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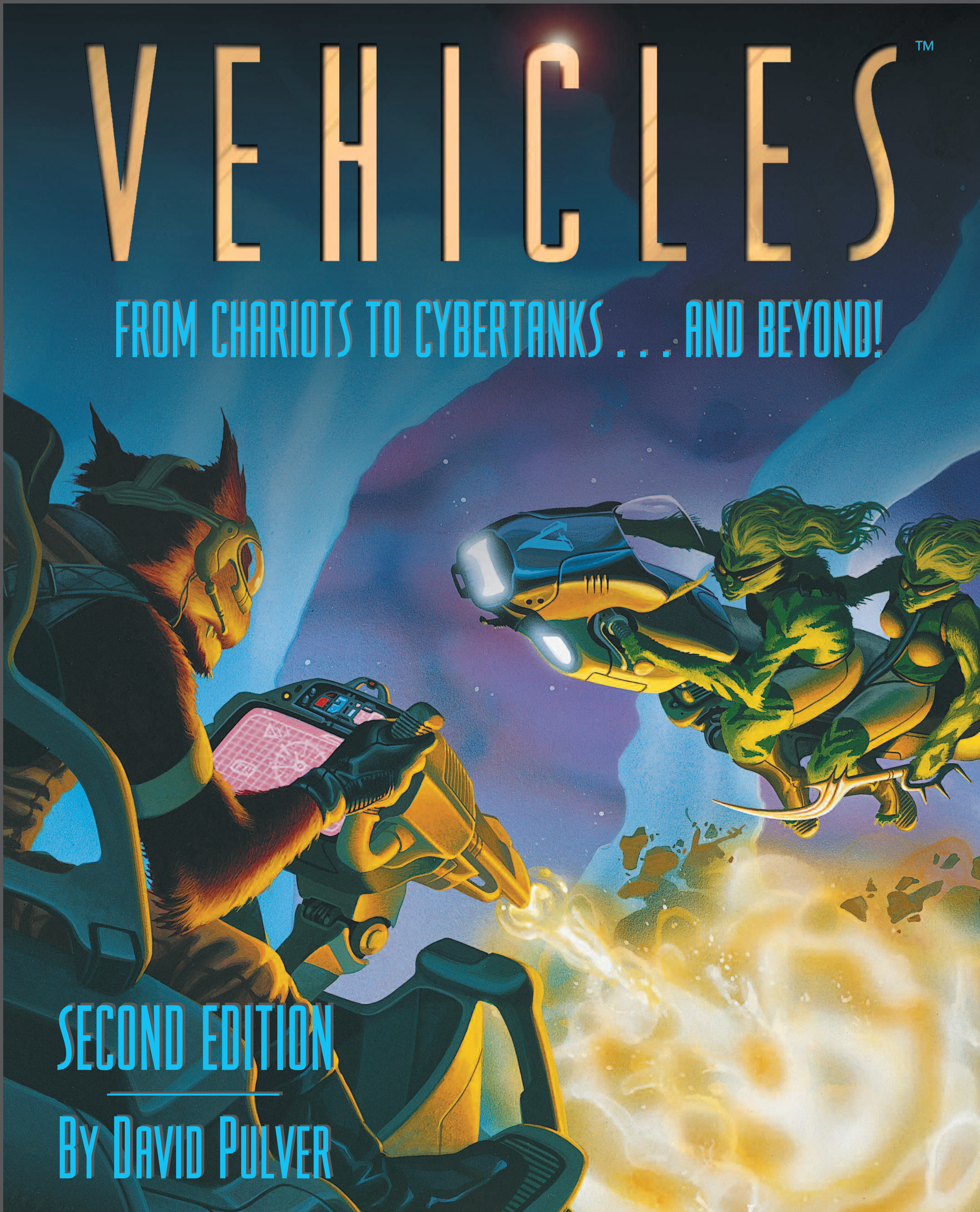

SECOND EDITION

By David Pulver

STEVE JACKSON GAMES

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Written by David L. Pulver
Edited by Sean Punch and
Susan Pinsonneault
Cover by John Zeleznik
Illustrated by John Hartwell and Dan Smith

STEVE JACKSON GAMES

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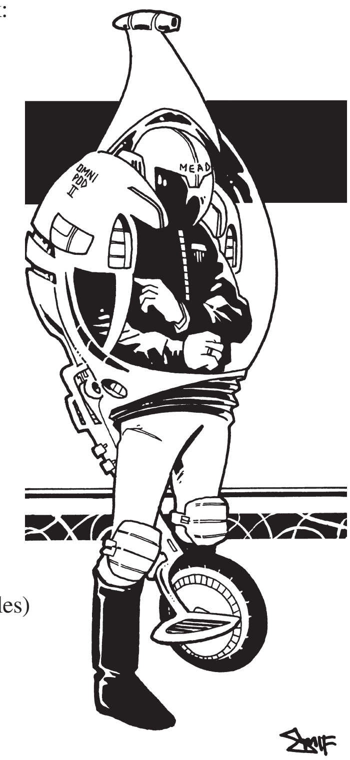
INTRODUCTION

GURPS Vehicles is a generic construction kit for designing almost any type of conveyance, from rowboats to antimatter-powered grav tanks. This second edition of ***GURPS Vehicles*** offers an easier-to-use design sequence and many new options, including detailed rules for building spacecraft and locomotives, as well as a comprehensive weapon design system.

GURPS Vehicles is designed to build a vehicle from the ground up, allowing maximum versatility by not restricting designers to specific hull or vehicle types. While ***GURPS Vehicles*** will let you design cars and airplanes, it will also let you create very exotic craft: Want a combination submarine-helicopter? You can build it . . .

