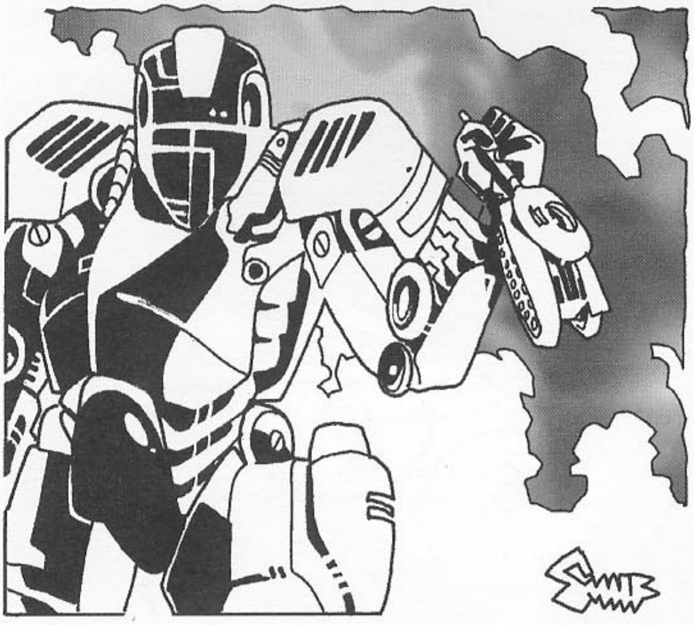
Thrust Propulsion: Two reactionless thrusters each with .25 KW motive power and 5 lbs. of thrust with vectored thrust option (each .375 lbs., .01875 cf, $750, .25 KW).

Weaponry: Forceblade, concealed (1.5 lbs., .075 cf, $750, LC 3). Gravbeamer, concealed (1 lb., .05 cf, $2,000, LC 3). Military x-laser rifle, concealed (9 lbs., .45 cf, $1,000). ST 8 crushing jaw ($800, .8 lbs., .04 cf, .08 KW, LC 6). Weaponry costs 107 points.

Accessories: X-ray laser periscope (.9 lbs., .045 cf, $200); Gyrobalance ($1,250, 15 points). Psychotronic circuits with Telepathy power 12 ($30,000, 60 points) and Teleportation power 15 ($37,500, 75 points).

Contragrav: Contragrav generator with 400 lbs. of lift ($2,510, 20.4 lbs., .408 cf, .4 KW).

Power: Power requirement 1.4 KW. Energy bank using rD cell ($500, 5 lbs., .05 cf) with 54,000 KWS stored power; TL12 Nuclear power unit with 1.4 KW output (2.8 lbs., .028, $20,000, LC 4, 20 points).



Subassemblies: Two arms (left and right); head; two legs.

Arm Design: Right arm houses ST 40 arm motor and force-blade (.115 cf); left arm houses ST 40 arm motor and grav beamer, and .025 cf empty space (.115 cf).

Head Design: Head houses brain, sensors, communicator, crushing jaws, rD cell, x-laser periscope and .0745 cf empty space (.3 cf).

Body Design: Body houses energy bank, nuclear power unit, contragrav, military x-laser rifle, waste space for head rotation and .234 cf empty space (1.2 cf).

Leg Design: Two legs, each housing leg motor and reactionless thruster and .25125 cf empty space (.36 cf each).

Surface Area: Arms 1.5 each, head 3, body 7, legs 3 each, total surface area 19.

Structure: Extra-heavy (38 lbs., $9,500).

Hit Points: Arms 18 each, head 18, body 42, legs18 each.

Armor: DR 200 ablative (19 lbs., $152, PD 4, LC 0, 610 points); sealed ($190, 20 points); thermal superconducting (2.375 lbs., $2,375, 61 points).

Biomorphics: Living flesh (9.5 lbs., $4,750); Attractive ($950, 5 points); surface sensors ($4,750).

