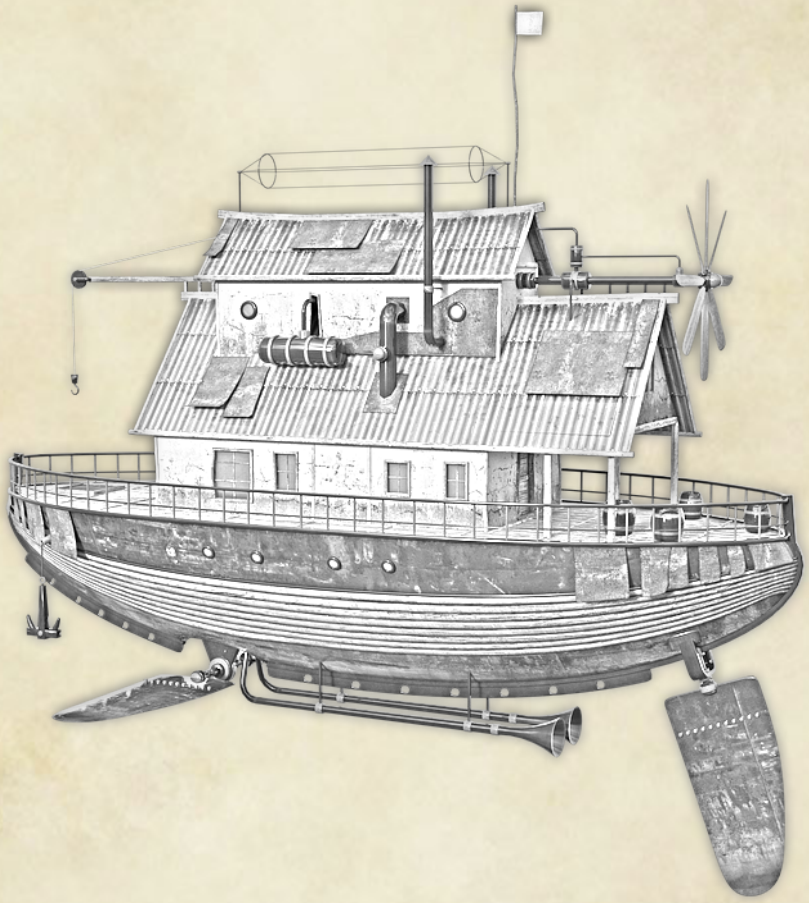
VEHICLE CONSTRUCTION KIT

For *Dungeons & Dragons* 5th Edition

Version 4.2



Contents

Vehicle Construction Kit

Elemental airships. Armored wagons. Steam-powered exoskeletons. This sourcebook allows you to create medieval fantasy vehicles – land, air or seafaring – ranging from small wagons to massive sailing ships. To aid you with the VCK system, there are some step-by-step examples in Appendix B.

Creating a vehicle is a four-step process:

1. **Body Mass.** Choose a body mass, which determines how much components cost.
2. **Components.** Select components such as a helm or cargo holds.
3. **Options.** Add options such as magic augmentations.
4. **Statistics.** Finalize and fudge statistics.

Version 4.2

- **Author.** Duncan Timiney (Marasmusine)
- **Images.** All images are public domain or CC0 (creative commons no-attribution).
- **Format.** http://homebrewery.naturalcrit.com/

VCK Concepts

Components and Slots

A vehicle is comprised of 20 slots, each representing a mass equal to one-twentieth of the gross mass of the vehicle. Normally each slot has one component (such as a cargo hold or sailing rig), but in some cases one component might span several slots; or a slot might hold several components.

Values

A number of values are used during the creation process of a vehicle. They are only used during creation. Once the vehicle is finalized, you no longer need to refer to them: they are not used while playing D&D.

Drag

Drag is a overall term representing things that slow a vehicle down such as air or water friction, buouyancy and ground pressure. Drag is increased by some components, and decreased by the vehicle's mass category and streamlining. The final Drag can postitive, decreasing the vehicle's speed; or negative, increasing its speed.

Lift

Helicopters, airships and other vehicles that have an upward force for flight must generate Lift. Lift is generated by some components and vehicle options, as a measure of how quickly the vehicle can ascend: the vehicle requires 3 Lift to hover, and greater than 3 Lift to ascend. Aeroplanes with fixed wings do not require Lift, although it can help reduce their stall speed.

Mass Category

A mass category is a roman numeral, from *i* to *xii*, representing the approximate mass of the vehicle or a vehicle component. A mass *i* component fits into one slot of a mass *i* vehicle.

Power Points

Some components, such as steam engines, generate Power Points (PP). These are allocated to other components that require power. PP is scaled to the mass of the vehicle.

Structure Points

Structure Points (SP) are gained by adding structure components to the vehicle. SP is used to determine a speed that the vehicle cannot exceed, and adds extra hit points.

Land Thrust

A self-moving land vehicle derives its speed and acceleration from Land Thrust, generated by components such as a wheel drivetrain or propellers. Thrust is not used for air or water speed: instead, a component gives you an air or water acceleration in mph-per-round.

Body Mass

Pick a mass category on the Body table. The mass category is denoted by a Roman numeral, and is used to determine the cost and statistics of the vehicle's components.

The mass you choose gives a laden weight for the vehicle, which includes the weight of the vehicle itself, along with all its cargo, crew and passengers.

Body

Mass	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	*xi*	*xii*
Laden Weight (tons)	2	3	6	10	20	30	60	100	200	300	600	1,000
Damage Threshold	5	5	5	5	10	10	10	15	15	15	20	25
Hit Points	30	35	45	55	70	80	100	115	145	165	210	250
Dexterity	11	10	10	9	9	8	8	7	7	6	6	5
Strength	11	11	12	12	13	13	14	14	15	15	16	16

Suggested Size

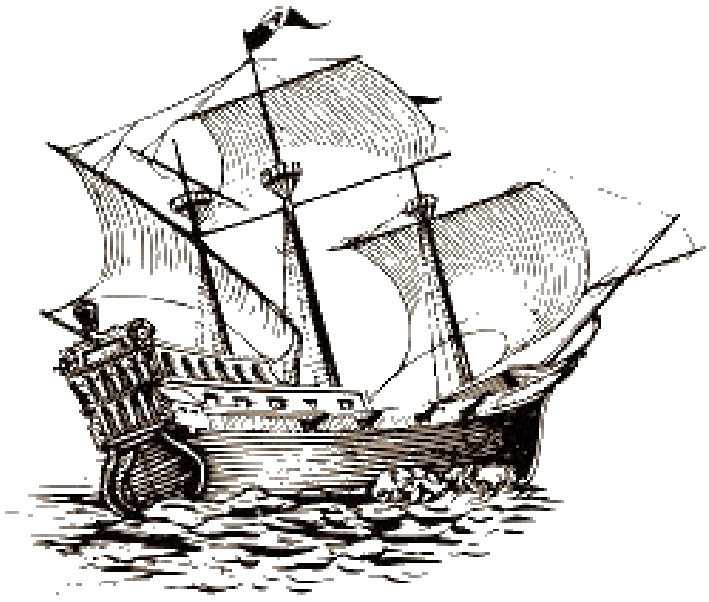
Mass	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	*xi*	*xii*
Size	L	L	H	H	H	G	G	G	G	G	G	G
Length (ft.)	10	15	20	20	30	40	50	60	80	100	125	180
Beam (ft.)	5	5	5	10	10	10	15	20	20	25	30	35
Decks	0	0	0	0	1	1	1	2	2	2	3	3

Damage Threshold Larger vehicles have a certain immunity to damage, as described in the *Dungeon Master's Guide* (p. 119).

Hit Points The vehicle's base hit points. This may be increased when you add structure components.

Dexterity and Dexterity The vehicle's base Dexterity and Strength scores. These ability scores are specific to one type of movement (air, land, water) and might be increased or decreased by your choice of components and features: see Ability Scores.

Size The size of a vehicle is based on its mass category: L (Large), H (Huge) or G (Gargantuan). The specific dimensions can vary greatly. The Suggested Size table gives typical dimensions of a seafaring vessel. A caravel is a *viii* vehicle (60 ft. by 20 ft., 3 decks), while galleon is an *xi* vehicle (125 ft. by 30 ft., 5 decks)



Ability Scores in Water

A vehicle's Dexterity score in water decreases by 6, and its Strength score in water increases by 4.

Facing

Choose if the vehicle uses facing (*Dungeon Master's Guide* p. 252) or not. A vehicle with facing has three body sections: front, center and rear.

Other Statistics

Armor Class Unless structure components are added, a vehicle's AC is 11.

Constitution A vehicle's base Constitution score is 10. This can be increased by adding structure components.

Resistances Vehicles are objects, so are immune to poison and psychic damage.

Speed The speed of a vehicle is determined in step 4 after you have added all the components and features.

Components

A vehicle comprises of twenty component slots. Each slot makes up one-twentieth the mass of the laden vehicle.

As you choose components, select which numbered component slot it goes in.

Facing If the vehicle has facing, slots are designated as being in the front, center or rear section as follows:

Slot	Section
1–6	Front
7–14	Center
15–20	Rear

Cost Each component has a cost given in gold coins, depending on the vehicle's mass category. In component tables "K" denotes a multiple of 1,000 gp and "M" denotes a multiple of 1,000,000 gp

Exposed Components Sails, oars and gasbags are exposed components. When targeted by an attack, they have an AC of 11 regardless of the vehicle's structure components. They can always be targeted regardless of facing.

Workspace

The tables for some components have a "workspace" row. This shows how many crew can work within the component performing maintenance or operating machinery. A component with workspace includes the tools required to repair it.

For motive and power components, crew are engineers or technicians. Magical components require acolytes or wizards. Quarters require stewards or botswains.

Optionally, if the vehicle has multiple identical components with workspace, you can use workspace value of a higher mass category for those components collectively. Use the Undersized Components table below to determine the number of steps to the right. For example, a vehicle with 5 mass *iv* quarters components uses the workspace value for mass *vii* (3 steps to the right): All 5 components together have 1 workspace.

Alternative Component Sizes

In most cases, one slot contains one component. However, it is possible for one large component to occupy several slots ("oversized"), or for one slot to contain several smaller components ("undersized").

Oversized Components

Not every component is available for the mass category of your vehicle. However, you can use a larger category of component by having it occupy more than one slot, as shown in this table.

Steps	Slots
1	2
2	3
3	5
4	10

For example, a mass *ii* vehicle can take a mass *iv* quarters component by having it take up 3 slots (since this is 2 steps to the right).

Power Points An oversized power-generating component multiplies its Power Points by the number of slots it occupies. Similarly, an oversized component that requires Power Points multiplies its requirement by the number of slots it occupies.

Undersized Components

Not every component can be undersized. The description will inform you if it is possible.

Some components indicate they take up a fraction of a slot. The following table shows the undersized steps: for example a component that takes up 1/3 of a slot is 2-step undersized.

Steps	Components	Penalty
1	2	2
2	3	3
3	5	5
4	10	10

The penalty applies to:

Structure The Structure Points gained by a structure component are divided by the penalty.

Dexterity The vehicle's Dexterity score is reduced by the penalty for each undersized helm, oar or wheel component.

Power Points An undersized power-generating component divides its Power Points by the undersize penalty. Similarly, an undersized component that requires Power Points divides its requirement by the penalty.

Recommended Components

When planning which components to add to the vehicle, take note of the following requirements.

Helm

Any design that isn't stationary or pulled along requires a helm.

Structure

Some designs require you to add enough structure components to meet a minimum number Structure Points.

Speed Limit A vehicle's maximum speed cannot exceed 5 mph per 1 Structure Point.

For example, a vehicle of any size with 2 wooden structure components has 12 Structure Points. It cannot travel faster than 60 mph.

Ballast

A water vehicle designed to traverse open ocean must have one cargo hold to act as ballast. If it is not laden with actual cargo, it is filled with rocks. From the industrial-era onwards, a vehicle can use a ballast tank instead.

A vehicle that relies on lifting gas gasbags for lift must also have one cargo hold (such as sandbags) or ballast tank for ballast. A hot air gasbag does not require ballast if it uses a burner to control its buoyancy; nor does a vacuum gasbag if it is perfectly sealed.

Land Speed

To achieve a land speed, the vehicle must have legs, wheels, runners.

A vehicle with wheels or runners can be pulled by draft animals or moved with a propeller or sailing rig. Wheels can also be powered with a wheel drivetrain.

Flying Speed

To achieve a flying speed, the vehicle must have ornithopter wings, rotory wings, fixed wings with a propeller, or the cloud keel magical augmentation.

A vehicle can hover if it has enough more Lift. Lift is generated by gasbags, soarwood, the levitating body magic augmentation, ornithopter wings or rotary wings. Some designs may also rely on updraft or ground effect. You need more than 3 Lift points to rise: you also need forward motive power from a propeller, rotary wing or sky rig.