Conventions

The following conventions are used throughout this book:



Abbreviations for Units

The following abbreviations are not standard, but are used to save space:

"cf" (instead of "cu. ft.") for "cubic foot"
"cy" (instead of "cu. yd. ") for "cubic yard"
"sf" (instead of "sq. ft.") for "square foot"

Metric and Other Conversions

1 cubic yard = 27 cubic feet
1 cubic foot = 7.481 US gallons = 28.317 liters
1 litre = 0.264 US gallons
1 displacement ton = 35 cubic feet
1 ton = 2,000 pounds
1 pound = 0.4536 kilograms
1 Astronomical Unit (AU) = 93 million miles
2 mph = (approx.) Speed or Move of 1
1 kph = 0.621 mph
1 knot = 1.15 mph
1 gravity (g) = 10.7 yd/s/s = 21.9 mph/s
1 horsepower = 0.746 kilowatts (kW)
1 kilowatt-hour = 3,600 kilowatt-seconds (kWs) (kilojoules)

Constants and Equivalents

The following equalities are assumed:
Speed of light in vacuum = 328,000,000 yd/s
1 inch of unsloped hard steel armor = DR 70
An "E" power cell holds 360,000 kilowatt-seconds at TL8

Calculations

There are lot of calculations in the vehicle design rules; a calculator is recommended! Two points of order:

Fractions and Rounding: Fractional hit points, DR, PD, DF, SR and crew requirements are rounded up to the next whole number (e.g., DR 7.5 becomes DR 8); values less than 0.5 are dropped to 0. In all other cases, retain fractions – but you can round them off to two decimal places (e.g., 20.1234 becomes 20.12) if desired. Any exceptions to these rounding conventions are noted in the text.

Cube Roots: A few of the formulas used for watercraft performance require cube roots to be calculated. In the event your calculator or spreadsheet lacks a cube root function, we've included a simplified cube root table in the appendix to the *Performance* chapter (p. 138).

About the Author

David L. Pulver is a writer and game designer based in Kingston, Ontario. He is the author of ***GURPS Ultra-Tech, Psionics*** and ***Robots,*** and the "Phoenix Sector" in ***Space Atlas 4,*** as well as many ***GURPS*** adventures. He has also written game supplements for other companies, including ***Glory of Rome*** and ***The Complete Druid*** (TSR) and ***Indiana Jones and the Rising Sun*** (West End Games). Besides gaming, David's interests include science fiction, military history and Japanese animation.

About GURPS

Steve Jackson Games is committed to full support of the ***GURPS*** line. Our address is SJ Games, Box 18957, Austin, TX 78760. Please include a self-addressed, stamped envelope (SASE) any time you write us! Resources now available include:

Pyramid. Our online magazine includes new rules and articles for ***GURPS***. It also covers all the hobby's top games – ***AD&D, Traveller, World of Darkness, Call of Cthulhu, Shadowrun*** and many more – and other SJ Games releases like ***In Nomine, INWO, Car Wars, Toon, Ogre Miniatures*** and more. And *Pyramid* subscribers also have access to playtest files online, to see (and comment on) new books before they're released.

New supplements and adventures. ***GURPS*** continues to grow, and we'll be happy to let you know what's new. A current catalog is available for an SASE. Or check out our Web site (below).

Errata. Everyone makes mistakes, including us – but we do our best to fix our errors. Up-to-date errata sheets for all ***GURPS*** releases, including this book, are always available from SJ Games; be sure to include an SASE with your request. Or download them from the Web – see below.

Q&A. We do our best to answer any game question accompanied by an SASE.

Gamer input. We value your comments. We will consider them, not only for new products, but also when we update this book on later printings!

Internet. Visit us on the World Wide Web at www.sjgames.com for an online catalog, errata and updates, and hundreds of pages of information. We also have conferences on Compuserve and America Online. ***GURPS*** has its own Usenet group, too: rec.games.frp.gurps.

GURPSnet. Much of the online discussion of ***GURPS*** happens on this e-mail list. To join, send mail to majordomo@io.com with "subscribe GURPSnet-L" in the body, or point your World Wide Web browser to www.io.com/~ftp/GURPSnet/www/.

Page References

References to the ***GURPS Basic Set,*** *Third Edition Revised* begin with a B – e.g., p. B121 is page 121 of that edition.

Similarly, CI refers to ***GURPS Compendium I: Character Creation;*** HT means ***GURPS High-Tech,*** *Second Ed.;* S means ***GURPS Space,*** *Second Ed.;* SU means ***GURPS Supers,*** *Second Ed.;* UT means ***GURPS Ultra-Tech,*** *Second Ed.;* M refers to ***GURPS Magic,*** *Second Ed.;* RO points to ***GURPS Robots;*** P signals ***GURPS Psionics*** and TT to ***GURPS Time Travel.***

This book provides a comprehensive metasystem for creating nearly any type of vehicle. A vehicle is designed by choosing the major *subassemblies* (like wheels or wings or turrets) it will have, along with any *body features* like streamlining. Next, components that go into it such as propulsion systems, weapons, seats and power systems are selected and placed within the body or subassemblies. Then the volume of the body and each subassembly is determined, and the size, weight and cost of the structure needed to contain and support these components is calculated. Surface features like armor are layered over the vehicle. Last of all, the vehicle's statistics are determined.

Create vehicles by following the steps outlined in this chapter, and referring to other chapters as directed, recording all the design features as they are chosen.

EXAMPLE

To demonstrate how the system works, we'll build Captain Morgan's Kitty Hawk, an "omnimobile" intended for a modern-day super agent campaign.

Tech Level

First, decide what tech level the vehicle will be built at – this may be anything from TL 0 (Stone Age) to TL16 (super science).

The various components and technologies that can be used in a vehicle are rated for the TL at which they first appear.

Occasionally, a historical tech level may be prefixed with "early," referring to the first half of the period covered in the tech level, or "late" indicating that availability limited to the latter half of that tech level. If no tech level is listed for a component, it is assumed to be available at any TL. A vehicle can normally only be built with technologies and components from its own or a lower TL, unless some source of higher-TL parts is available, or the designer has the Gadgeteer advantage.

EXAMPLE

The Kitty Hawk is built at late TL7, but has a few TL13 components salvaged from a wrecked UFO.

Concept

Next, come up with a general concept of the vehicle. What's it for? What should it look like? The most basic concepts are:

Ground Vehicle (TL0): A vehicle designed to move in contact with the ground or another solid surface, such as a car, locomotive or tank.