Statistics: 127.55 lbs. (.0635 tons); 2.45 cf (5.8' tall); $1,820,289.50. Body ST 43, arm ST 40 (180.75 points), DX 15 (60 points), IQ 13 (30 points), HT 12/42 (170 points). Ground Speed 12.29; air Speed (in contragrav-assisted vectored thrust flight) 31.4, can hover (75 points). Floats; water speed 13. Legality Class 0. Point Cost: 1,673 points.

Biological Androids

Three typical bioroids are described below. ***GURPS Cyberpunk Adventures*** also contains android designs compatible with the biological android creation system described in this book.

"Arachne II" Zero-G Worker Android

The "Arachne II" is designed for zero-G and microgravity construction work; some are also used in asteroid mining. Arachnes resemble skinny human females with four arms, dark skin, and short hair. Although legs aren't much use in zero-G, they were retained to allow Arachnes to operate in habitats or ships that possess artificial gravity.

Advantages: DX +3 (30 points); Absolute Direction (5 points); Ambidexterity (10 points); two Extra limbs (20 points). Perfect Balance (15 points); Oxygen Storage (10 points); Temperature Tolerance (10 points); total 100 points.

Disadvantages: ST -3 (-20 points); Reduced Hit Points, -2 (-10 points); Self-Destruct (-20 points); Short Lifespan one level (-10 points); Skinny (-5 points); Sterile (-3 points); total -68 points.

Model Point Cost: 32 points.

Price: $196,500 at TL9, $98,250 at TL10, $49,125 at TL11+

Doberman IV "Dog-Soldier" (TL9)

The Doberman IV is a military squad-support android, designed to carry heavy weapons into dangerous situations as part of an organized infantry unit. Its appearance is that of a human with a canine muzzle and fur: it was built with both dog and bear DNA, giving it enhanced strength and superior sensory abilities. The most common model is male, but female versions also exist.

Model advantages: ST bonus +3 (30 points); DX bonus +1 (10 points); HT bonus +1 (10 points); Alertness +2 (10 points); Combat Reflexes (15 points); Discriminatory Smell (15 points); Fur (4 points); High Pain Threshold (10 points); Hyper-Strength (30 points); Sharp Teeth (5 points); total 139 points.

Model Disadvantages: Bloodlust (-10 points); Self-Destruct (-20 points); Short Lifespan (2 levels; -20 points); Sterile (-3 points): total -53 points.

Model Point Cost: 86 points.

Price: $225,500 at TL9, $112,750 at TL10, $56,375 at TL11+.

NI-3 "Selkie" and NI-4 "Neried" (TL10)

The Nereid and Selkie are designed as underwater mining and construction workers. They can also be trained to perform military and security functions, serving as SEALs or underwater demolition specialists. Selkies (male) or Nereids (female) look like humans with gray fur, sleek bodies, webbed fingers and toes, and pointed, somewhat otter-like facial features. Adrenal modifications allow sudden bursts of speed for quick reactions to emergencies (such as rescues). Thanks to advanced genetic engineering, they can remain underwater for up to an hour without tanks, while their fur enables them to function in freezing water without bulky diving suits. Since they breathe air, Selkies and Nereids can also use human-design diving equipment, their own internal oxygen supply providing an additional margin of safety and permitting them to surface swiftly with no risk of developing "the bends."

Advantages: ST +2 (20 points), DX +2 (20 points); HT +1 (10 points); Alertness +2 (10 points); Amphibious (10 points); Combat Reflexes (15 points); Hyper-Reflexes (15 points); Fur (4 points); Oxygen Storage (10 points); Sharp Teeth (5 points); Temperature tolerance (cold, 6 points); total 125 points.

Disadvantages: Self-Destruct (-20 points); Short Lifespan one level (-10); Sterile (-3 points); total -33 points.

Model Point Cost: 92 points.

Price: $209,000 at TL9, $104,500 at TL10, $52,250 at TL11+.

The Nereid NI-4 (female) differs from the Selkie NI-3 (male) in having ST bonus +1, DX bonus +3, but is otherwise identical.

BIBLIOGRAPHY

Androids and robots have been appearing in science fiction since Mary Shelley wrote *Frankenstein.* There are far too novels, TV shows and films featuring robots to list in this brief space. Instead, here's an annotated list of the works that, in the author's opinion, feature the most enjoyable, inspirational or gameable examples of robots, androids, artificial intelligences or nanotechnology. For more references, see the *Campaigns* chapter.