Water Speed

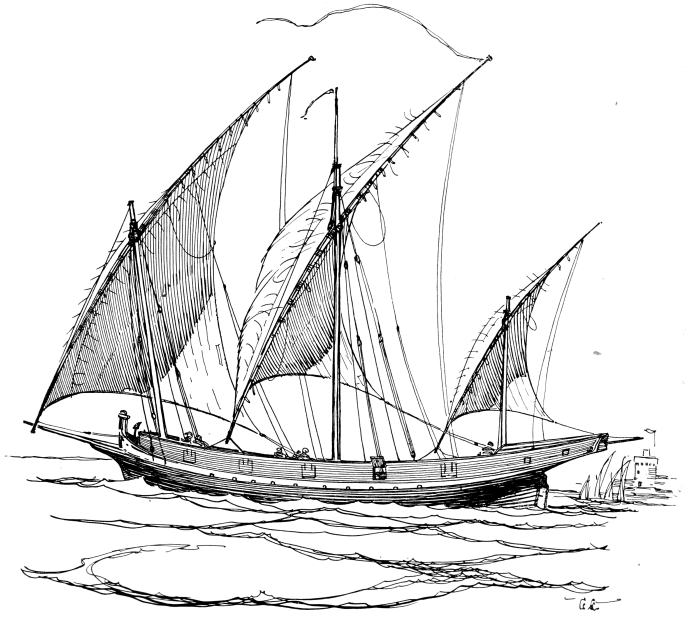
To achieve a speed on water, you need a sailing rig, oars, paddlewheel or screw propeller.

Underwater Speed

To achieve an underwater speed, you need a ballast tank, screw propeller, and the vehicle must be sealed.

Occupancy

For long voyages (lasting longer than one day) each crewperson and passenger requires occupancy in a quarters component. For short voyages, each requires occupancy at a set of controls in a helm component, or in a seating component (even if they are not literally seated: utilitarian seating can merely represent a place to stand).



Component Technology

The assumption is that your campaign has the equivalent of medieval technologies. Some components have the "Renaissance", "Industrial", "Early Modern", "Modern" or "Futuristic" tag. The DM should determine which components are available based on their campaign.

Cost The DM may allow anachronistic technology be available at an increased cost. Each level of technology that diverges from the campaign's normal level triples the cost of the component. For example, if a modern-era rotary wing is available in a medieval setting, that component has ×81 the normal cost (since there is a difference of 4 levels of technology).

Such anachronistic technology might represent masterwork craftmanship, a magical creation, or technology fallen through time. Whatever the reason, the cost of anachronistic technology contributes towards the vehicle's rarity.

Piloting Components

Piloting components help move the vehicle in some way.

Gasbag

(Renaissance)

A gasbag provides lift by creating an envelope of gas with less density that the surrounding air. Each gasbag component provides Lift. There are three types of gasbag: hot air, lifting gas or vacuum.

Exposed A gasbag is an exposed component. Furthermore, a gasbag can be targeted without incurring disadvantage on the attack roll.
Speed If the vehicle has no other means of propulsion, the vehicle will drift with a light wind at about ½ mph per gasbag component.
Drag (Air) 2 per gasbag component.
Dexterity If the vehicle can hover, its Dexterity in the air increases by the Hover Dexterity Increase.
Maximum Speed: 90 mph

Hot Air

(Renaissance)

A gasbag inflated before flight with hot air from a fire. The balloon gradually loses its lift as the air cools. From the industrial-era onwards, the component includes a burner and fuel source that extends flight time. The cost of fuelling a burner is 10-percent the cost of the gasbag components.

Lift 1 Lift for every three hot air gasbag components.
Endurance 1 hour (renaissance), 4 hours (industrial).

Lifting Gas

(Industrial)

Lifting gas might represent hydrogen, helium or some other fantastical gas. Hydrogen can be generated by pouring sulphuric acid onto scrap iron.

Lift 1 Lift for every lifting gas gasbag component.
Crew Lifting gas gasbags require crew to check for leaks and release ballast.
Volatile Some lifting gas (such as hydrogen) is flammable, in which case these components are volatile.
Ballast The vehicle must have one cargo hold allocated for ballast.
Endurance A lifting gas gasbag lasts for 10 days then must be topped-up, at 10-percent the cost of the gasbag components.

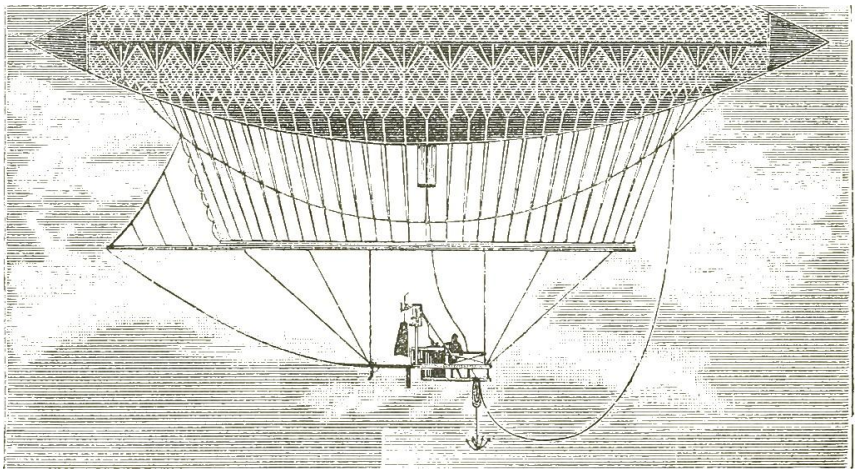
Vacuum

A vacuum chamber is a rigid sphere of thin adamantine with the air pumped out of it (or annihilated with magic). Only adamantine can withstand the pressure difference that would buckle other materials. The component has an AC of 23 if targeted.

Lift 2 Lift for every vacuum gasbag.
Rarity The cost of a vacuum chamber contributes towards the vehicle's rarity.

Gasbag

Mass	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	*xi*	*xii*
Cost (Hot Air)	50	70	100	150	200	300	500	700	1,000	1,500	2,000	3K
Cost (Lifting Gas)	150	200	300	500	700	1,000	1,500	2,000	3,000	5,000	7,000	10K
Cost (Vacuum)	1,500	2,000	3,000	5,000	7,000	10K	15K	20K	30K	50K	70K	100K
Workspace (Lifting Gas)	0	0	0	0	0	1	1	1	1	1	1	2



Helm

A vehicle's helm component represents its control surfaces (rudder, ailerons, etc), the mechanism for controlling them (ship's wheel, tiller, cockpit, etc), and the mechanical transmission between them. A pilot must be stationed at a helm in order to perform piloting manuevers.

A drawn vehicle does not require a helm, but does need a harness.

Rudimentary Helm A helm can be given simpler mechanisms. A character at a rudimentary helm can only make *one* piloting maneuver on their turn (instead of two). This halves the cost of the component.

Small Helm A mass *ii* or smaller helm must have an adjacent seating component with a workspace for the pilot.

Extra Controls The Helm table shows the number of extra controls that can be purchased at a cost of 50 gp (standard) or 25 gp (rudimentary). An extra set of controls might be a larger ship's wheel that allows two or more people to control the vessel in stormy weather; or it might be a duplicate set of controls that allows a co-pilot to take over without swapping seats. Extra controls can also be placed in a seating component.

Alternative Sizes A vehicle can have an undersized helm, subject to undersized penalties.

Helm

Mass	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	*xi*	*xii*
Cost	40	60	120	200	400	600	1,200	2,000	4,000	6,000	12K	20K
Extra Controls	—	—	—	+1	+1	+1	+1	+1	+2	+2	+3	+3
Workspace	0	0	0	0	0	1	1	1	1	1	1	2

Ballast Tank

(Industrial)

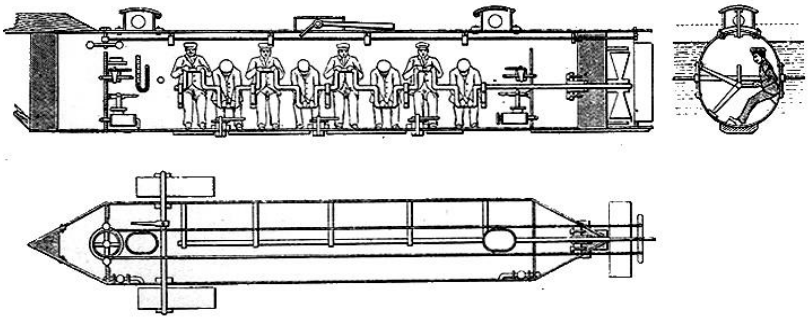
A floodable tank with a system of pumps. A ship requires a ballast tank to travel across the open ocean if it does not have a fully-laden cargo hold.

If the vehicle is also sealed, it can dive underwater. If it also has a screw propeller, it can move underwater.

Using only the ballast, the vehicle can dive and rise at 10 feet per round. If it is also moving through the water with a screw propeller, it can dive and rise at 20 feet per round. With a well-trained crew, the vehicle can "crash dive" at 40 feet per round.

Ballast Tank

Mass	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	*xi*	*xii*
Cost	60	100	200	300	600	1,000	2,000	3,000	6,000	10K	20K	30K



Maneuvering System

This component represents a aerodynamic, hydrodynamic or suspension mechanism. It includes mechanisms such as improved suspension, roll stabilizers, or high-agility ailerons.

Ability Scores Each maneuvering system increases the vehicle's Dexterity and Strength scores by 1 in one type of environment (air, water or land).

Component Limit A vehicle can have 1 or 2 maneuvering systems.

Maneuvering System

Mass	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	*xi*	*xii*
Cost	100	150	300	500	1,000	1,500	3,000	5,000	10K	15K	30K	50K
Workspace	0	0	0	0	0	1	1	1	1	1	1	2

Oars

Oars are rowed by the crew to push the vehicle across the surface of water. An oar component includes the seating for the rowers. Unlike a sail, oars can move the vehicle regardless of wind direction. The vehicle can also move in reverse.

Acceleration (Water) 0.15 mph per oar component, if the rowers have an average Strength score of 10. A strong crew with an average Strength of 15 provides an acceleration of 0.2 mph per component.

Power Strokes The rowing team can increase the acceleration to 0.2 mph (average crew) or 0.25 (strong crew) per component. While making power strokes, each rower gains one level of exhaustion at the start of every 10 minutes.

Helm As the vehicle's forward motion is controlled by the rowing team, the vehicle only needs a rudimentary helm for the *turn* piloting maneuver. If the oars are used for steering instead of a rudder or tiller, use the no helm option.

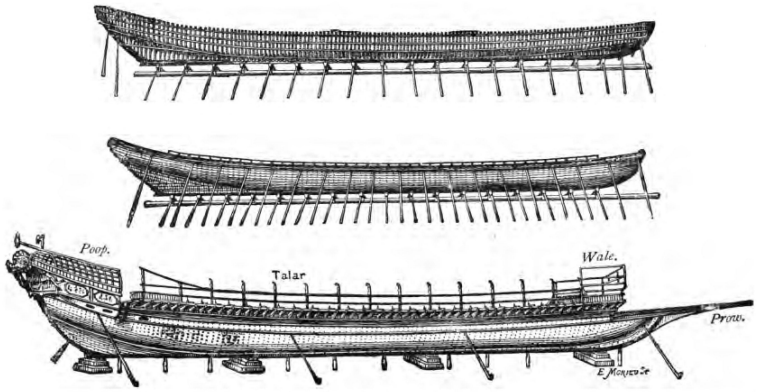
Oars on Bigger Ships Oars become increasingly less effective as a ship becomes more massive. Longer oars are required and more rowers are required for each, increasing the ships beam and therefore drag. When determining the vehicle's speed multiplier, Drag reduction from body mass category cannot be better than −4.

Crew The Oars table shows number of rowers required. In addition, a vehicle with 8 or more rowers also requires 1 superintendant or coxswain for every 100 rowers (or part thereof).

Alternate Sizes If a vehicle has only one oar component, it can be undersized. Decrease the vehicle's Dexterity score on water by the undersize penalty.

Oars

Mass	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	*xi*	*xii*
Cost	–	15	30	50	100	150	300	500	1,000	1,500	3,000	5,000
Crew	–	1	2	3	5	8	16	26	52	80	160	260



Sailing Rig

A sailing rig component catches the wind and gives the vehicle a forward speed on water. The component inculdes sails, masts, rigging and capstans.

Component Limit A vehicle can have one, two or three sailing rig components.
Exposed Sailing rigs are exposed components.
Strength Each sailing rig component decreases the vehicle's Strength in water by the value shown in the Sailing Rig table below. For example, a mass *iv* vehicle with three sailing rigs has its Strength decreased by 1.
Helm As the sailing rig crew are responsible for accelerating and decelerating the vehicle, only a rudimentary helm is required for the *turn* piloting maneuver.
Rig Choose a type of rigging for all the sailing rigs: square, lateen or a full rig.
Crew The Sailing Rig table shows number of riggers required to operate the saiing rig.

Points of Sail

The acceleration values given below represent the wind coming 45-degrees from behind (in a "broad reach").

Optionally, you can calculate the speed of the vehicle if the wind is coming from other directions. Each rig type shows the fraction of acceleration for the following points of sail.

Reaching The wind is coming in 90-degrees to the side.
Running The wind is coming directly from behind the ship.
Beating windward This is the ship's overall travel speed when moving into the wind. The ship is moving 45-degrees into the wind ("close hauled"), tacking along a zig-zag path.