Water Vehicle (TL0): A watercraft; a vehicle designed to float on water or another liquid, such as a boat or ship.

Underwater Vehicle (TL5): A watercraft that can swim while totally submerged in liquid – a submarine.

Air Vehicle (TL5): An aircraft; a vehicle designed to fly in an atmosphere, such as a balloon or airplane.

Space Vehicle (TL7): A spacecraft; a vehicle designed to fly beyond an atmosphere.

Hovercraft (TL7): A vehicle that uses hover fans to maintain an air cushion and achieve lift, and as such is capable of skimming over ground or water at altitudes of a few feet. Also called an air cushion vehicle (ACV) or ground-effect vehicle (GEV).

A vehicle can combine one or more of these concepts. For instance, most airplanes are a combination of aircraft and ground vehicles (taxiing on a runway), and seaplanes are combination watercraft and air vehicles.

EXAMPLE

The Kitty Hawk is a combination aircraft, water vehicle, ground vehicle and submarine: an "omnimobile." It's supposed to resemble an ordinary automobile, but with special features that enable it to fly and swim in or under water.

Part I: Subassemblies

Every vehicle has a main *body.* But many vehicles have subassemblies attached to their bodies, such as wheels, wings or turrets. At this stage, choose which subassemblies, if any, the vehicle has.

Subassemblies are broken down into three broad categories: motive subassemblies (like wheels or legs), flight subassemblies (like wings or rotors) and structures (like turrets or arms).

A. Motive Subassemblies

If the vehicle will have skids, wheels, tracks, halftracks, skitracks or legs for moving on the ground, pick one or more of these subassemblies and refer to the appropriate section below; otherwise skip ahead to *B. Flight Subassemblies,* on p. 7. A ground vehicle will normally have a motive subassembly; the only way a vehicle can travel in contact with the ground without one is to install a flexibody drivetrain (covered later, in the *Propulsion and Lift Systems* chapter) and slither like a snake.

If a motive subassembly is desired, refer to each one's description below for its available TLs, capabilities and any other design decisions that need to be made (e.g., if a wheeled subassembly is chosen, there are several subtypes available).

EXAMPLE

The Kitty Hawk will have wheels.

EXAMPLE

The Kitty Hawk has a jet engine. We consider adding two engines for safety, but decide on only one to save space. We use a TL7 turbofan with a mere 500 lbs. of motive thrust. Why not use more? Because we've decided the vehicle will use contragravity to lift it, so we don't need much thrust. We put the turbofan in the body. It weighs (0.2 × thrust) + 200 lbs., or 300 lbs. Its volume is weight/50 cf, or 6 cf. It costs $50 × weight, or $15,000. It has no power requirement, but uses 0.03 gph jet fuel × 500 lbs. thrust = 15 gph.

Rocket Engines and Spacedrives

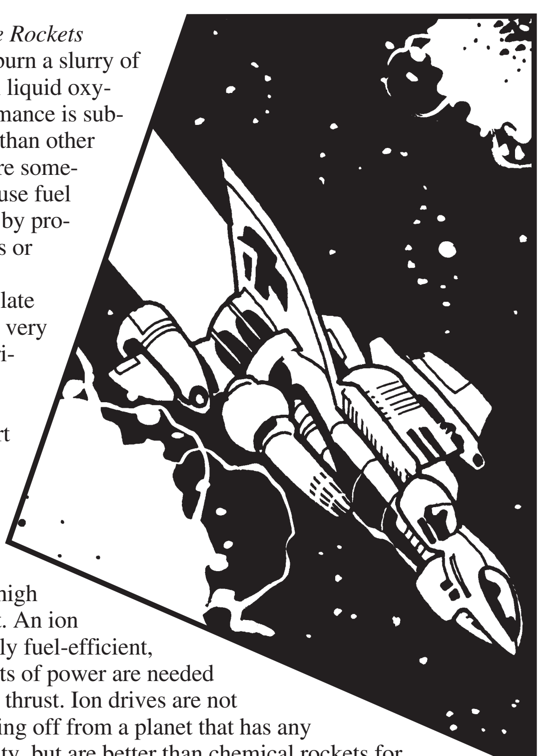
Rocket engines are reaction engines that do not require air or oxygen to operate. They can be used for propulsion by aircraft, spacecraft, watercraft or underwater vehicles, as well as by ground vehicles that are equipped with skid or wheels subassemblies.

There are numerous types of rocket engines, from simple solid fuel rockets to antimatter drives. Like jet engines, they are rated for pounds of motive thrust. A vehicle can have multiple rocket engines, and can use more than one type. Many of the TL9+ rocket engines are unlikely to be used if reactionless thrusters are available (p. 38); they are included for cultures or backgrounds where this technology does not exist.

The types include:

Solid Fuel Chemical Rockets (TL3): These are the simplest and earliest type of chemical rockets, in which the fuel is a solid (or putty) at ordinary temperatures. Such rockets have no need for fuel tanks or moving parts because the casing that holds the fuel is also the combustion chamber; a solid fuel rocket can be stored with fuel, and launched on a moment's notice. However, once a solid fuel rocket is started (unlike all other types of rocket), it cannot be shut down. A solid fuel rocket cannot be quickly refuelled – replacement of the solid fuel core takes several hours at a specialized repair shop, and costs 20% of the rocket's cost. This means that on manned vehicles, solid fuel rockets are best used as "boosters" rather than as the main propulsion system.

Liquid-Fuel Chemical Rockets (TL6): These are rocket engines that burn a mixture of fuel and oxidizer, and expel the resulting hot gas exhaust to create thrust. Liquid-fuel rocket engines are quite lightweight, but they are extremely fuel-thirsty.



Metal Oxide Rockets (MOX) (TL8): burn a slurry of metal powder in liquid oxygen. The performance is substantially lower than other types but they are sometimes used because fuel can be obtained by processing asteroids or lunar rocks.