Novels

Asimov, Isaac, *I, Robot*. The earliest and best of this prolific writer's many works featuring robots, introducing the three laws of robotics and robot psychologist Susan Calvin. Asimov was the first to write stories in which robots did more than just rebel against their creators.

Asimov, Isaac, *The Caves of Steel*. A human and robot detective have to learn to work as partners. There are many sequels, some by other authors.

Banks, Iain, *Use of Weapons*. "The Culture" is a utopian future society in which humans and AIs work as partners. Several prequels and sequels.

Bear, Greg, *Blood Music*. The accidental release of biological nanomachines leads to apocalyptic events. One of the best "nanotechnology" novels, written just before the word came into use.

Bear, Greg, *Queen of Angels*. A cop investigates a murder in a Los Angeles in which nanotechnology is a fact of daily life.

Bear, Greg, *The Forge of God*. Earth is caught in a war between two groups of Von Neumann machines.

Benford, Gregory, *Great Sky River*. An alien machine civilization owns the stars. On a distant world, a small band of human cyborgs struggle to survive and reclaim mankind's destiny. Sequel: *Tides of Light;* other related books featuring robots: *In the Ocean of Night* and *Across the Sea of Suns.*

Berry, Stephen Ames, *The Biofab War*. An energetic space opera that begins on 20th-century Earth and races off into a multi-dimensional conflict between organic and machine intelligences. Many sequels.

Blish, James, *The Seedling Stars*. Radically-modified humans are used to colonize alien worlds.

Cherryh, C.J., *Cyteen*. The main focus of this story is on human cloning, but the way Cherryh's cloned "azi" are treated and controlled can easily apply to biological androids.

Dick, Philip K., *Do Androids Dream of Electric Sheep?* The novel that inspired the movie *Bladerunner* (see p. 125). The book has less cyberpunk atmosphere but more depth.

Gibson, William, *Neuromancer*. The cyberpunk classic. A streetwise computer hacker and a street-samurai are manipulated by an AI computer. Sequels: *Count Zero, Mona Lisa Overdrive.*

Hansen, Karl, *War Games*. Describes a rebellion of gene-engineered variant humans that parallels Viet Nam. Not for the squeamish, though. Sequel: *Dream Games.*

Heinlein, Robert, *Friday*. The adventures of a biological android who works as a secret agent. The best of Heinlein's later novels.

Hogan, James, *Code of the Lifemaker*. An alien probe seeds one of Saturn's moons with self-replicating machines. When human explorers arrive, they find a robot society.