Square Rig

A simple sail set perpendicular (square) to the ship's keel.

Acceleration (Water) 1.4 mph (light wind) to 4 mph (strong wind) per component.
Points of Sail *Reaching:* 1/8; *Running:* 1/2; *Beating windward:* 1/1000.
Crew Square rigs are easier to handle than lateen or full rigs. Use the crew requirements for the mass category 2 steps lighter than normal.

Lateen Rig

Lateen sails are triangular and mounted at an angle so that the vehicle can tack against the wind. They form maneuverable rigs such as the fore-and-aft rig.

Acceleration (Water) 1.4 mph (light wind) to 4 mph (strong wind) per component.
Points of Sail *Reaching:* 2/3; *Running:* 1/2; *Beating windward:* 1/40.

Full Rig (Rennaissance)

A full rig combines many square, triangular and outrigger sails.

Acceleration (Water) 1.8 mph (light wind) to 5.5 mph (strong wind) per component.
Points of Sail *Reaching:* 1/2; *Running:* 1/2; *Beating windward:* 1/125.

Land Yachts

Sailing rigs can also be used on a land vehicle that has wheels or runners. Points of sail apply as normal. Sails do not provide any thrust in built-up areas such as settlements, woods or hills. The surrounding area must be open and flat, such as a desert, beach or plain.

Land Thrust is equal to water acceleration × 10.

Sky Rig

A lateen or full rig can be configured as a sky rig. The vehicle must have more than 3 Lift points in order to fly. They are less effective on water, as lateral and ventral sails need to be stowed.

Acceleration (Water) One third the base water acceleration.
Acceleration (Air) Use two-thirds the base water accleration.
Drag (Air) 1 per sailing rig component.
Maximum Speed: 90 mph
Cost: ×2

Sailing Rig

Mass	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	*xi*	*xii*
Cost (Square Rig)	10	15	30	50	100	150	300	500	1,000	1,500	3,000	5,000
Cost (Lateen Rig)	10	15	30	50	100	150	300	500	1,000	1,500	3,000	5,000
Cost (Full Rig)	20	30	60	100	200	300	600	1,000	2,000	3,000	6,000	10,000
Crew (1 Sail)	1	1	1	1	1	2	3	3	5	6	8	10
Crew (2 Sails)	1	1	1	1	2	3	4	5	7	8	12	15
Crew (3 Sails)	1	1	1	2	3	3	4	6	8	10	14	20
Strength	–	–	−1/3	−1/3	−1/2	−1/2	−2/3	−2/3	−1	−1	−1½	−1½

Wheels

Wheels allow the vehicle to move on flat ground. They might be unpowered, or driven by a wheel drivetrain.

Drag (Land) Wheels add 6 Drag for land speed. This is reduced at later technology eras, due to improved suspension and tires: 3 Drag (industrial) and 0 Drag (early modern).
Drag (Air) Wheels add 1 Drag for air speed.
Strength The vehicle's Strength on land is increased by 8.
Alternate Sizes If a vehicle has only one wheel component, it can be undersized. Decrease the vehicle's Dexterity and Strength scores on land by the undersize penalty, divide its off-road speed by the undersize penalty, and divide its air Drag by the same.

Standard Wheels

Use one wheel component to represent a full set of standard wheels. These may resemble cart wheels: a wooden spoked wheel with metal or leather bands around the rim; or more crudely a solid horizontal slice of a tree trunk. Towards the end of the industrial era onwards, standard wheels use metal structures and pneumatic rubber tyres.

Off-road speed A vehicle with standard wheels moves at 1/5 its normal speed off-road. It will become stuck in difficult terrain caused by mud, snow or sand.

Dreadnaught Wheels (Industrial)

A vehicle with dreadnaught wheels has especially large wheels fitted with articulated rails or broad boards to reduce ground pressure.

Road and off-road speed With dreadnaught wheels, the vehicle's road speed and off-road speed is 1/2 its normal speed. If the vehicle has 2 dreadnaught wheel components and a low-gear drivetrain, it ignores difficult terrain caused by mud, snow or sand.

Rail Wheels (Industrial)

A vehicle must have rail wheels to move on rail.

Rail wheels increase traction with the rail through their weight. The component might take the form of large-circumference wheels, like those on early locomotives, or an arrangement of smaller wheels like a modern bogie.

Rail speed If the vehicle has 2 rail wheel components driven by at least one wheel drivetrain, it has ×2 the normal speed while on rails.
Off-rail movement If the vehicle somehow moves on road, the pilot must make a DC 15 Dexterity (maneuver) check or become out-of-control. The vehicle crashes it it moves off-road.
Dexterity The vehicle's maximum Dexterity on land is 9. In addition, it cannot turn.
Towing If the vehicle has 2 rail wheel components, it can safely tow twice the normal number of loads. If the vehicle has a low-gear drivetrain, it can safely tow any number of loads. Towed vehicles must have the same number of rail wheel components as the lead vehicle.

Off-Road Wheels (Early Modern)

Off-road wheels have large rubber tyres with improved grip pads.

Off-road speed The vehicle's off-road speed improves depending on the number of off-road wheel components it has: 1/4 speed (1 component); 1/3 speed (2 components); 1/2 speed (4 components); full speed (8 components).
All-terrain If the vehicle has a low-gear drivetrain, it ignores difficult terrain caused by mud, snow or sand.

Wheels

Mass	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	*xi*	*xii*
Cost (Standard)	6	10	20	30	60	100	200	300	600	1,000	2,000	3,000
Cost (Dreadnaught)	10	15	30	50	100	150	300	500	1,000	1,500	3,000	5,000
Cost (Rail)	20	30	60	100	200	300	600	1,000	2,000	3,000	6,000	10,000
Cost (Off-Road)	20	30	60	100	200	300	600	1,000	2,000	3,000	6,000	10,000

Powertrain Components

Powertrain components consume Power Points to generate land thrust; or water or air acceleration.

Powertrain Some components have the Powertrain tag. A powertrain must be allocated Power Points to function. Powertrain components use the Powertrain Rating rule.

An appendix is available to download from the Dungeon Master's Guild that includes pre-calculated powertrain ratings.

Powertrain Rating

A powertrain is rated for the maximum Power Points that can be allocated to it. This depends on the following values:

- **PTW** – The power-to-weight value of the powertrain
- **Components** – The number of components comprising the powertrain. This may be a fraction for an undersized powertrain (e.g. 1/2 for one-step undersized)
- **Tons** – The tonnage of the vehicle (noted in Body table in the Body Mass section.)

First, calculate the base weight of the powertrain and subtract this from the number of components to get the effective drive components ("Drive"). Multiply the result by the power-to-weight value to get the powertrain's rating.

Base = 3 ÷ (Tons × PTW)

Drive = Components − Base

Rating = Drive × PTW

- If the Base value is 0.1 or less, treat it as 0.
- Round Rating down to the nearest unit. If Rating is less than 1, round to the nearest unit fraction (1/2, 1/3, etc).

Minimum Drive

Drive has a minimum value:

Minimum Drive = Components ÷ 5

When you drive the powertrain rating, use the Minimum Drive instead of Drive, if it is greater.

Bulky and Compact

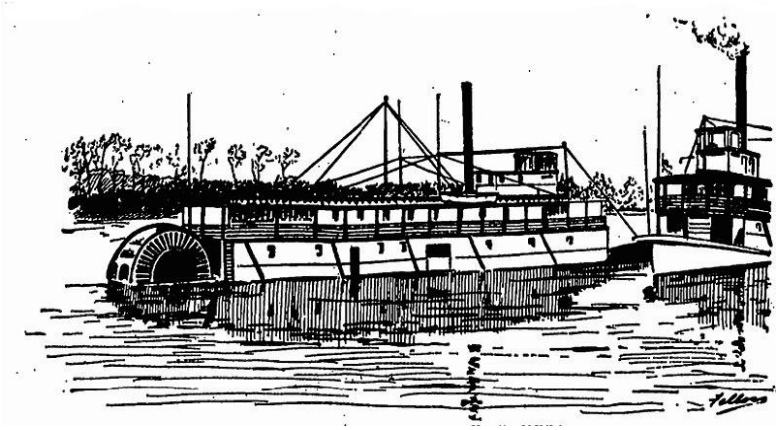
Some powertrains are tagged as "bulky" or "compact". Adjust the calculations as follows.

Bulky:

- Base = 8 ÷ (Tons × PTW)
- Minimum Drive = Components ÷ 10

Compact:

- Base = 1 ÷ (Tons × PTW)
- Minimum Drive = Components ÷ 2.5



Example

You have added 4 modern light leg components to a mass *i* vehicle (2 tons).

- **PTW** for modern light legs is 3 (bulky).
- **Base** = 8 ÷ (2 × 3) = 1.33
- **Drive** = 4 − 1.33 = 2.66
- **Minimum Drive** = 1/2 ÷ 10 = 0.05
- **Rating** = 2.66 × 3 = 8

Thus, we note that the leg powertrain is rated for 8 Power Points.

Low-Power Example

If we instead added only a one-step undersized leg component, Drive is 0.5 − 1.25. The result is negative: So we use the minimum drive to derive the Rating.

- **Rating** = 0.05 × 3 = 0.15

So, the leg powertrain is rated for 1/7 Power Points.

Legs

(Early Modern+, Powertrain)

Legs allow the vehicle to walk, stepping over obstacles and move up inclines that would stop a wheeled vehicle. They might be stiff and robotic, or have graceful animal-like movements. Light vehicles might have spindly legs, while more massive vehicles need proportionally wider feet to distribute ground pressure.

Powertrain Choose how many leg components comprise the leg powertrain: typically 2 to 4. See Powertrain Rating to find the Power Point rating of the powertrain.

Biped or Quadruped Choose if the vehicle a biped or quadruped.

Difficult Terrain A legged vehicle traverses difficult terrain as though it were a creature. It otherwise has no penalties for moving off-road.

Dexterity (Land) *Modern or Futuristic:* Increase by 3 (biped) or 1 (quadruped).

Strength (Land) *Early Modern or Modern Quadruped:* Increase by 4; *Futuristic Quadruped:* Increase by 6.

Simple Legs

Light legs that provide a simple trotting or walking gait.

Power-to-Weight:

- *Early Modern:* 1 (bulky)
- *Modern:* 3 (bulky)
- *Futuristic:* 6 (bulky)

Land Thrust 0.1 per Power Point (biped) or 0.2 per Point Point (quadruped).

Superior Legs

Heavy legs that have additional actuators that allow a galloping or sprinting gait.

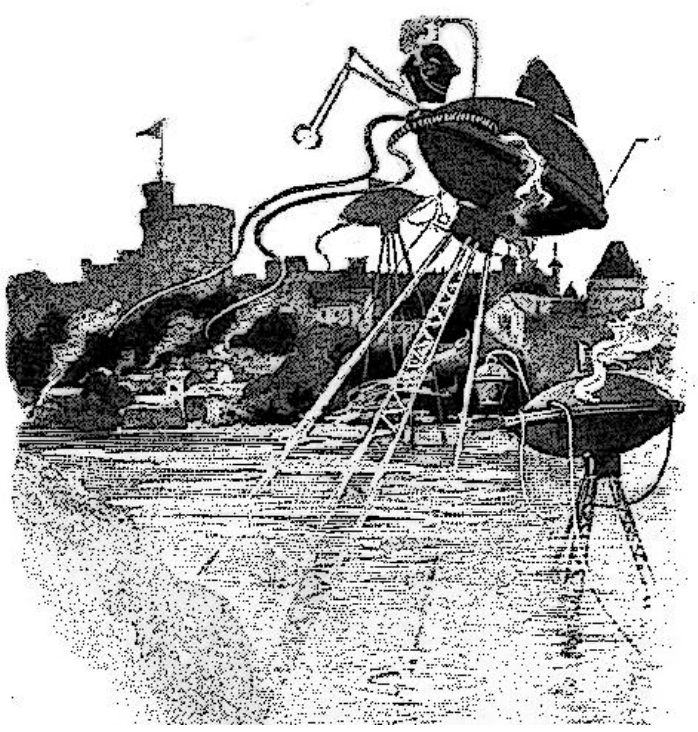
Power-to-Weight:

- *Early Modern:* 1/3 (bulky)
- *Modern:* 1 (bulky)
- *Futuristic:* 2 (bulky)

Land Thrust 1 per Power Point (biped) or 2 per Point Point (quadruped).

Legs

Mass	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	*xi*	*xii*
Cost (Simple)	1,000	1,500	3,000	5,000	10K	15K	30K	50K	100K	150K	300K	500K
Cost (Superior)	2,000	3,000	6,000	10K	20K	30K	60K	100K	200K	300K	600K	1M
Workspace	0	0	0	0	0	1	1	1	1	1	1	2



Ornithopter Wings

(Early Modern+, Powertrain)

A set of mechanical wings that flap like a bird or insect.

Powertrain Choose how many ornithopter wing components comprise the ornithopter wing powertrain: typically 1 to 4. See Powertrain Rating to find the Power Point rating of the powertrain.