Ion Drives (late TL7): These are very low thrust electrical-acceleration propulsion systems that convert reaction mass into a stream of ions (charged atoms or molecules), which acts as a high velocity exhaust. An ion drive is extremely fuel-efficient, but huge amounts of power are needed to generate high thrust. Ion drives are not practical for taking off from a planet that has any significant gravity, but are better than chemical rockets for long, slow interplanetary voyages.

Fission Rockets (late TL7): These utilize a built-in fission reactor optimized to heat reaction mass and expel it to produce thrust. They are heavy and expensive, but offer more thrust than ion drives. Their exhaust is somewhat radioactive.

Fusion Rockets (TL9): These rockets incorporate an integral fusion reactor that heats reaction mass and expels it to produce thrust. The disadvantage is a very hot (and somewhat radioactive) exhaust. The *optimized* fusion rocket is designed for fuel efficiency at the expense of greater weight.

Antimatter Thermal Rocket (TL9): This rocket mixes minute quantities of antimatter with far larger amounts of normal fuel to generate heat and produce an extremely energetic exhaust. The antimatter rocket is far easier to build (even at low TLs) than an antimatter power plant – the only limitation is that antimatter is *extremely* expensive at TL9. See *Antimatter Fuel Bays* (p. 90) for rules covering antimatter storage and failsafes.

Antimatter Pion Rockets (TL9): A much more sophisticated space drive, this system mixes an *equal* quantity of matter and antimatter whose mutual annihilation generates energy. Part of this is in the form of pion particles, which are directed by magnetic fields rearward to provide thrust. The antimatter drive's main advantage is that it requires very little fuel and as such can accelerate for a long time, gradually building up to a very high velocity. Its disadvantage is that the exhaust is an intense plume of gamma rays and other radiation thousands of miles long! Antimatter pion rockets usually have some form of secondary drive for use when maneuvering in close proximity to other ships or space stations.

Rocket engines are rated for their pounds of motive thrust. The more thrust a vehicle has, the faster it will move and accelerate. As with jet engines, vehicles may have more than one rocket engine for added safety; each is built individually, but their thrust will add together.

Decide what type of engine the vehicle will use, how many it will have, and what each engine's motive thrust will be. For each engine the vehicle has, decide on its location and calculate its statistics as shown below. *Exception:* for solid fuel rockets, see p. 37.

Rocket Engines Table

TL	*Type*	*Weight*	*Fuel Usage*	*Power*
6	Liquid Fuel Rocket	0.015 × thrust	1.5R	0
7	Liquid Fuel Rocket	0.012 × thrust	1.25R	0
8+	Liquid Fuel Rocket	0.01 × thrust	1.1R	0
8+	MOX Rocket	0.025 × thrust	1.08MOX	0
7	Ion Drive	(1,000 × thrust) + 5	0.0017C	650
8+	Ion Drive	(200 × thrust) + 5	0.0017C	650
7	Fission Rocket	(0.325 × thrust) + 4,000	0.5W	0
8+	Fission Rocket	(0.15 × thrust) + 1,000	0.1W	0
7+	Orion Engine	see p. 37	special	0
9	Fusion Rocket	(0.05 × thrust) + 50	0.02W	0
9	Optimized Fusion	(3,000 × th.) + 20,000	0.004H	0
10+	Fusion Rocket	(0.025 × thrust) + 25	0.02W	0
10+	Optimized Fusion	(300 × thrust) + 2,000	0.004H	0
9	Antimatter Thermal	(0.02 × thrust) + 1,000	0.05W/AM	0
10+	Antimatter Thermal	(0.02 × thrust) + 100	0.05W/AM	0
9	Antimatter Pion	(1,000 × th.) + 20,000	M/AM	0
10+	Antimatter Pion	(200 × thrust) + 4,000	M/AM	0

Location: The engine may be placed in the body, wing, pod, superstructure, or leg.

Weight: The table shows the weight of the propulsion system (in pounds) 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 $25 if Liquid Fuel Rocket, or by $100 (any other system).

Power: This is the power consumption per pound of thrust. Systems with 0 power consumption usually convert their fuel into energy, or in the case of a fission or fusion systems, are self-contained reactors optimized for propulsion.

Nuclear, Antimatter and Mass-Energy Conversion Power Table

TL	Type	Weight if output is under 5kW	Weight if output is 5kW or more	Cost	Years
Fission Reactors					
7	Fission Reactor	no	(8×kW) + 20,000	$200	2
8	Fission Reactor	no	(4×kW) + 4,000	$100	2
9	Fission Reactor	no	(1×kW) + 1,000	$40	2
10+	Fission Reactor	no	(1×kW) + 1,000	$20	2
Radiothermal Generators					
6	RTG	1000×kW	(200×kW) + 4,000	$5000	14
7	RTG	300×kW	(50×kW) + 1,250	$1000	14
8	RTG	50×kW	(10×kW) + 200	$50	14
9	RTG	20×kW	(5×kW) + 75	$50	14
10	RTG	12×kW	(2×kW) + 50	$50	14
11+	RTG	6×kW	(1×kW) + 25	$50	14
Nuclear Power Units					
8	NPU	no	(8×kW) + 200	$200	0.5
9	NPU	12×kW	(2×kW) + 50	$200	1
10	NPU	6×kW	(1×kW) + 25	$200	2
11	NPU	4×kW	(0.4×kW) + 18	$200	5
12+	NPU	2×kW	(0.2×kW) + 9	$200	10
Fusion Reactors					
9	Fusion Reactor	no	(1×kW) + 20,000	$200	200
10	Fusion Reactor	no	(0.2×kW) + 2,000	$50	200
11+	Fusion Reactor	no	(0.2×kW) + 2,000	$25	200
Antimatter Reactors					
11	Antimatter Reactor	no	(0.1×kW) + 4,000	$20	2.5
12	Antimatter Reactor	no	(0.05×kW) + 2,000	$20	5
13	Antimatter Reactor	no	0.05×kW	$20	5
Total Conversion					
14	Total Conversion	no	0.02×kW	$30	infinite
16	Cosmic Power Plant	1×kW	(0.01×kW) + 4.95	$2	infinite

Location: These power plants can go in the body, pods, or wings.