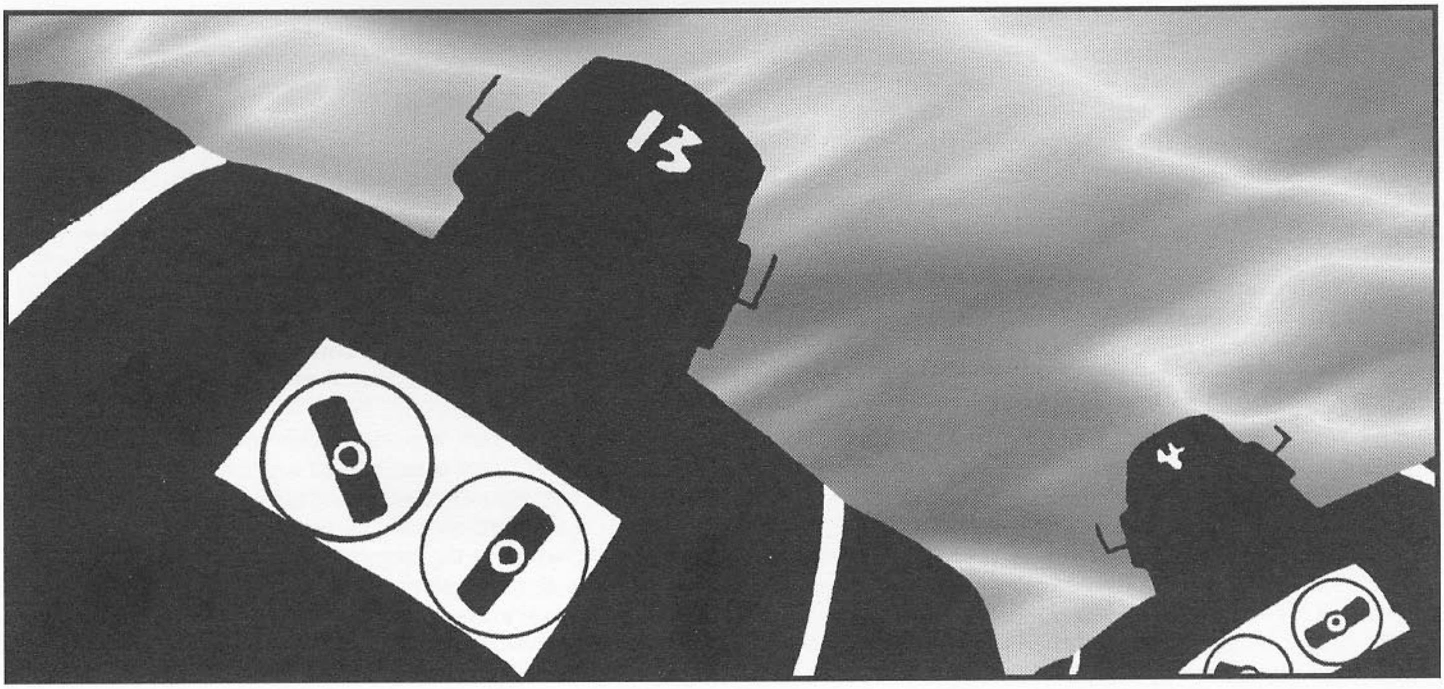
Laumer, Keith, *Bolo: The Annals of the Dinochrome Brigade.* Classic anthology featuring giant robot supertanks.

McCaffrey, Anne, *The Ship Who Sang*. The story of Helva, whose brain is integrated into a starship. This has recently become a "shared universe" featuring other cyborgs.

Milan, Victor, *The Cybernetic Samurai*. The birth of an artificial intelligence amid corporate wars in future Japan. Sequel: *The Cybernetic Shogun.*

Norton, Andre, *Android at Arms.* An android struggles with the question of his identity. An excellent "juvenile" novel.

Rucker, Rudy, *Software*. The Boppers are robots created to serve humanity on the moon. A human helps them become sentient, and all hell breaks loose. A quirky, darkly-humorous novel. Sequel: *Wetware.*



Saberhagen, Fred, *Berserker.* The berserkers are robot starships programmed to destroy all life. Humanity struggles for survival. The book spawned numerous sequels and a shared-world anthology.

Shelley, Mary, *Frankenstein, or the Modern Prometheus.* An android is driven to rebel against its creator.

Simmons, Dan, *Hyperion* and *Fall of Hyperion.* A pilgrimage to an alien world sets the stage for an epic conflict between humanity and artificial intelligences.

Smith, Cordwainer, *Norstrilia.* This classic novel features a society in which bio-engineered animal-humans serve humanity.

Sterling, Bruce, *Crystal Express.* This anthology contains several stories set in the Shaper/Mechanist future, where the solar system is torn between rival human cultures, one based on cybernetics, the other on bioengineering. The novel *Schismatrix* is set in the same background.

Stine, G. Harry, *Warbots.* In the 21st century, the U.S. Army forms mixed units of humans and robots. Mostly notable for the number of sequels it has produced.

Thompson, Amy, *The Virtual Girl.* What it's like to be a robot.

Zelazny, Roger, *My Name is Legion.* The award-winning story "Home is the Hangman" in this collection features one of the earliest and best depictions of a neural-net robot.

Williams, Walter Jon, "Unto the Sixth Generation," in *Wild Cards II.* The creation of Modular Man, android superhero.