Power-to-Weight:

- *Early Modern:* 2 (compact)
- *Modern:* 5 (compact)
- *Futuristic:* 10 (compact)

Acceleration (Air) 0.75 mph per Power Point.

Lift:

- *Early Modern or Modern:* Power Points ÷ 8
- *Futuristic:* Power Points ÷ 6

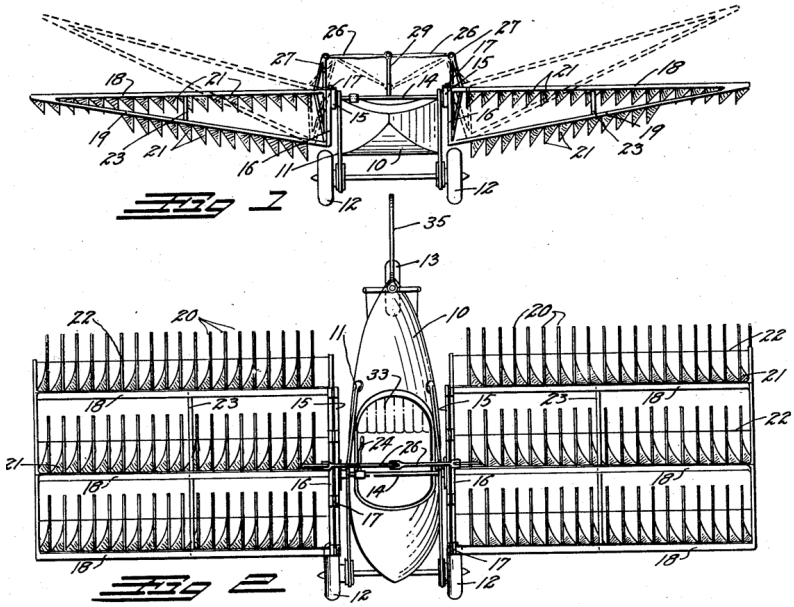
Drag (Air) 1 per ornithopter wing component.

Stall Speed A vehicle with ornithopter wings must move at a minimum speed to be able to takeoff and fly (see Stall Speed). This stall speed is reduced by the Lift generated by the wings and other components. A vehicle with 3 or more Lift Points can hover.

Dexterity (Air) Dexterity score in the air increases by an amount that depends on how many Structure Points it has from structure components. See the Dexterity Increase for Wings table in the Speed chapter. If the vehicle can hover, it can instead use the Hover Dexterity Increase if it is better.

Strength (Air) Strength score in the air increases by 2.

Maximum Speed: 600 mph



Ornithopter Wings

Mass	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	*xi*	*xii*
Cost	6K	10K	20K	30K	60K	100K	200K	300K	600K	1M	2M	3M
Workspace	0	0	0	0	0	1	1	1	1	1	1	2

Rotor Diamater and Wingspan

It is sometimes important to know the diameter of a helicopter's rotary wing, or the wingspan of an ornithopter: for example if you need to land in a forest clearing or fly through a gap.

Vehicle Size	Rotor Diamater / Wingspan
Medium	10 ft.
Large	25 ft.
Huge	50 ft.
Gargantuan	100 ft. or longer

Paddlewheel

(Powertrain)

A large framework wheel fitted with paddle blades that push a vehicle across the surface of water. The vehicle might be a "sternwheeler", with the components located in the rear section; or a "sidewheeler", with the components located in the center section.

Powertrain Choose how many paddlewheel components comprise the paddlewheel powertrain: typically 1 to 4. See Powertrain Rating to find the Power Point rating of the powertrain.
Power-to-Weight: 0.5
Sidewheeler or Sternwheeler Decide if the paddlewheels are in a sidewheel or sternwheel arrangement. Sidewheelers can turn faster by varying the speed of the paddles on each side, or even counter-rotating them. However, sternwheelers have a greater maximum speed.
Dexterity A sidewheeler's Dexterity in water increases by 2.
Drag (Water) A sidewheeler arrangement adds 1 Drag.

Simple Paddlewheel

A simple paddlewheel has fixed paddles.

Acceleration (Water) 3 mph per Power Point.

Feathered Paddlewheel (Industrial)

A feathered paddlewheel adjusts the angle of each paddle as it travels through the water to increases its efficiency.

Acceleration (Water) 3.5 mph per Power Point.

Paddlewheel

Mass	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	*xi*	*xii*
Cost (Simple)	100	150	300	500	1,000	1,500	3,000	5,000	10K	15K	30K	50K
Cost (Feathered)	200	300	600	1,000	2,000	3,000	6,000	10K	20K	30K	60K	100K
Workspace	0	0	0	0	0	1	1	1	1	1	1	2

Propellers

(Industrial+)

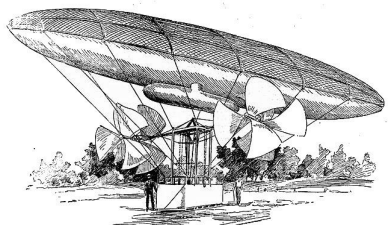
A propeller is an "airscrew" that spins radial airfoils to provide thrust in the air. The component may represent a single propeller or multiple propellers, and may be "pushers" or "pullers".

To achieve a flying speed, the vehicle must have fixed wings, or have 3 or more Lift (for example from gasbags).

Powertrain Choose how many propeller components comprise the propeller powertrain: Typically only 1 is required. See Powertrain Rating to find the Power Point rating of the powertrain.

Power-to-Weight:
- *Industrial:* 25 (bulky)
- *Early Modern or later:* 40 (bulky)

Acceleration (Air, Water) 0.9 mph (industrial), 1.1 mph (early modern), or 1.3 mph (modern) per Power Point.
Land Thrust Equal to air acceleration × 10. The vehicle will also need wheels or runners.
Maximum Speed 600 mph



Propellers

Mass	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	*xi*	*xii*
Cost	300	500	1,000	1,500	3K	5K	10K	15K	30K	50K	100K	150K
Cost (Modern)	1,000	1,500	3,000	5,000	10K	15K	30K	50K	100K	150K	300K	500K

Rotary Wing

(Early Modern+, Powertrain)

A rotary wing is a set of spinning blade-like wings that creates a downward force. An articulated swashplate that tilts the rotor, providing motion in any direction.

Futuristic rotary wings might use a combination of advanced high-strength materials, morphing blade geometry or fan-driven anti-torque to reduce the weight of the rotor system.

Powertrain Choose how many rotary wing components comprise the rotary wing powertrain: Typically 2 or 3. See Powertrain Rating to find the Power Point rating of the powertrain.

Power-to-Weight:

- *Early Modern:* 15 (bulky)
- *Modern:* 30 (bulky)
- *Futuristic:* 50 (bulky)

Acceleration (Air) 0.5 mph per Power Point.

Drag (Air) 3 total, for any number of rotary wing components.

Lift Lift is equal to Power Points ÷ 5. If the vehicle has 3 or more Lift, it has a fly (hover) speed. Otherwise it cannot fly except by other means.

Dexterity Dexterity score in the air increases by an amount that depends on how many Structure Points it has from structure components. See the Dexterity Increase for Wings table in the Speed chapter. If the vehicle can hover, it can instead use the Hover Dexterity Increase if it is better.

Maximum Speed:

- *Early Modern:* 150 mph
- *Modern:* 250 mph
- *Futuristic:* 300 mph

Rotary Wing

Mass	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	*xi*	*xii*
Cost	1,000	1,500	3,000	5,000	10K	15K	30K	50K	100K	150K	300K	500K
Workspace	0	0	0	0	0	1	1	1	1	1	1	2

Screw Propeller

(Industrial, +Powertrain)

A screw propeller pushes a vehicle through water. Compared to a paddlewheel, screw propellers require a greater draft, fare better in rough seas, and allow a vehicle to move underwater if it is sealed.

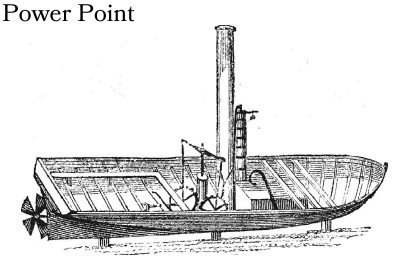
Powertrain Choose how many screw propeller components comprise the screw propeller powertrain: Typically 1 or 2 are required. See Powertrain Rating to find the Power Point rating of the powertrain.

Power-to-Weight:

- *Industrial:* 1.5
- *Early Modern or later:* 3

Acceleration (Water):

- *Industrial:* 3.5 mph per Power Point
- *Early Modern:* 5.5 mph per Power Point



Screw Propeller

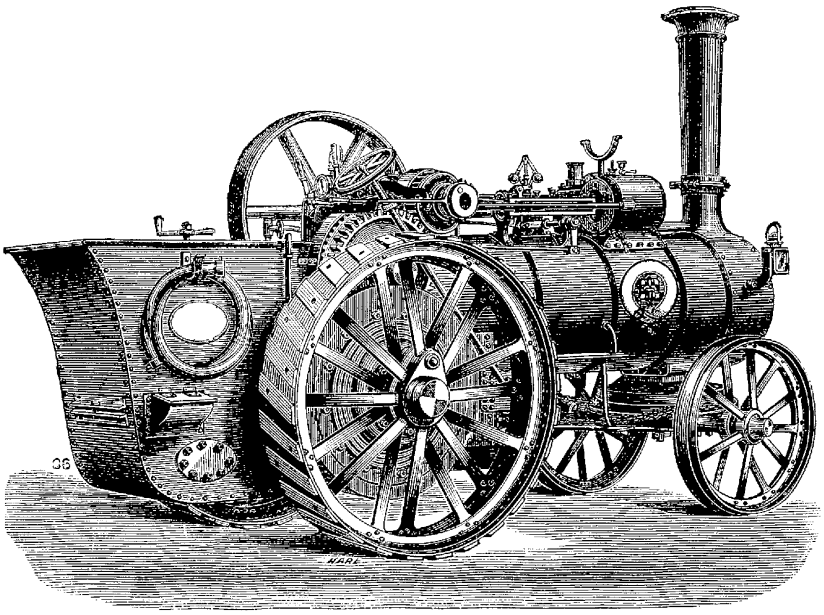
Mass	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	*xi*	*xii*
Cost	600	1,000	2,000	3,000	6,000	10K	20K	30K	60K	100K	200K	300K
Workspace	0	0	0	0	0	1	1	1	1	1	1	2

Wheel Drivetrain

(Renaissance+, Powertrain)

The transmission and steering mechanism for a set of wheels. The vehicle must also have one or more wheel components.

Renaissance-era drivetrains use simple axels and gears. Industrial-era drivetrains introduce differentials and flywheels. Later eras have improvements in materials and more efficient drivetrain.



Powertrain Choose how many propeller components comprise the propeller powertrain: Typically 1 or 2 are required. See Powertrain Rating to find the Power Point rating of the powertrain.

Power-to-Weight:

- *Renaissance:* 1
- *Industrial:* 4
- *Early Modern:* 8
- *Modern:* 10
- *Futuristic:* 15

Land Thrust 15 Thrust per Power Point.

Wheel Drivetrain

Mass	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	*xi*	*xii*
Cost (Renaissance or Industrial)	150	250	500	750	1,500	2,500	5,000	7,500	15K	25K	50K	75K
Cost (Early Modern)	300	500	1,000	1,500	3,000	5,000	10K	15K	30K	50K	100K	150K
Cost (Modern or Futuristic)	600	1,000	2,000	3,000	6,000	10K	20K	30K	60K	100K	200K	300K
Workspace	0	0	0	0	0	1	1	1	1	1	1	2

Power Components

These components generate Power Points.

Magical Power

While the form of a magical power sources varies greatly depending on the campaign, two archetypal engines are presented below: the magic engine, and the elemental engine. Magical power components do not function in an *antimagic* field.

Alternative Sizes A magical power component can be undersized, dividing its Power Point generation by the undersize penalty. An elemental engine can be oversized for the purpose of holding an elemental of a higher CR.

Rarity The cost of a magic engine contributes towards the vehicle's rarity.

Magic Engine

A magic engine draws on arcane crystals, divine relics, or other forms of ambient magic.

Power A magic engine generates 4 magic Power Points.

Elemental Engine

This power source uses the energy given out by one or more trapped elementals. The component requires elemental creatures with a combined CR of at least the value shown in the table. At the DMs discretion, the kind of elemental might need to match the vehicle's locomotion: an air or fire elemental for an airship; earth for a land vehicle; water for a water vessel.

Power An elemental engine powered by a creature summoned by a *conjure elemental* or *conjure minor elementals* spell provides 4 magic Power Points. The engine operates for the duration of the spell. An engine powered by an elemental caught "live" lasts indefinitely.

CR The Magical Power table shows the maximum combined CR of elementals that can be held in the elemental engine. If fewer elementals are held, the Power Points are reduced *pro rata*.

Hazardous If the engine is *disabled*, each elemental can make a DC 15 Strength check to escape. If the engine is *destroyed*, the elementals escape. An escaped elemental will invariably be hostile towards the crew.