Weight: Calculate the weight of the power plant as shown on the table above, based on output. Note that there are two columns, one for power plants with outputs under 5 kW, the other for larger power plants. A "no" in the under 5 kW column means a power plant cannot be built with less than 5 kW output.

Volume: Divide weight by 50 to find volume in cf except for NPUs or RTGs; for those, divide the weight by 100.

Cost: This is the cost per pound of power plant weight. Some power plants have minimum or extra costs. There is an extra cost for the reactor core of some systems: TL7 fission ($400,000), TL8 fission ($200,000), TL9 fission ($40,000), TL9 fusion ($1,000,000), TL10 fusion ($200,000), TL11 fusion ($100,000); TL11 antimatter ($200,000), TL12 antimatter ($100,000). There is also a minimum cost: all systems except RTGs have a minimum cost of $20,000; RTGs have a minimum cost of $2,000.

Years: This is the number of years the power plant can operate for using its internal built-in fuel supply. Total conversion power plants have a negligible fuel requirement and can operate indefinitely on minute amounts of matter.

Exotic Power Plants

These power plants are primarily intended for use in fantasy, science fantasy, supers or horror games.

Bioconvertors are bio-mechanical machines living inside the vehicle, eating food and producing bioelectrical or mechanical energy. They generate energy using food and atmospheric oxygen, and have a "mouth" into which water and food (anything biological) must be placed. All bioconvertors require 1 gallon of water per kW of output per day. Herbivore bioconvertors also eat ten pounds per day of any plant material per kW. Carnivore bioconvertors require two pounds of meat per day per kW. Omnivore bioconvertors require either meat or plant material. Finally, the Vampire bioconvertor requires 1 gallon of blood per kW per day. (An average human body has 1.5 gallons of blood.) It would require TL10 genetic engineering to build them, but wizards or alien cultures with advanced biotechnology might create them at much lower TLs, perhaps by breeding exotic animals.

Soulburner is a generic term for a necromantic machine fuelled by life-force. It does not use normal fuel. Instead, an intelligent, sentient being must be placed within it. A soulburner's victim loses HT every 10 hours equal to the power output of the soulburner in kW. For example, a person placed within a 30 kW soulburner loses 30 HT every 10 hours, or 3 HT per hour. When a victim dies, he must be replaced if the power plant is to continue operation. Soulburners do not function in no-mana areas. A vehicular soulburner can be created by a TL1+ mage who knows the Enchant, Summon Demon and Steal HT spells; the Soulburner requires 600 energy to create per kW of power output. Damage caused by a soulburner heals at the normal healing rate. Regeneration, medicine or Healing spells do not speed recovery.

Air-Golems (p. M70) can be used to drive muscle engines (p. 82). Each air golem is the equivalent of a ST 15 person, thus generating 0.3 kW of power.

Elemental Furnaces (also called "infernal combustion engines") are magical steam engines using bound fire and air (for combustion) elementals. An elemental furnace functions like a TL5 steam engine, except that it can be built by any TL4 blacksmith working with a mage and requires no fuel. It requires a mage with the Fireproof, Air Golem, Control and Summon Fire Elemental and Control and Summon Air Elemental spells to create it, costing 300 energy per kW of power output. Also, any ordinary, TL5+ steam engine may be "elemental-enhanced" with a bound fire elemental to provide extra control. The air spells are not needed and energy cost is halved; elemental enhancement adds 100% to the engine's power output.

Mana Engines are technomagic devices that gather ambient magical energy (in the same way a mana organ does in a magical creature) and transform it into electrical power. They do not require fuel, but do not function in no-mana zones. To create a mana engine requires a variant of the Powerstone spell cast on a rune-carved copper or silver metal sphere or block, which then produces a controllable amount of electrical power. The energy cost is 100 per kW of power output. The spell's prerequisite is the Power spell.

Occupancy: Short. *Passengers:* One. *Crew:* Driver. *Accommodations:* Cycle seat.

Power Plant: TL7 30 kW standard gasoline engine (HP 14, uses 1.2 gph gasoline). TL7 lead-acid battery, stores 1,000 kWs (HP 2) for lights, etc.

Fuel: Standard 5 gallon tank (HP 5, fire +0). 5 gallons gasoline (fire 11). 4.17 hours engine fuel.

Access, Cargo and Empty Space: 7.5 cf empty space.

Volume: Body 13.35 cf, wheels 1.335 cf. *Surface Area:* Body 40, wheels 8, total 48.

Structure: Cheap. *Armor:* None.

Hit Points: Body 60, wheels 12 each.

Statistics: Empty weight 722 lbs. Usual payload 400 lbs. Loaded weight 1,152 lbs. (0.58 tons). Volume 14.685 cf. Size modifier +1. Price $2,975. HT 12.

Ground Performance: Speed 115 mph. gAccel 5 mph/s. gDecel 10 mph/s. gMR 1.5. gSR 2. High GP. 1/6 off-road speed.

Main Battle Tank (TL7)

This is a modern, Western-design main battle tank like the German Leopard II or the U.S. Army's M1 Abrams.

Subassemblies: Tracks, turret (full rotation, on body), two open mounts (#1 and #2, limited rotation, on turret).

Body Features: Slope on body: front 60 degrees. Slope on turret: front 60 degrees, right 30 degrees, left 30 degrees.

Propulsion: Tracked drivetrain with 1,100 kW motive power (HP 125, 1,100 kW).

Weaponry: TL7 120mm tank gun (TuF, HP 125). 7.62mm GMPG (TuF, HP 3). 12.7mm HMG (Om1F, HP 8). 7.62mm GMPG (Om2F, HP 3). 40 × 120mm shots (Tu, HP 50). 1,000 × solid 12.7mm HMG shots (Tu, HP 10). 12,000 × 7.62mm shots (Tu, HP 17).

Weapon Accessories: Tank gun and turreted 7.62mm GMPG are linked. Anti-blast magazine for 120mm shots (Tu). Full stabilization for tank gun (Tu, HPs 27), 7.62mm GMPG (Tu, HP 1).