Nonfiction

Asimov, Isaac, and Karen Frankel, *Robots: Machines in Man's Image.* A well-written book on the role of robots in both science fiction, industry and popular culture, with many photographs of "real" robots.

Drexler, K. Eric, Chris Peterson and Gayle Pergamit, *Unbounding the Future: The Nanotechnology Revolution.*The guru of nanotechnology explains how it works and what impact it may have on future society. It's somewhat more accessible then Drexler's first book, the classic *Engines of Creation.*

Levy, Steven, *Artificial Life.* Describes the melding of computer science, biology and robotics in the quest to create artificial lifeforms. A good primer on current trends in robotics.

Regis, Ed, *Great Mambo Chicken and the Transhuman Condition: Science Slightly Over the Edge.* An irreverent look at nanotechnology, cryonics and other emerging technologies, with some fascinating speculation on the future of robots and mankind.

Movies and Plays

Blade Runner. A bounty hunter "retires" escaped androids, until he's forced to recognize that they are as human as he is. A loose adaptation of *Do Androids Dream of Electric Sheep?* The prototype "cyberpunk" movie.

Doctor Who. The long-running British time-travel show had several episodes featuring recurring machine adversaries. The most notable were two races of machines, the Daleks and Cybermen. K-9, a robot dog, was one of the fourth Doctor's companions.

Eve of Destruction. A female neural-net robot programmed with its creator's memories has malfunctioned. Its inventor and a soldier must track it down and destroy it – before the nuclear bomb installed inside it explodes.

Lost in Space. This 1960s television show was the first live-action series to feature a continuing robot character.

Metropolis. The proletariat revolt under the messianic leadership of a female robot in this classic black-and-white movie.

Nemesis. Action movie featuring robot cops vs. robot terrorists, with a part-human cyborg caught in the middle. It has excellent robot vs. robot action scenes.

Robocop. A police officer is transformed into a crime-fighting cyborg. The first movie is worth seeing. The sequels and comedic TV show are less inspiring.

Runaway. A duel between a law officer and a terrorist who makes use of various robots as weapons.

R.U.R. Karel Capek's play about android workers gave us the world "robot."

Star Trek. Several episodes focused on robots or sentient computers, notably the second season's "The Doomsday Machine" and *Star Trek: The Motion Picture.*

Star Trek: The Next Generation. One of the series' stars was Data, a robot officer. Some episodes have detailed Data's origins, the alien Borg cyborgs, or out-of-control "nanite" nanomachines.

Star Wars. If you haven't seen it, do so. *Star Wars* provides an excellent model for integrating robots into a traditional space-opera setting.

Terminator – A robot assassin is sent back in time to kill a woman whose unborn child will be the key figure in a future conflict between man and machine. The result is a dynamic chase and a tender love story, and probably the best movie featuring either robots or time travel to come out of Hollywood.

Terminator 2: Judgment Day – A high-quality sequel to *Terminator,* featuring a fascinating "liquid-metal" robot.

2001: A Space Odyssey – Alien machines guide our evolution, and humanity probes the depths of space to learn their secrets. *2001's* most memorable character is the computer HAL 9000, the archetypical rogue computer.

Anime (Japanese Animation)

The Japanese have an ongoing love affair with robots. Thanks to the efforts of several subtitling and dubbing companies, more and more Japanese animation is available at video rental stores or specialist outlets like comic shops. The best of the translated anime featuring robots, cyborgs, androids or small battlesuits (as opposed to the giant human-piloted "mecha" of TV shows like *Robotech*) are:

AD Police. In 21st-century Tokyo, police struggle to deal with crimes committed by "boomers" – humanoid robots and cyborgs. Three subtitled videos. A prequel to *Bubblegum Crisis.*

Battle Angel. On a far future Earth, a doctor-turned-bounty hunter finds the head of a young female cyborg in a scrap yard. He rebuilds her, and she becomes the ultimate bounty hunter, until she falls in love. Based on the comic *Battle Angel Alita.* Subtitled.

Black Magic M-66. A pair of M-66 robot soldiers are misprogrammed and begin hunting for a target – the daughter of their creator. Army commandos and a scoop-chasing female reporter try to save her. The plot is a simple chase, but the M-66 is one of the most dynamic robots ever designed. One video, subtitled.