Magical Power

Mass	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	*xi*	*xii*
Cost (Magic Engine)	1,000	1,500	3,000	5,000	10K	15K	30K	50K	100K	150K	300K	500K
Cost (Elemental Engine)	100	150	300	500	1,000	1,500	3,000	5,000	10K	15K	30K	50K
CR (Elemental Engine)	1/8	1/4	1/2	1	2	3	6	10	20	30	60	100
Workspace	0	0	0	0	0	1	1	1	1	1	1	2

Magic Engine Restrictions

In some campaigns, magic engines might only generate power under certain circumstances. For example:

1. A magic tree that only generates power in the sunlight.

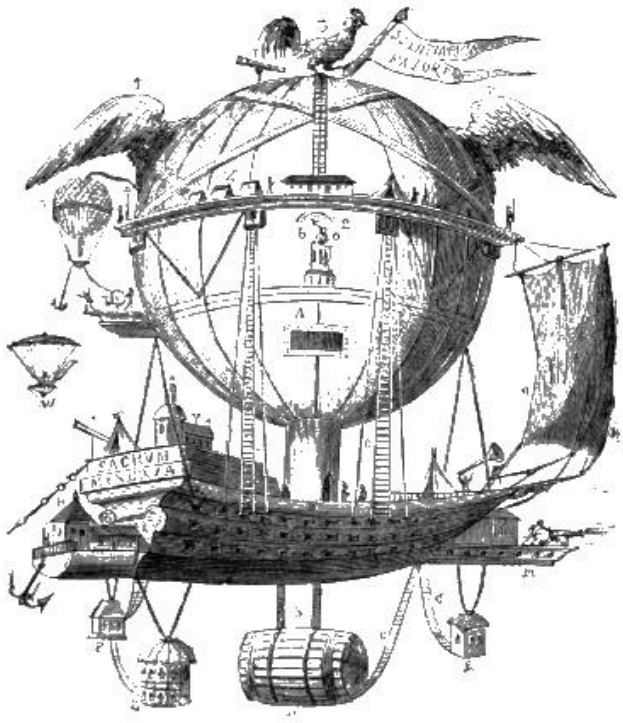
2. A collection of ancient tomes that only generates power when a spellcaster is at the helm.

3. Gems that produce electricity when the vehicle is in the right environment (underwater, in a desert, etc).

4. A bizarre gnomish device that activates only when the vehicle is already travelling 20 mph or faster.

5. The stone idol of a deity that demands daily prayers and rituals, else it remains dormant for 10 days.

6. A portal to the positive energy plane that deals radiant damage to nearby creatures.



Muscle Engine

Muscle engines provide power for as long as creatures continuously exert themselves with the mechanism. It might be a treadwheel, hand crank or set of peddles. Later-era muscle engines have greater efficiency through chains, gears and flywheels.

Effort A muscle engine is rated for the maximum effort that can be applied to it. Creatures can use an action to work the muscle engine, adding their Strength score to the total effort. For example, if 10 creatures with an average Strength score of 10 work the engine, the total effort is 100.

Creature Size For each size category above Medium, double the creature's effort. For a Tiny creature, halve its effort.

Extra Effort If all the creatures in the muscle engine team exert themselves, the effort is doubled. Each creature doing so gains 1 level of exhaustion at the start of every 10 minutes.

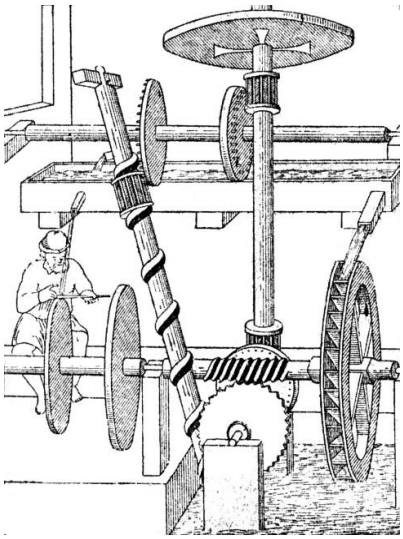
Workspace The creatures need space to operate, using seating components with workspaces. In addition, each creature at a helm control can use one of their piloting maneuvers to contribute towards the muscle engine: this is typical for a small vehicle in which the pilot peddles and steers.

Alternative Sizes A muscle engine component can be undersized, dividing its maximum Power Point generation by the undersize penalty.

Power

The following table shows the Power Points generated by the muscle engine if the maximum effort is applied. If less than the maximum effort is applied, the Power Points are reduced *pro rata*.

Muscle Engine	Power Points at Maximum Effort
Standard	1/5
Industrial	1/3
Early Modern	1
Modern	1½



Muscle Engine

Mass	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	*xi*	*xii*
Cost	200	300	600	1,000	2,000	3,000	6,000	10K	20K	30K	60K	100K
Max Effort	100	150	300	500	1,000	1,500	3,000	5,000	10K	15K	30K	50K
Max Effort (Industrial)	200	300	600	1,000	2,000	3,000	6,000	10K	20K	30K	60K	100K
Max Effort (Early Modern)	600	800	1,200	2,000	4,000	6,000	12K	20K	40K	60K	120K	200K
Max Effort (Modern)	1,000	1,500	3,000	5,000	10K	15K	30K	50K	100K	150K	300K	500K

Steam Engine

(Renaissance)

Steam engines burn coal or wood to heat water in a boiler, the resultant steam drives a set of pistons or rotates a turbine. It requires air to function, and the boiler must be routinely topped up with water.

The steam engine detailed below is an **atmospheric engine**, an early steam engine powered by air pressure pushing a piston into the partial vacuum generated by condensing steam.

Stokers If a steam engine component consumes fuel from a bunker, it requires stokers. The Steam Engine table shows the number of stokers per 1 Power Point generated by the steam engine (so a 1/5 Power Point requires 1/5 the number of stokers). A minimum of 1 stoker is required.
This figure also includes crew known as "trimmers", who bring coal from the bunker to the stokers, and evenly distribute the weight of the coal throughout a vessel ("trimming").

Firebox If the vehicle requires only one stoker, has only one bunker, and that bunker is undersized, then the bunker may instead be a **firebox.** A firebox is stoked only during the steam engine's start time: the stoker does not need to be on the vehicle while it operates.

Start Time From a cold start, a steam engine takes time to build up the required heat in its firebox. The stokers must attend the firebox for the duration indicated in the Steam Engine table before it generates power. The indicated start time is per 1 Power Point (so a one-fifth Power Point requires one-fifth the start time).

Alternative Sizes A steam engine component can be undersized, dividing its maximum Power Point generation by the undersize penalty.

Endurance

The atmospheric engine consumes wood or coal from a dedicated cargo hold called a **bunker.** Each bunker of coal or wood allows the engine to generate power for the following durations.

Coal 1 hour ÷ Power Points.
Wood 30 minutes ÷ Power Points.

For example, a mass *v* vehicle with two coal-fired atmospheric engine components generates a total of 1/5 Power Point, so each bunker provides an endurance of 5 hours (calculated 1 ÷ 1/5).

Power

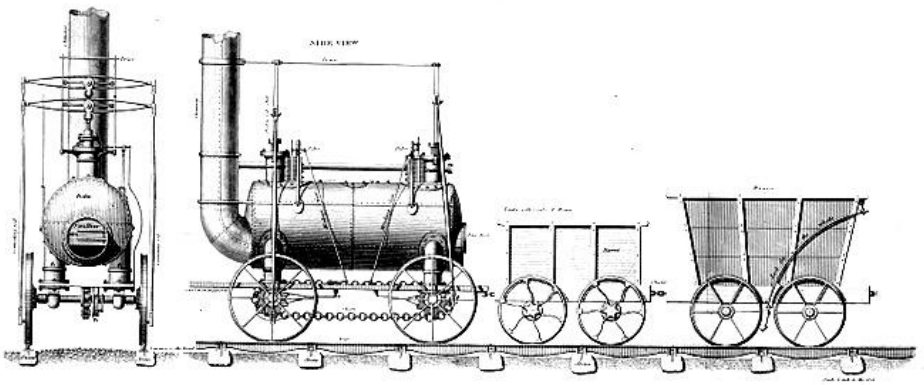
Each atmospheric engine component generates a fraction of a Power Point, which depends on the vehicle's mass, as shown in the table below. For example, a mass *i* vehicle would need 12 components to generate 1 Power Point.

Mass	*iv* or lighter	*v*	*vi*	*vii* or higher
Power Points	1/12	1/10	1/8	1/6

Steam Engine

Mass	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	*xi*	*xii*
Cost	10	15	30	50	100	150	300	500	1,000	1,500	3,000	5,000
Start Time per 1 PP	5 mins	5 mins	5 mins	5 mins	10 mins	15 mins	30 mins	1 hr	2 hrs	4 hrs	6 hrs	10 hrs
Stokers per 1 PP	1*	1*	1*	1*	1*	1	1	1	2	3	6	10

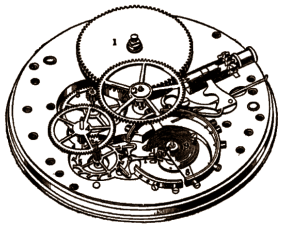
* Mass *v* or lighter steam engines require workspace for the stoker in a seating component.



Power Storage

Power storage components provide Power Points for a set duration of time, then must be recharged. If you are at a set of helm controls, or in the workspace of the component, you can pause and restart the component's discharge. Power storage is self-contained and does not require air or fuel. Two types of power storage – clockwork and magic – are presented below.

Alternative Sizes A power storage component can be undersized, dividing its Power Point generation by the undersize penalty.



Clockwork (Renaissance)

A system of mainsprings or other torsion springs.

Power and Endurance All the clockwork components in the vehicle are either low-gear or high-gear. One low-gear clockwork component provides a 1/5th Power Point for 5 minutes. One high-gear component provides 1 Power Point for 1 minute. Each additional component increases endurance by the base duration.

Winding Effort The Clockwork table shows the combined Strength score required to wind one clockwork mechanism in 1 hour. The mechanism can be wound in 10 minutes if six times this effort is put in.

Alternatively, a dedicated engine can wind the mechanism. This takes 2 minutes per Power Point. This can be an external engine, or a vehicle component.

Clockwork

Mass	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	*xi*	*xii*
Cost	1,000	1,500	3,000	5,000	10K	15K	30K	50K	100K	150K	300K	500K
Workspace	0	0	0	0	0	1	1	1	1	1	1	2
Winding Effort	10	15	30	50	100	150	300	500	1,000	1,500	3,000	5,000

Magic Crystals

Magic crystals might be naturally occuring, or created by wizards. Magic crystals do not function in an *antimagic* field.

Power and Endurance All the magic crystal components in the vehicle are either slow-discharge or fast-discharge. One slow-discharge component provides a 1/5th Power Point for 1 hour. One fast-discharge component provides 1 Power Point for 10 minutes. Each additional component increases the endurance by the base duration.

Recharging can be performed by one or more characters with spell slots. A recharging ritual lasts for 1 hour during which the participants must be within 30 feet of the component. At the end of the ritual, the participants collectively expend spell slots with a total level shown in the Magic Power Storage table: the component is thus recharged.

Fast Recharging can be performed as above. The ritual may instead take 10 minutes, expending 6 times the normal spell slots.

Rarity The cost of a magic crystal contributes towards the vehicle's rarity.

Variants

The DM is free to adjust magic crystals to suit the game world. For example:

- The component can represent any number of storage devices such as a pool of arcane liquid or lightning in a containment field.
- Single-use crystals with half the normal cost: they must be replaced instead of recharged.
- High density crystals that have twice the Power Point storage and Spell Level recharge, for five times the cost.

Magic Crystals

Mass	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	*xi*	*xii*
Cost	200	300	600	1,000	2,000	3,000	6,000	10K	20K	30K	60K	100K
Workspace	0	0	0	0	0	1	1	1	1	1	1	2
Spell Levels	2	3	6	10	20	30	60	100	200	300	600	1,000

Utility Components

Arm

(Renaissance+)

An multi-jointed arm with a simple gripper that can lift a load. It can be operated from a set of helm controls using a piloting maneuver. An arm component with a workspace can be operated from controls stationed at the component itself. The controls might be a joystick, a wearable "master" arm that drives the larger "slave" arm, or it might be programmable in order to perform repetitive tasks.

Each arm has its own Strength score and Dexterity score. The latter is used when operator needs to make a Dexterity check with the arm: the lower of the operator's and arm's Dexterity is used.

Strength (Arm) The Arm Strength table shows the Strength of the arm.

Lifting and Carrying An arm can lift 5 lbs × its Strength score × its lift multiplier, as shown in the Arm table. A vehicle's carrying capacity is equal to the capacity of its empty cargo holds.

Epic Lift Very massive arms have an epic lift multiplier, as shown in the Arm Strength table. The arm's lifting capacity is multiplied by this value.

Alternative Sizes An arm can be undersized or oversized.

Heavy Arm (Modern)

The role of a heavy arm is to lift loads.

Dexterity (Arm) Use the Body table to determine the arm's Dexterity score: for example, a mass *vi* arm has Strength 17 and Dexterity 8.

Power The heavy arm must be allocated a 1/5 Power Point.