Instruments and Electronics: Two communicators, medium range (30 mi, Tu, HP 1 each) with scramblers. Light amplification (HP 1). Thermograph with 2 mi. range, scan 13 (Tu, HP 3). Military GPS (HP 2). Laser rangefinder, 5 mi. range (Tu, HP 3). Minicomputer, hardened, dedicated to Targeting program (Tu, HP 7, comp. 2, +2 Gunner skill).

Miscellaneous: Fire suppression system (HP 16).

Controls: Mechanical. *Crew stations:* "Driver" runs controls, light amp., one communicator from normal crew station. "Commander" runs GPS, thermograph, other communicator, 12.7mm HMG from normal crew station (Tu). "Gunner" runs 120mm gun, turret 7.62mm GMPG, computer, laser rangefinder from normal crew station (Tu). "Loader" runs 7.62mm GMPG in open mount from normal crew station (Tu).

Occupancy: Short. *Passengers:* None. *Crew:* Driver, Gunner, Loader, Commander. Loader loads 120mm gun when not firing GMPG. *Environmental Systems:* NBC Kit for four people (Tu, HP 10, 1 kW).

Power: 1,118 kW ruggedized standard gas turbine (HP 200, uses 67.08 gph diesel fuel). Powers all systems.

Fuel: Self-sealing 500 gallon tank (HP 125, fire -1). 500 gallons diesel fuel (fire 8). 7.45 hours fuel for power plant.

Access, Cargo and Empty Space: 157.88 cf access space. 27 cf cargo space (Bo). 20 cf cargo space (Tu). Empty space (Bo 68.12 cf; Tu 15.328 cf).

Volumes: Om1 (1.606 cf). Om 2 (0.352 cf). Tu (400 cf). Body (750 cf). Tr (450 cf). *Surface Area:* Om1 9, Om2 3, Tu 400, Bo 500, Tr 400. Total area 1,312. Structural area 1,300.

Structure: Extra-heavy.

Hit Points: Om1 18, Om2 6, Tu 2,400, Tr 1,200 each, Bo 3,000.

Structural Options: Heavy compartmentalization for body and turret. Improved suspension.

Body Armor: F PD 6, DR 1,680 exp. laminate. R,L,B: PD 4, DR 140 std. laminate. T, U: PD 4, DR 90 std. metal.

Turret Armor: F: PD 6, DR 1,500 exp. laminate. R,L: PD 5, DR 200 std. laminate. B: PD 4, DR 200 std. laminate. T: PD 4, DR 120 std. metal.

Tracks Armor: PD 4, DR 30 std. metal; tread skirts with extra DR 70 std. metal. Combined armor is PD 4, DR 100 if tread skirts successfully protect, PD 4, DR 30 if they do not.

Defensive Surface Features: Sealed.

Vision: Poor. *Details:* Headlights, no windows, hatches instead of doors.

Statistics: Empty weight 118,215.9 lbs. Usual payload 1,740 lbs. Loaded weight 125,885.9 lbs. (62.94 tons). Volume 1,601.96 cf. Size modifier +5. Price $2,125,543.30. HT 10.

Ground Performance: Speed 55 mph. gAccel 3 mph./s gDecel 20 mph/s. gMR 0.5. gSR 7. Low GP. 2/3 off-road speed.

Utility Helicopter (TL7)

A general-purpose transport helicopter. This kind will still be used in TL8 by civilian and military groups that can't afford newer hardware.

Subassemblies: Skids (two), TTR rotor.

Propulsion: 1,050 kW TTR helicopter drivetrain with 1,680 lbs. thrust, 10,500 lbs. lift (HP 30, 1,050 kW).

Instruments and Electronics: Communicator with long (300-mile) range (HP 4, 0.04 kW).

Controls: Mechanical. *Crew stations:* "Pilot" runs controls, communicator from normal crew station.

Occupancy: Short. *Passengers:* 13. *Crew:* Pilot. *Accommodations:* One normal seat. 12 cramped seats *Safety Systems:* Seat belts.

Power Plant: TL7 1,050 kW HP gas turbine (HP 50, uses 73.5 gph jet fuel). Powers drivetrain. TL7 3,600 kWs advanced battery (HP 2). Powers communicator.

Fuel: Light 220 gallon tank (HP 75, fire +1). 220 gallons jet fuel (fire 14). Three hours fuel for gas turbine.

Access, Cargo and Empty Space: 32.3 cf access space. 30 cf cargo space. 1.82 cf empty space.

Volumes: Bo (430 cf). Ro (8.6 cf). Skd (21.5 cf). *Areas:* Bo 400, Ro 81, Skd 50. Total area 531.

Structure: Light frame, standard materials.

Hit Points: Body 300, rotary wing 122, skids 38.

Structural Options: Folding rotors.

Armor: Overall PD 3, DR 5 std. metal.

Vision: Fair.

Statistics: Empty Weight 4,995.65 lbs. Usual payload 3,400 lbs. Loaded weight 9,825.65 lbs. (4.91 tons). Volume 460.1 cf. Size modifier +4. Price $207,688.75. HT 11.

Air Performance: Stall speed 0, can fly. Aerial motive thrust 1,680 lbs. Aerodynamic drag 531. Speed 155 mph. aAccel 2.5 mph/s. aMR 4, aSR 2, aDecel 16 mph/s.

VEHICLES IN THE CAMPAIGN 15

A battered Kitty Hawk landed beside Cassidy's hanger. Morgan jumped out. She seemed tired but unhurt, and inordinately pleased with herself. They hugged quickly, then pulled apart.

"Armageddon postponed, Captain?" Cassidy asked.

"The cause of light triumphs again," Morgan sighed, leaning back against the hood. "She of the Seven Eyes is in the trunk."

"But you got tagged," Cassidy observed. He pointed to a huge dent near the front fender. "What did that, a 25mm cannon round?"

"You should see the other guys." Morgan grinned evilly. "Harriers zip, Kitty Hawk two. But speaking of repairs . . ."

This chapter covers the role of vehicles in the campaign. It deals both with issues that concern PCs (such as obtaining and legally operating vehicles, designing new ones and personal vehicular equipment), and those that concern GMs (such as tech paradigms and alternative vehicular technologies).