Bubblegum Crisis. The Knight Sabers – four women equipped with form-fitting battlesuits – wage a vigilante campaign against the ruthless megacorporation Genom, builder of robot "Boomers." The series features superior animation, good characterization and some of the best robot and suit designs ever. It also has a fantastic soundtrack. Eight videos, subtitled. Sequel: *Bubblegum Crash.*

Iczer One. A superpowered android protects Earth from an invasion of horrific Things Man Was Not Meant to Know. An excellent source of ideas for a *Supers* campaign. Three videos, so-so dubbing. If possible, see it in the original Japanese.

Rhea Gall Force. The most visually dynamic of the *Gall Force* series, featuring a war between humans and robots.

Robot Carnival. A collection of vignettes by Japanese animators on robots. Many are affected or consciously arty, but the prize segment is a struggle between two 19th-century "Steampunk" giant robots and their inventors, one Japanese, one Western.

Transformers. The most well-known animated robot series, featuring transforming robots that can turn into everything from cars to toasters. Several American and Japanese shows in the tradition of *Transformers* can be still be found on Saturday morning TV, although most of them are aimed at young children.

Comics

Cyborg and robot supers are commonplace in comic books. The following series focus specifically on robot or android characters:

Appleseed, Masamune Shirow. An "optimistic cyberpunk" police story set in a world where humans, cyborgs and bioroids must learn to co-exist. This long-running manga serial is available in English translation.

Avengers, Marvel Comics. A team of superheroes that sometimes included the Vision, a density-changing android.

Battle Angel Alita, Yukito Kishiro. See the description of the anime. An ongoing series available in translation. In the third series, Alita becomes a cyborg gladiator.

Bubblegum Crisis, Adam Warren. New stories set in the BGC universe. Introduces the concept of the "neurophage," a novel means of creating a neural-net artificial intelligence via nano-technology.

Dirty Pair, Adam Warren. A cyberpunk reworking of the Japanese series. Two scantily-clad super-agents battle bioroid criminals, terrorist robots and renegade nanotechnology.

DNAgents, Marc Evanier. A team of bioengineered superheroes who work for the mega-corporation that created them.

Magnus, Robot Fighter, Acclaim (first published by Gold Key, 1963). A classic "humans vs. robots" serial that has recently been resurrected.

The Metal Men. A classic D.C. comics series featuring a team of robot super heroes. Hard to find, but fun.

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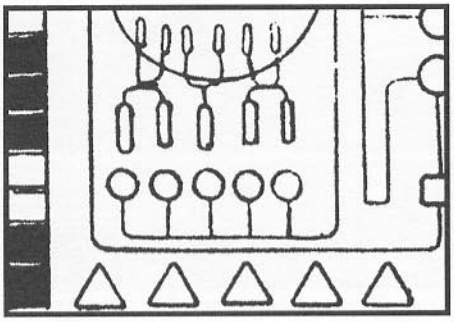


YOU ARE NOW OBSOLETE . . .