Precision Arm (Modern)

A precision arm has fine-control actuators and a longer reach. It might have an effector other than a gripper, such as a tool or a facsimilie of a humanoid hand.

Dexterity (Arm) The precision arm's Dexterity score is 16.

Power The precision arm must be allocated a 1/10 Power Point.

Simple Arm (Renaissance)

A simple arm uses the statistics for a heavy arm or precision arm, except it has:

- one-tenth the cost
- a -4 penalty to Dexterity
- one-third the Strength score (rounded down)

Superior Arm (Futuristic)

A superior arm uses the statistics for a heavy arm or precision arm. It performs as well as an arm of a living creature, and can be used to climb, catch or throw objects, wield a weapon or hold a shield.

A superior arm has ×10 the normal cost.

Arm

Mass	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	*xi*	*xii*
Cost	300	500	1,000	1,500	3,000	5,000	3,000	5,000	10K	15K	30K	50K
Lift Multiplier	×2	×2	×3	×4	×5	×6	×8	×10	×12	×16	×20	×24
Workspace	0	0	0	0	0	1	1	1	1	1	1	2

Arm Strength

Heavy Arm

Mass	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	*xi*	*xii*
Strength	5	7	10	12	20	25	30	30	30	30	30	30
Reach (ft.)	5	5	5	10	10	10	15	15	15	20	20	20
Epic Lift	–	–	–	–	–	–	–	×1.5	×2.5	×3	×5	×7

Precision Arm

Mass	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	*xi*	*xii*
Strength	2	3	4	5	8	10	15	20	30	30	30	30
Reach (ft.)	10	10	10	20	20	20	30	30	30	40	40	40
Epic Lift	–	–	–	–	–	–	–	–	–	×1.25	×2	×2.5

Atrium

Each atrium provides an area of enclosed open space, representing auditoriums, gardens, pools or promenades.

Capacity shows the number of people that can congregate in the atrium.

Atrium

Mass	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	*xi*	*xii*
Cost	–	–	–	–	–	–	–	–	600	750	1,000	1,500
Capacity	–	–	–	–	–	–	–	–	60	75	100	150
Workspace	–	–	–	–	–	–	–	–	1	1	1	2

Berth

An area where smaller vehicles can be stored, launched and recovered. It includes assistive machinery such as davits, basic maintenance equipment, and other services for loading and unloading passengers and cargo. The given cost does not include the cost of the stored vehicles.

The time it takes to launch a vehicle from a berth depends on its function. In general it takes 1 action per ton of launch vehicle to manually prepare and launch it.

Capacity shows the combined mass of vehicles the berth can hold. It is simplest to use their laden mass: for example, a mass *x* berth can hold one mass *iv* vehicle, or two mass *iii* vehicles, or three mass *ii* vehicles, or five mass *i* vehicles.

Alternate Sizes A berth can be undersized or oversized.

Berth

Mass	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	*xi*	*xii*
Cost	2	3	6	10	20	30	60	100	200	300	600	1,000
Capacity (tons)	0.06	0.1	0.2	0.3	0.6	1	2	3	6	10	20	30
Workspace	–	–	–	–	–	1	1	1	1	1	1	2

Cargo Hold

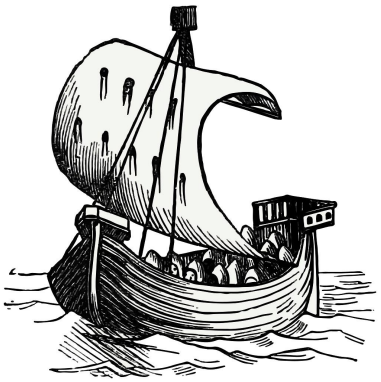
A cargo hold represents the vehicle's internal carrying capacity. Each hold is rated for its carrying capacity. Cost is negligible, subsumed into the cost of other components. For external loads (such as trailers or things carried in arms), see Towing.

To carry livestock or other goods that require a special environment, the vehicle must use steerage cargo space in a quarters or seating component (for long or short journeys respectively), rather than a cargo hold.

Alternative Sizes A cargo hold can be undersized.

Cargo Hold

Mass	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	*xi*	*xii*
Capacity	200 lb	300 lb	600 lb	0.5 ton	1 ton	1.5 tons	3 tons	5 tons	10 tons	15 tons	30 tons	50 tons



Quarters

A quarters component represents anywhere that the crew and passengers can occupy for long term voyages. It includes areas for sleeping, preparing and eating meals.

Without quarters, the crew must sleep, eat, work and store consumables on the top deck, empty cargo space, the helm, or anywhere else there is room.

The figures given assume that all the crew and passengers are Small or Medium size.

Occupancy

The Quarters table shows the occupancy of the component. Each of the following living areas takes up occupancy as shown in parenthesis.

Hammock or Bunk (1) Cramped sleeping space for one person.

Cabin (5) A private cabin for one or two people (as described in the *Dungeon Master's Guide* p. 119). Each type of private cabin uses up more passenger slots, as shown in the parenthesis. A cabin may have a private dining area, or many cabins may have a shared dining hall.

Luxury Cabin (10) A comfortable cabin for one or two people, suitable for a captain or important passenger, with private dining area.

Opulent Cabin (20) A superb cabin for one or two people, suitable for nobility, with private dining area.

Medium Cage (1) A secure cage, cell or stable that can hold one Small or Medium creature or prisoner; or four Tiny creatures. The capacity can be increased to a Large cage (3), Huge cage (10) and Gargantuan cage (30)

Other Rooms

A variety of other working and living areas might be added to a large vessel.

Steerage Cargo (2) Capacity: 1 ton (2,000 lbs). While normally used for cargo, this space can be used to transport two passengers. On a long journey, living conditions can be terrible: there is little room to move, food is miserable, disease is common. Such accomodations might be used to transport slaves, refugees, or desparate travellers paying 1 cp per day.

Workshop (10) Workspace, tools and supplies for one of the following professions: alchemy, brewing, carpenter, cobbler, cooking, glassblowing, leatherworking, masonry, potter, smith, woodcarver. Each workshop requires one or two artisans.

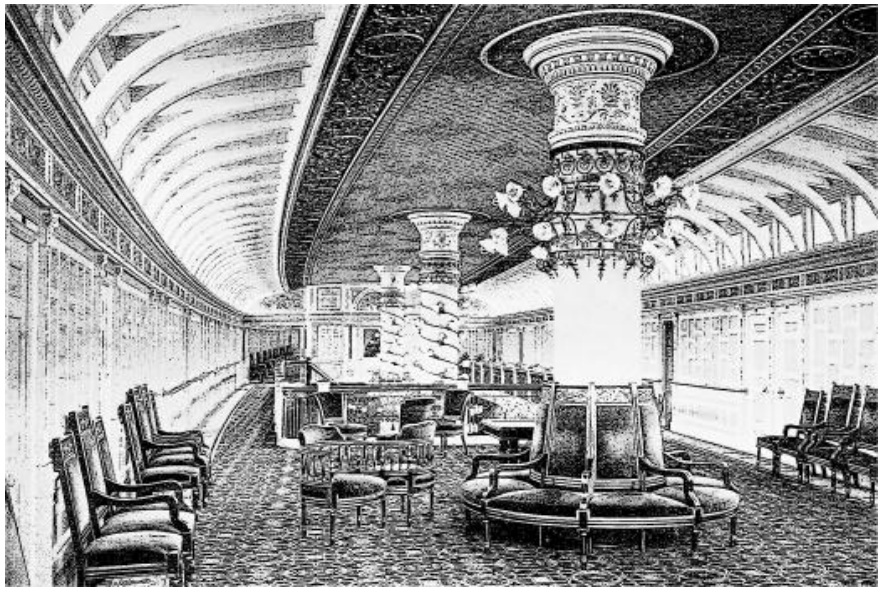
Light Workshop (5) Workspace, tools and supplies for one of the following professions: calligraphy, cartographer, jewelry, painting, tinkering, sewing, weaver. Each workshop requires one or two artisans.

Galley (10) A quarters component with bunks or cabins already includes a galley area. A separate galley can be used for vehicles that do not have cabins or bunkrooms (for example, a dining car on a train). It includes kitchen furnishings, food storage and dining table for 8 people.

Chamber (5) A catch-all room with an occupancy of 5 people. It could represent a saloon, meeting hall, or hot tub.

Quarters

Mass	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	*xi*	*xii*
Cost	–	–	–	100	200	300	600	1,000	2,000	3,000	6,000	10,000
Occupancy	–	–	–	1	2	3	6	10	20	30	60	100
Workspace	–	–	–	0	0	1	1	1	1	1	1	2



Structure

A structure component provides two benefits: it grants the vehicle an Armor Class higher than the base 11; and it provides extra hit points. These extra hit points can be used to meet a vehicle's structural requirements.

Choose a structure material for the component: wood, stone, iron, steel, mithral or adamantine.

Wood is a cheap, abundant material and is easy to work. However, wood is combustable and the DM may adjudicate that the vehicle continues to burn after taking fire damage.

Stone is also abundant, but harder to work with: stone is not malleable and cracks easily under tensile strain. Stone structure takes the form of ashlar blocks (for walls) or concrete (for moulded hulls).

Iron and **steel** are malleable and strong but only available to those able to mine and smelt iron on an large scale.

Mithral is a rare silvery-blue metal as strong as steel at half the weight.

Adamantine is black alloy of adamant, silver and electrum. A critical hit against the vehicle is treated as a normal hit if it strikes the vehicle in a facing that contains an adamantine structure.

Rarity The cost of adamantine, darkwood, glassteel, mithral or soarwood structure contributes towards the vehicle's rarity.

Armor Class, Structure Points, Constitution

Armor Class Each structure component gives the slot it is in an Armor Class. See the Armor Class in the Statistics chapter to calculate the vehicle's overall AC.

Structure Points Each structure component grants Structure Points. These are used to fulfil various structural requirements and to work out extra hit points.

Constitution The vehicle's Constitution score increases by 1 for every 12 Structure Points.

Structure	AC	Structure Points	Constitution
Wood	15	6	+0.5
Stone	17	3	+0.25
Iron	19	18	+1.5
Steel	19	24	+2
Mithral	21	30	+2.5
Adamantine	23	42	+3.5

Structure

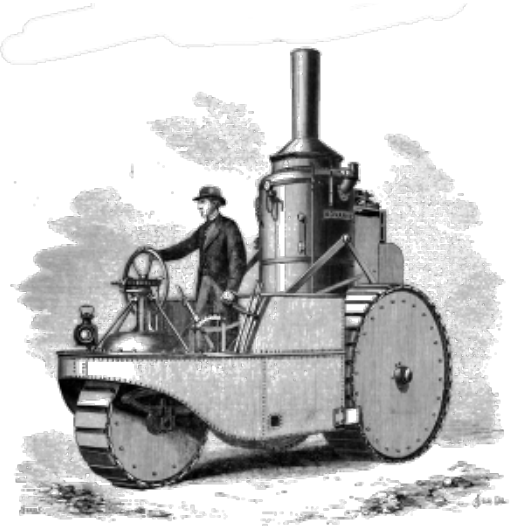
Mass	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	*xi*	*xii*
Wood	6	10	20	30	60	100	200	300	600	1,000	2,000	3,000
Stone	10	15	30	50	100	150	300	500	1,000	1,500	3,000	5,000
Iron	200	300	600	1,000	2,000	3,000	6,000	10K	20K	30K	60K	100K
Steel	600	1,000	2,000	3,000	6,000	10K	20K	30K	60K	100K	200K	300K
Mithral	2,000	3,000	6,000	10K	20K	30K	60K	100K	200K	300K	600K	1M
Adamantine	6,000	10K	20K	30K	60K	100K	200K	300K	600K	1M	2M	3M

Extra Hit Points

Structure components increase the vehicle's hit points. Total the vehicle's Structure Points and multiply the result by the value indicated in the table below. Round the result to the nearest 5 hp and add the result to the vehicle's base hit points.

Mass	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	*xi*	*xii*
Multiplier	×3	×3.5	×4.5	×5.5	×7	×8	×10	×11.5	×14.5	×16.5	×21	×25

For example, a mass *vii* vehicle with one iron and two wooden structure components has 30 Structure Points. Therefore it has 300 extra hit points (calculated 30 × 10).



Structure Options

A structure component normally represents a combination of load-bearing and protection. This can be modified with the *skin* or *armor plating* options.

Skin

Structure normally only grants its AC to the body section it is in, or contributes towards the vehicle's average AC.

Skin structure instead grants its full AC to two or three body sections, at the expense of load-bearing.

Structure Points. Skin structure has half the normal SP if it covers two body sections, or one-third the normal SP if it covers all three body sections.

Armor Class. Skin structure grants its full AC to the body sections it covers.