USING GURPS VEHICLES

What can you do with ***GURPS Vehicles?*** That depends on the worldbook you use it with. Obviously, it can be used as a source for vehicles and vehicle combat for historical, fantasy, modern-day or futuristic adventures. In addition:

GURPS Time Travel

When characters are adventuring in the past, the GM can use this book to create period transportation. Furthermore, using the ***Basic Set*** rules for building up tech levels, characters stranded in an earlier time can try to construct their own non-historical vehicles. As well, the rules for "parachronic conveyers" (p. 40) are suitable for use in ***GURPS Time Travel's*** *Infinite Worlds* background.

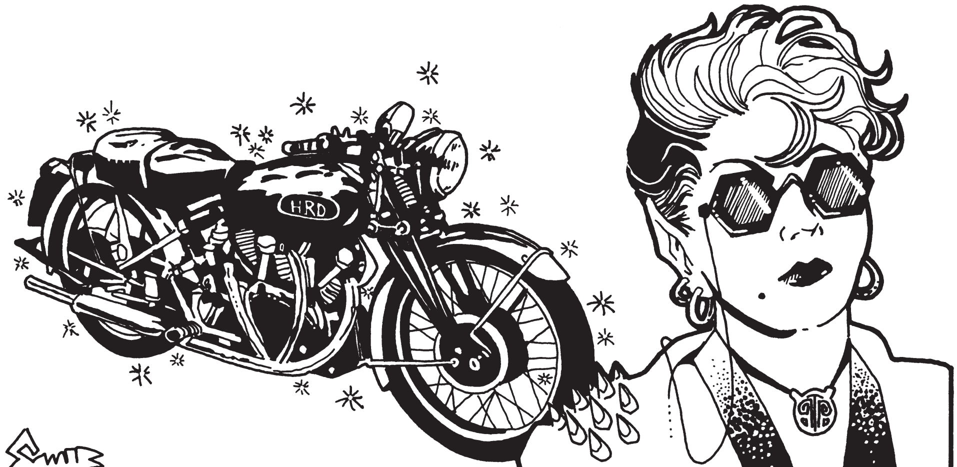
GURPS Magic

The GM can use ***Vehicles*** to create exotic enchanted craft such as demonic war machines powered by soulburners, flying ships drawn by gryphons or boats rowed by zombie oarsmen.

In a modern-day "mana-punk" campaign, or a weird science one like ***GURPS IOU,*** spell-powered motorbikes and autos can be easily created using these rules.

GURPS Espionage

What's an espionage game without car chases and exotic vehicles? These rules allow the design of "spymobiles" with everything from mutable license plates to oil jets.



Sensitive and Secret Technology

When PCs wish to build vehicles, GMs should feel free to classify as "sensitive technology" any item whose manufacturing process is classified and unavailable to ordinary citizens. Examples at TL6 would be most kinds of radar, advanced bomb sights and proximity fuses. At TL7, examples of sensitive technology include most ECM and stealth systems, fission power plants, advanced sensors, laminate armor and some guided missiles.

Characters will usually be unable to purchase sensitive equipment commercially, and stealing it, or the plans or machines used to build it, may be the focus of an adventure.

The actual manufacturing blueprints of many military (and some civilian) *vehicles* are also classified, even if the vehicle itself is for sale. Even though none of its components may be classified in and of themselves, designing the vehicle is still a long and expensive process. However, possession of the engineering drawings enables the vehicle to be easily "reverse engineered." After France embargoed sales of advanced jets to Israel, Israeli agents stole the blueprints of the French Mirage 5 fighter. Later, Israel produced its own Mirage 5 clone, the Nesher.

Making Lemons

If a vehicle is poorly maintained (or very used) it may have various bugs. Also, some vehicles are just designed badly. Some sample flaws are given below. Pick a few that can apply to the vehicle, or make some up.

Minor Bugs

Hangar Queen: Reduce the time the vehicle can run between maintenance checkups (p. 146) by 10-60%.

Low Mileage: Add 10%-30% to the fuel consumption of the vehicle's power plant.

Complex Controls: The vehicle's controls are very complex. Anyone new to the vehicle will be at an extra -1 to skill beyond the usual -2 for unfamiliarity with the vehicle type. Default use is at an *extra* -2 penalty. This is common on military jets.

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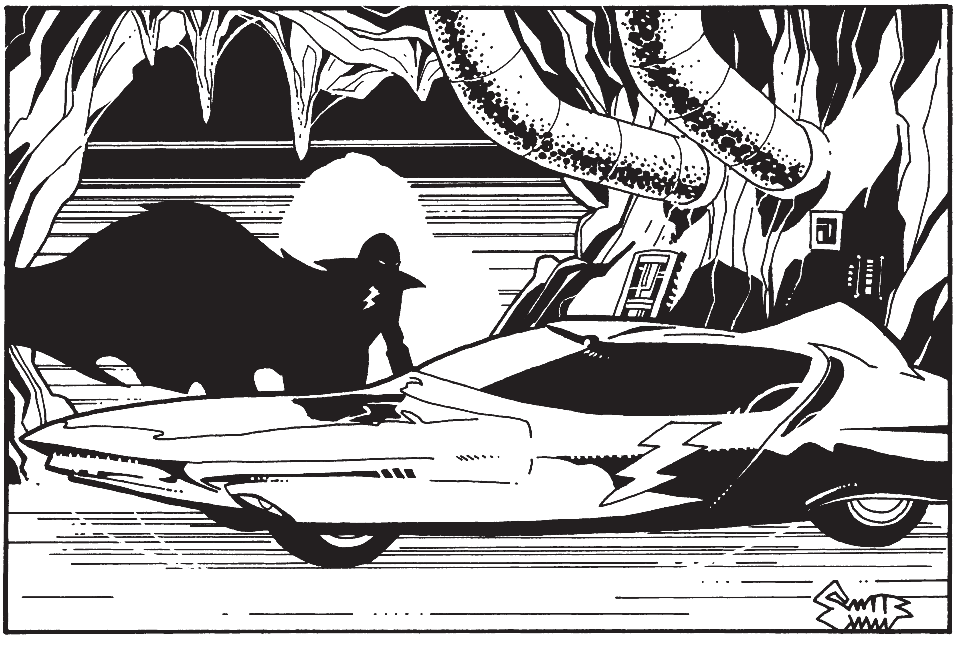

Super-Vehicles

GURPS Supers GMs may allow characters to purchase ultra-tech or heavily-armed vehicles as gadgets. When using the gadget-purchasing rules to buy large vehicles, the GM can decide that individual components count as separate gadgets. If a PC wants a sports car, he just has to pay the cash and buy the car. If he wants to use his gadgeteer abilities to modify it with a TL9 MHD turbine power plant, TL10 armor and a TL9 Gatling laser under the hood, these count as three gadgets, each of which should be researched and paid for separately.