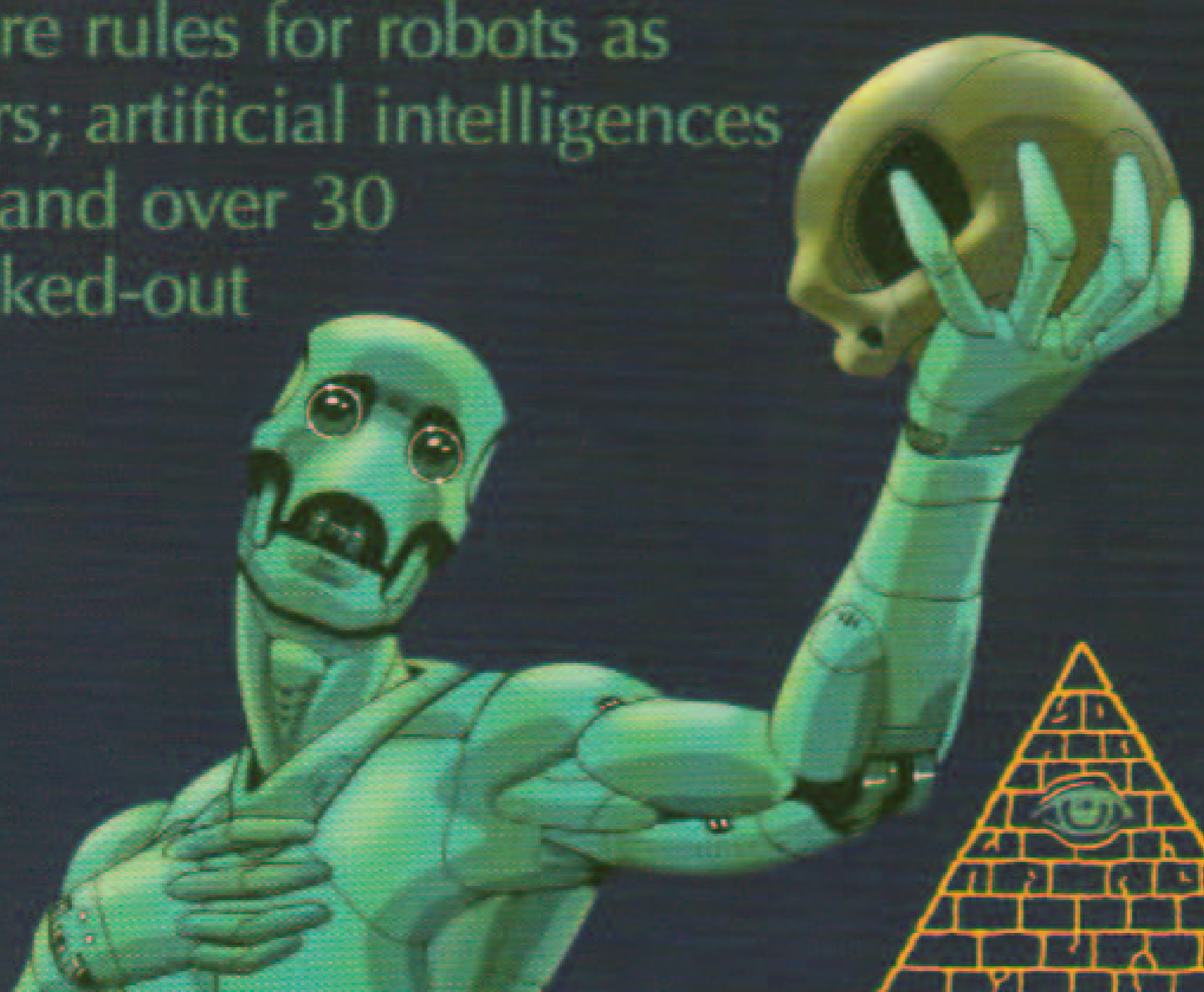
PRAY THEY DON'T FIND OUT!

A cold-eyed stare from the shadows of the alley . . . the spine-tingling *scrape, scrape* as metallic feet drag along the concrete . . . the squeak and whirr of hinges and hydraulics as the machine approaches. The robot is an intriguing yet sinister being – created to serve, but in many ways superior to its weak and fallible human masters. We need the robots. *Do they need us?*

This book contains detailed rules for designing, building and *playing* robots – from the tiniest nanobots to the mightiest megabots. You can create cyborgs, androids, and even biomorphs – deadly fluid-metal machines that can take *any shape*.

Use the advanced design rules (completely compatible with ***GURPS Vehicles****, 2nd Edition*) to choose everything from frames to power plants to weapons to the tiniest accessories!

Also included are rules for robots as player characters; artificial intelligences and battlesuits; and over 30 completely-worked-out sample robots.



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GURPS Basic Set*, Third Edition Revised* is required to use this supplement in a ***GURPS*** campaign; ***GURPS Compendium I*** and ***GURPS Ultra-Tech****, Second Edition Revised* would be useful, but are not required. Much of the material in this book is generic, and will be of use in *any* science-fiction roleplaying campaign featuring robots.

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