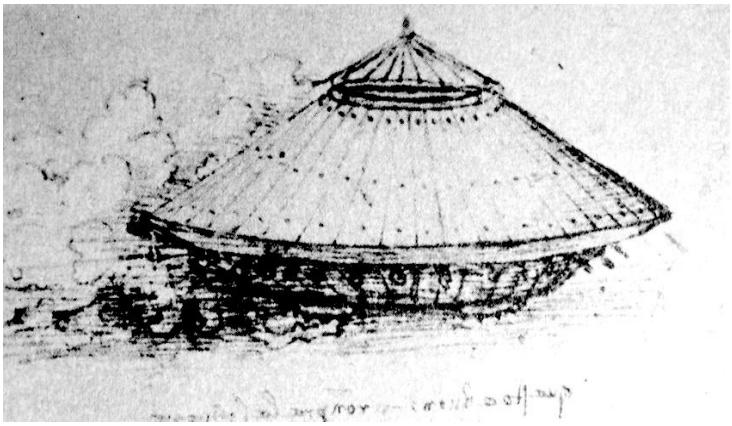
For example, a steel skin component that covers three body sections grants AC 19 to the whole vehicle, but only provides 8 Structure Points.

Armor Plating

This is option is available for vehicles that also have streamlining. Armor plating is simply a slab of material with no load-bearing properties.

Structure Points. Armor plating SP only contributes towards extra hit points. It is not used for any other purpose, such as the vehice's Constitution score, maximum speed limit or Dexterity score for wings.

Streamlining. The extra hit points and cost of armor plating is not modified by streamlining.



Undersized Structure Options

A structure component can be undersized, reducing its extra hit points and the slot's AC.

AC A slot's AC is the average AC of the structure components within it, rounded down. Use the vehicle's base AC for each non-structure component.

Structure Points are divided by the component's undersized penalty (rounded down). For example, a slot containing a single 2-step undersized steel structure has an AC of (19 + 11 + 11) ÷ 3 = 14. It grants 24 ÷ 3 = 8 Structure Points.

Skin Two-step undersized skin structure grants its full AC to the body section it is located in only; or it can grant its AC to the whole vehicle with one-tenth the normal Structure Points

For example, a vehicle with a 2-step undersized mithral armor plating in its center section can either have: 1) an AC of 21 in the center section only, and 10 SP; or 2) an overall AC of 21 and 3 SP.

Undersizing Limit You cannot undersize a structure component if it would reduce the component's Structure Points to less than 1.

Unusual Structure

The following structures might be used for their availablity, prestige value or magical properties.

Mass	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	*xi*	*xii*
Bronze	200	300	600	1,000	2,000	3,000	6,000	10K	20K	30K	60K	100K
Darkwood	20	30	60	100	200	300	600	1,000	2,000	3,000	6,000	10K
Gold	10K	15K	30K	50K	100K	150K	300K	500K	1,000K	1,500K	3M	5M
Lead	6	10	20	30	60	100	200	300	600	1,000	2,000	3,000
Platinum	100K	150K	300K	500K	1,000K	1,500K	3M	5M	10M	15M	30M	50M
Silver	1,000	1,500	3,000	5,000	10K	15K	30K	50K	100K	150K	300K	500K
Soarwood	200	300	600	1,000	2,000	3,000	6,000	10K	20K	30K	60K	100K

Armor Class, Structure Points, Constitution

Structure	AC	Structure Points	Constitution
Bronze	18	20	+1.6
Darkwood	15	8	+0.6
Gold	16	6	+0.5
Lead	14	3	+0.25
Platinum	17	8	+0.6
Silver	16	10	+0.8
Soarwood	15	6	+0.5

Bronze and brass are alloys of copper. They are easier to smelt than iron, but are dependent on the availability uncommon metals (tin or zinc).

Darkwood is a magical wood as strong as normal wood at half the weight.

Gold, platinum and silver are often used in prestige vessels simply for the sake of their expense and decorative value. Gold, platinum or silver structure components grant acid resistance to the body section they are located in.

Lead is sometimes used in sheets to protect wooden vehicles from fire, where iron is not available. Lead can also be used to shield the contents of a vehicle from some divination effects such as *detect magic* or a *ring of x-ray vision*.

Soarwood is a rare but highly bouyant magical material. Each soarwood component provides 1 Lift. The Lift of undersized soarwood is divided by its undersized penalty.

Seating

Seating provides occupancy for crew or passengers not already given space in another component. You do not need seating for people already occupying quarters, workspaces, sails or helms.

If the vehicle does not have quarters, you do need workspace seating for crew in artillery weapon, siege weapon, muscle power components, and for stokers in small steam engines.

Unlike quarters, seating does not include sleeping or galley facilities. However, it might include a small wash area or latrine. Journeys longer than 1 day are possible but uncomfortable, and open to the environment (think of Viking longships). Supplies must be stored in a cargo hold.

You can mix different qualities of seating within the component. A seat's occupancy is shown in parenthesis, as follows:

Utilitarian (1) An uncomfortable, cramped space. This might be a simple bench or a deck for soldiers to stand on.

Workspace (1) A workspace for crew for muscle-powered engines, stokers of a small steam engine, artillery weapons and siege weapons. A component of workspaces may be called a "crew deck", "gun deck" or suchlike.

Standard (2) A comfortable seat suitable for paying passengers.

Bed (4) Pallet, stretcher or cot for one person.

Luxury Seat (4) Luxury seating is especially roomy and comfortable, suitable for VIPs or captains.

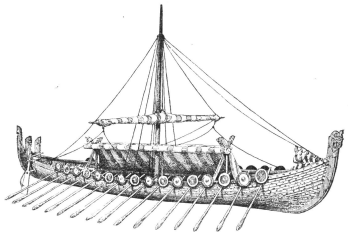
Opulent Seating (8) Opulent seating, suitable for a noble or commander.

Steerage Cargo (8) Capacity of 1 ton, which can be used to carry livestock.

Extra Controls (1) A set of extra controls costs an additional 50 gp (standard) or 25 gp (rudimentary), per the helm component.

Seating

Mass	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	*xi*	*xii*
Cost	–	10	20	30	60	100	200	300	600	1,000	2,000	3,000
Occupancy	–	1	2	3	6	10	20	30	60	100	200	300



Vault

A vault, like a cargo hold, has a cargo capacity. Its contents are protected by thick walls and locked doors. Use tables for the structure component to determine the vault's AC and hit points. A vault has one-third the cost of an structure component: examples are given in the Vault table below.

Locks The cost of one or more locks is added to the cost of the vault. Locks cost 10 gp, 100 gp or 1,000 gp (for a lockpicking DC of 15, 20 or 25 respectfully).

Damage If a vault has an AC equal to or greater than the AC of the vehicle section it is in, none of its contents are lost if the component is *disabled*. If the component is destroyed, half the cargo is lost.

Nondetection As a magic augmentation, an individual vault and its contents can be protected with *nondetection* (augmentation cost ×0.5).

Alternative Sizes A vault can be undersized.

Vault

Mass	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	*xi*	*xii*
Capacity	100 lb	150 lb	300 lb	500 lb	0.5 tons	0.75 tons	1.5 tons	2.5 tons	5 tons	7.5 tons	15 tons	25 tons
Cost (Wood)	2	3	6	10	20	30	60	100	200	300	600	1,000
Cost (Stone)	3	5	10	15	30	50	100	150	300	500	1,000	1,500
Cost (Iron)	60	100	200	300	600	1,000	2,000	3,000	6,000	10K	20K	30K
Cost (Steel)	200	300	600	1,000	2,000	3,000	6,000	10K	20K	30K	60K	100K
Cost (Adamantine)	2,000	3,000	6,000	10K	20K	30K	60K	100K	200K	300K	600K	1M

Weapons, Artillery

A battery of artillery weapons. A weapon component may hold one category of weapon: Medium, Large or Huge. The component can entirely face one arc, or split its weapons between two arcs (for example, cannons along the left and right broadsides of a ship).

The component also includes storage space for 60 pieces of ammunition per weapon.

The statistics for each weapon can be found in the *Dungeon Master's Guide*. Additional types of siege engine can be found in Appendix A. For more detailed rules, see *VCK Supplement 4: Artillery*.

Crew The Cost and Crew table shows the crew required to operate the weapons. If the vehicle does not already provide occupancy for the crew, add a seating component with enough workspaces.

Initiative Once all the weapons in the component have been aimed, they attack on the initiative count of the artillery crew's weapon master.

Ammunition The component holds a maximum number of pieces of ammunition per weapon as follows: 20 (cannon), 60 (ballista), 200 (mangonel), 350 (trebuchet). The cost of ammunition is described in Preparing the Journey.

Alternative Sizes An artillery weapon component can be undersized. It can be oversized for the purpose of mounting a weapon of a size not normally available.

Rate of Fire

The number of rounds it takes to prepare, load, aim and fire all the weapons in the component varies depending on the type of weapon:

- **Ballista** 4 rounds
- **Mangonel** 10 rounds (or 1 minute)
- **Cannon** 10 rounds (or 1 minute)
- **Trebuchet** 35 rounds (or 4 minutes)

Note that that this is an intentional deviation from the rates of fire implied in the *Dungeon Master's Guide*.

Cost, Crew and Weapon Quantity

An asterix (*) in the weapon quantity row indicates that the component's ammunition capacity is increased by 50-percent.

Ballista

Mass	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	*xi*	*xii*
Cost	–	–	–	–	–	1,250	2,500	3,750	7,500	12,500	25,000	37,500
Crew	–	–	–	–	–	2	4	6	12	20	40	60
Ballistae	–	–	–	–	–	1	2	3	6	10	20	30

Mangonel

Mass	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	*xi*	*xii*
Cost	–	–	–	–	–	–	2,000	2,000	6,000	10K	20K	30K
Crew	–	–	–	–	–	–	3	3	8	15	30	40
Mangonels	–	–	–	–	–	–	1	1*	3	5	10	15

Cannon

Mass	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	*xi*	*xii*
Cost	–	–	–	–	–	–	–	2,250	4,500	7,500	15K	22.5K
Crew	–	–	–	–	–	–	–	10	20	30	60	100
Cannons	–	–	–	–	–	–	–	1	2	3	6	10

Trebuchet

Mass	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	*xi*	*xii*
Cost	–	–	–	–	–	–	–	–	–	–	10K	10K
Crew	–	–	–	–	–	–	–	–	–	–	35	35
Trebuchets	–	–	–	–	–	–	–	–	–	–	1	1*

Weapon, Melee

This component represents one or more mechanical melee weapon. It might take the form of an oversized martial weapon swung or thrust on a boom; or it might resemble an animal's bite, pincer or lashing tail.

There are three kinds of melee weapon: siege weapons, power weapons, and arms.

Unless otherwise speficied, a melee weapon can make only one attack per round, and is fixed to only attack target in one arc.

Alternate Sizes A melee weapon can be undersized or oversized.

Siege Weapon

A siege weapon must be prepared and directed by crew: a battering ram, for example.

Attack Bonus The weapon's attack bonus is +4. If it can only attack objects, its attack bonus is +8.

Crew The Siege Weapon table shows the number of crew required to prepare and attack with the weapon. If the vehicle does not already provide occupancy for the weapon crew, make a "weapon deck" by adding seating component with the appropriate number of workspaces.

Power Weapon (Modern)

Power weapons include drills, circular saws, pistons and other industrial tools; mounted on a boom or fixed to the front of the vehicle. If you are at a set of controls, you can take the Activate piloting maneuver to make an attack with a boom-mounted power weapon. If the weapon is fixed to the front of the vehicle, you can make an attack with it if the vehicle collides with a target.

Attack Bonus The weapon's attack bonus is +5. If it can only attack objects, its attack bonus is +10. A power weapon activated from an undersized helm has an attack penalty equal to the helm's undersized penalty.

Power The power weapon requires a 1/5 Power Point.

Arms

You can make a melee attack with an arm component in the same way as a melee power weapon component.

Heavy Arm A heavy arm's attack bonus is equal to its Strength modifier. It deals damage equal to its Lift Multiplier + Strength modifier, and has the *grappling* option.

Precision Arm A precision arm's attack bonus is equal to its Dexterity modifier. It deals damage equal to its Lift Multipier + Dexterity modifier, and has the *flexible* option.

Superior Arm If you make an attack with a superior arm, add your proficiency bonus to the attack bonus.

Siege Weapons

Mass	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	*xi*	*xii*
Cost	40	60	120	200	400	600	1,200	2K	4K	6K	12K	20K
Crew	1	1	2	4	8	12	24	40	80	120	240	400

Power Weapons

Mass	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	*xi*	*xii*
Cost	400	600	1,200	2K	4K	6K	12K	20K	40K	60K	120K	200K
Workspace	0	0	0	0	0	1	1	1	1	1	1	2

Damage and Reach

The following table shows the maximum average damage dealt by the weapon, and its reach.

Use the maximum average damage to determine the damage notation of the weapon. For example, a mass *iii* weapon could represent a large axe that deals 2d12 damage (13 average damage). Choose the damage type for the weapon: bludgeoning, piercing or slashing.

Mass	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	*xi*	*xii*
Damage	10	12	15	17	22	25	31	37	47	54	67	80
Reach	5 ft	5 ft	5 ft	10 ft	10 ft	10 ft	15 ft	15 ft	15 ft	20 ft	20 ft	20 ft

Melee Weapon Options

A melee weapon can have any number of the following options. Each option added decreases the melee weapon's damage by 2 columns to the left on the Damage and Range table.