A super vehicle can have special powers. Imagine a demonic motorcycle with Shadow Form and Body of Fire, or an Elizabethan galleon with Flight! Particularly in-genre are Body of Air, Body of Fire, Bouncing, Clinging, Chameleon, Insubstantiality, Invisibility, Flight, Hyperflight, Matter Surfing, Regeneration, Shrinking, Super Jump, Tunneling, Unaging and Walk (drive) on Air or Liquid. At the GM's option, vehicles can also have disadvantages to pay off their advantages, e.g. Terminally Ill (it's going to break down *soon*), Enemy (someone wants it back) or Weirdness Magnet. The source of a vehicle's powers may be some weird gadget built into it, an enchantment, or the same odd processes that produce superheroes ("After a tire was bitten by a radioactive hare, the ordinary VW Rabbit mutated into Fluffy the Bouncing Bunnymobile.").

Enchanted Vehicles

The GM will have to arbitrate the exact effects of spells cast on vehicles. For most Regular spells, it will be important to know how many "hexes" a vehicle takes up. Since a "hex" is a 3' circle, and magical effects are assumed to extend 4 yards (12') up (as per p. M11), each "hex" corresponds to a volume of roughly 85 cf. So to place a regular spell on a vehicle, determine its "size in hexes" by dividing its volume in cf by 85, then multiply the spell's fatigue cost by the quotient. The same multiplier is applied to the energy cost of enchantments. When the cost of a spell or enchantment depends on weight, simply use the vehicle's loaded weight.

Example 1: To enchant a 200-cf subcompact car with Walk on Air (500 energy; see p. M35) would cost (200/85) × 500 = 1176 energy.

Example 2: To enchant a 500-lb. motorcycle with Invisibility (500 energy per 50 lbs.; see p. M58) would cost (500/50) × 500 = 5000 energy.

The energy cost to activate a vehicular enchantment is normally paid by the vehicle operator, a Power enchantment or a dedicated Powerstone. Alternatively, the vehicle can be enchanted with Draw Power (p. G101) and powered by conventional power supplies (see p. 201 to convert kWs to fatigue).

For armor enchantments, multiply the energy cost by (surface area being armored/25). When cast on vehicle locations with DR 20 or more armor, the *Fortify* spell will increase DR on a percentage basis instead of adding a flat bonus: 50 energy gives +5%, 200 gives +10%, 800 gives +15%, 3,000 gives +20% and 8,000 gives +25%.

GURPS Robots and GURPS Vehicles (Continued)

Wheels and Wheeled Drivetrains: Robot wheels are the same as vehicle off-road wheels with all-wheel drive.

Rotors and Helicopter Drivetrains: The robot systems are all coaxial (CAR) drivetrains and rotors.

Fuel Tanks: The tanks included in ***Robots*** have been simplified by combining the weight of the tank and fuel and also by rounding off the weight of hydrogen fuel.

Jets and Rockets: Chemical rockets in ***Robots*** are simplifications of more complex designs in ***Vehicles.*** Use the ***Robots*** rockets in ***Vehicles*** if desired!

Wings: Robot wings are the same as "standard" vehicle wings.

Structure: Robot structures have the "robotic" structure option built in, which is why they cost twice as much!

Armor: The robot armor types are identical to the "advanced" ***Vehicles*** versions.

Camouflage and Threat Protection: Robot stealth and IR cloaking are identical to the "basic" ***Vehicles*** versions.

Sensor Scans: Radars, ladars, sonars, xadars and scanners in ***Robots*** don't have a Scan rating. To use the advanced sensor rules with them, determine their Scan rating by referring to the table on p. 52.

Flotation and Water Speed: The ***Vehicles*** rules use a more realistic system, better suited to larger craft. If desired, this more complex system can be adopted for robots built entirely with ***Robots*** rules. Just find the aquatic motive thrust as given in ***Vehicles*** and then use the *Water Performance* section of the ***Vehicles*** rules to recalculate the flotation and top speed statistics.

Empty Weight, Acceleration, Deceleration, MR, SR, Off-Road: These stats do not appear in ***Robots.*** Calculate them for robots using the ***Vehicles*** guidelines. Or continue using the simplified rules beginning on p. RO93.

Personal Equipment

Some items useful for vehicle crews:

Life Jacket (TL6): An inflatable life jacket prevents a person from drowning, but cuts swimming Move in half. Laws often require watercraft to carry enough life jackets for crew and passengers. 6 lbs., 0.2 cf if stowed. $10 at TL6-, $50 at TL7+.

Parachute (TL6): These become available after World War I. They are used when people bail out of aircraft (see p. B48). They are normally worn by military aircraft crew who do not have ejection seats and by paratroopers. Trying to get out of an aircraft takes 25-DX seconds if a person isn't in an open or external seat. Once out, a person will normally fall for at least 80 yards before the chute can open and significantly slow his fall. A parachutist will then descend at approximately 5 yards per second, drifting with the wind until he reaches the ground. An open parachute is +4 to hit and has 50 hit points, but can only be damaged by proximity explosions or flamethrowers. 30 lbs., 1.5 cf. $100 at TL6, $400 at TL7+. Weight and price includes harness, main chute and one reserve chute.

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