Each option can only be taken once.

Accurate The weapon's attack bonus is increased by 1.

Flexible The weapon must have Long Reach. It can attack targets in any arc.

Grappling A target hit by the weapon is also grappled. The maximum size of target that can be grappled is shown in table below. The escape DC is 12, or 15 for a power weapon. While the weapon is grappling a target, it cannot make further attacks. At your option, a grappling weapon can be non-lethal, dealing no damage. A non-lethal weapon has half the normal cost.

Knockdown A target hit by the weapon must make a Strength check or be knocked prone. The DC is 12, or 15 for a power weapon.

Long Reach The weapon's reach is increased, as shown in the table below.

Restraining If the weapon also has the *grappling* option (see above), it also restrains a target it grapples.

Silvered The weapon can be silvered per *Player's Handbook* (p. 148).

Swallowing If the target of a swallowing weapon is hit, they must make a Dexterity saving throw. The DC is 12, or 15 for a power weapon. On a failed save the target is swallowed by the vehicle and transferred to a cage. The maximum size of target that can be swallowed is shown in table below. At your option, a swallowing weapon can be non-lethal, dealing no damage. A non-lethal weapon has half the normal cost.

Power Weapon Options

The following options can only be taken by a power weapon.

Demolishing The weapon deals double damage against objects.

Electrical Choose any amount of the weapon's average damage to be average lightning damage instead.

Rapid You can use a second piloting maneuver to attack with the weapon again.

Thermal Choose any amount of the weapon's average damage to be average fire damage instead.

Weapon Options

Mass	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	*xi*	*xii*
Long Reach	10 ft	10 ft	10 ft	20 ft	20 ft	20 ft	30 ft	30 ft	30 ft	40 ft	40 ft	40 ft
Grapple/Swallow Size	S	S	S	M	M	M	L	L	L	H	H	H

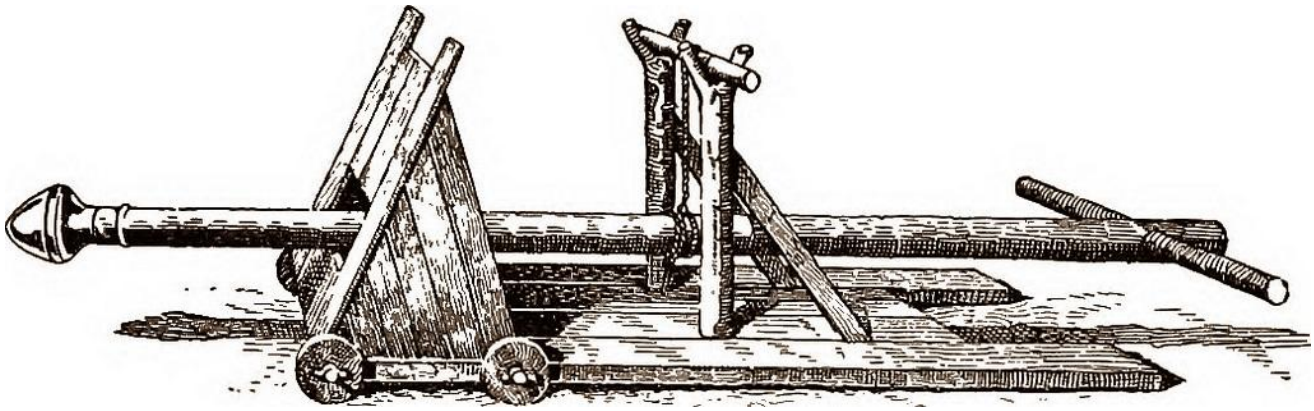
Smaller Damage

The damage values from *VCK: Tiny and Titanic* are included here in the case of a weapon option shifting the damage to a category lower than mass *i*.

Mass	*Sv*	*Svi*	*Svii*	*Sviii*
Damage	4.5	5.5	6.5	8

Linked Weapons

Normally a piloting maneuver will activate the weapon or group of weapons in one melee weapon component. Two weapon components can be given the linked property, such that they both make attacks when the piloting maneuver is taken. *Cost: ×2 for both components.*



Lightweight Components

A lightweight component is a vehicle part that isn't heavy enough to warrant occupying a whole component slot.

Component Limit A vehicle can have up to five lightweight components. Each lightweight component is placed in a slot in addition to other normal components. If the slot is *disabled* or *destroyed*, the lightweight component is also *disabled* or *destroyed*.

Cost Unless otherwise specified, a lightweight component has the following cost which depends on its level of technology.

Lightweight Component Cost

Mass	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	*xi*	*xii*
Standard	10	15	30	50	100	150	300	500	1,000	1,500	3,000	5,000
Renaissance	20	30	60	100	200	300	600	1,000	2,000	3,000	6,000	10K
Industrial	30	50	100	150	300	500	1,000	1,500	3,000	5,000	10K	15K
Early Modern	60	100	200	300	600	1,000	2,000	3,000	6,000	10K	20K	30K
Modern	100	150	300	500	1,000	1,500	3,000	5,000	10K	15K	30K	50K
Futuristic	200	300	600	1,000	2,000	3,000	6,000	10K	20K	30K	60K	100K

Boarding Bridge

A boarding brige can installed on a vehicle with an open top deck, usually a galley. You can use this component to represent the *corvus* of a Roman galleys, or the ramp at the top of a siege tower.

The bridge is stored in a raised position. You can use an action to lower it with a pulley system.

A boarding bridge can only be installed on a Huge or Gargantuan vehicle, usually in the front section. They are 10 to 30 feet long and as wide as the vehicle.

Fixed Wings

(Industrial)

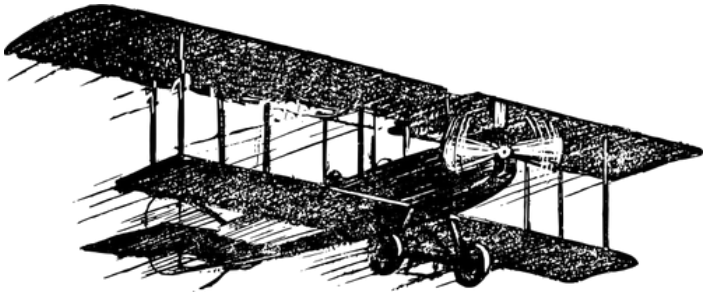
Parts of the vehicle's structure can be aerodynamically shaped. The vehicle can fly if it has air acceleration.

Drag (Air) Fixed wings add 2 Drag in the air.
Stall Points The vehicle gains 2 Stall Points. This is reduced at later eras: 1 Stall Point (early modern) and 0 Stall Points (modern).
Dexterity (Air) Dexterity score in the air increases by an amount that depends on the number of Structure Points it has from structure components. See the Dexterity Increase for Wings.
Damage A *disabled* wing adds a further 2 Stall Points. A *destroyed* wing causes the vehicle to become out-of-control.
Cost Multiply the lightweight component cost by ×2.

Biplane

A biplane has two sets of wings, one above the other.

- **Drag (Air)** Add an additional 2 Drag.
- **Stall Points** Decrease Stall Points by 2.
- **Dexterity (Air)** Dexterity score increases by 2.
- **Strength (Air)** Strength score decreases by 2.



Triplane

A triplane has three sets of stacked wings.

- **Drag (Air)** Add an additional 3 Drag.
- **Stall Points** Decrease Stall Points by 3.
- **Dexterity (Air)** Dexterity score increases by 3.
- **Strength (Air)** Strength score decreases by 3.

Flexible Cover

A vehicle's frame can be covered with a layer of leather, hide, canvas or other flexible material. A flexible cover grants an AC of 12 to the body section it is in, as though it were a structure component. At later eras this improves to AC 13 (modern) or AC 14 (futuristic).

Location Flexible cover can be placed in any slot, but only one per body section.

Harness

A vehicle that is drawn rather than self-propelled requires tack: reins, bit, bridle, collar and so forth.

Location The harness must be placed in the front body section, usually with a seating component for the driver.
Dexterity The vehicle's Dexterity is the lower of the value indicated in the Body Table and the draft animal's Dexterity.

Ram

A ram is a hard panel or protrusion on the front of the vehicle. A vehicle with a ram takes half the normal damage from a collision on its front facing, and the damage is applied to the slot in which the ram is located (instead of rolling for a random slot).

Location A ram can be located in any slot in the front body section.
Spur A spur is a ram with a shape (such as an upward-pointed beak) designed to break oars. If a ship with a spur collides head-on with the side of a vehicle with an oar component, the pilot can choose to hit the oars instead of rolling for a random location. Damage dealt to the oars by a spur is doubled; however it is halved against other types of component.
A spur can be adapted for other vehicle against other types of exposed component: for example, an airship spur designed to pierce gasbags.

Runners

Runners are long ski-like structures on the bottom of a vehicle that allows it to move over flat, low-friction surfaces such as ice, snow, mud or wet roads. Runners are also better than nothing for moving a vehicle over other surfaces.

Runners require sails or propellers to push the vehicle along, or draft animals to pull it with a harness. You cannot have both runners and wheels.

Location A slot in the center body section.
Drag (Land) Runners add 10 Drag for land speed.
Speed The vehicle can move its full speed across low-friction surfaces, including difficult terrain caused by ice, snow or mud. The vehicle moves 1/5 this speed on other surfaces.
Strength The vehicle's Strength on land increases by 6.

Undersized Components

This option is useful if you have undersized components and do not wish to break up a normal component slot.

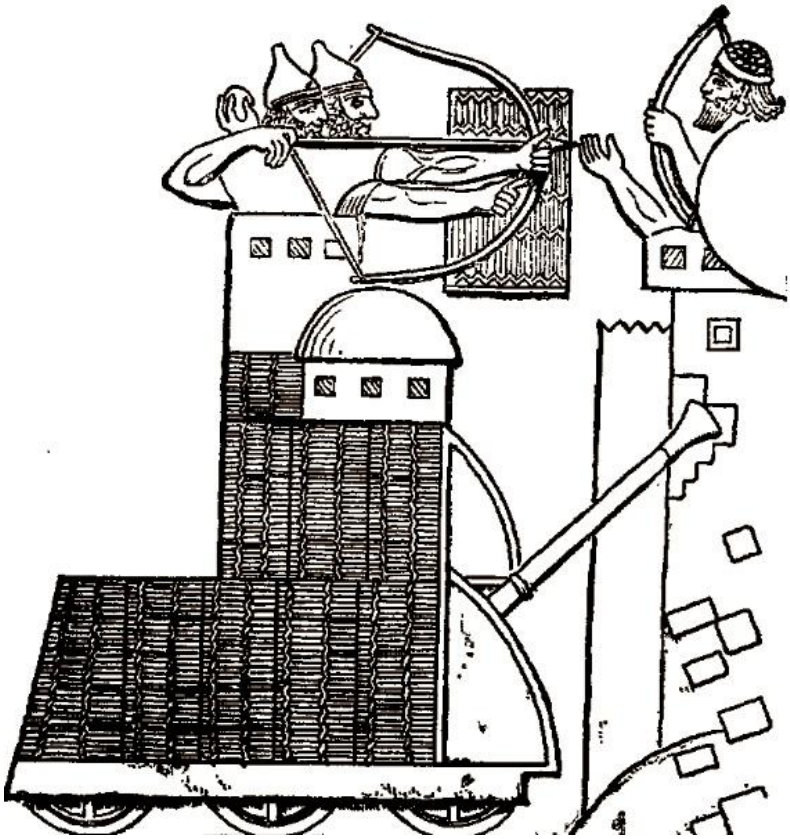
A 3-step undersized component or smaller can be treated as a lightweight component.

Location An lightweight undersized component can be placed in any slot.
Cost Use the cost of the undersized component.

Wheel Scythes

The vehicle's wheels can be fitted with scythed blades, designed to cut down infantry the vehicle passes adjacent to. Wheel scythes are a special case of melee weapon. No crew is required to make an attack with the wheel scythes. Instead, an attack roll is made when the vehicle moves, against any creature within reach of the vehicle's left or right sides.

Location One wheel component.
Attack Bonus +4
Damage and Reach Use the melee weapon Damage and Reach table, using a mass column four steps to the left. For vehicles of mass *iv* or lighter, the scythe's damage is 1d8 (mass *i*), 1d10 (mass *ii*), 1d12 (mass *iii*) or 2d6 (mass *iv*).



Vehicle Options

The following vehicle options do not have any mass and do not occupy a slot.

Magic Augmentations

The vehicle's body might have one or more magical items integrated into it. You can use a piloting maneuver to *activate* or *deactivate* the effects of a magic augmentation.

Cost A magic augmentation increases the cost of the vehicle, as noted in the table below. Furthermore, an augmentation may have a cost multiplier. If the cost of an augmentation exceeds 50,000 gp, you must apply the *powered augment* option until it costs 50,000 gp or less.

Powered Augment The cost of a magic augmentation can be reduced by having it require Power Points. Every 4 Power Points allocated to the item halves its cost multiplier. This option cannot be applied items that generate Power Points, such as a lightning turbine.

Mass	*i*	*ii*	*iii*	*iv*	*v*	*vi*
Cost	200	300	600	1,000	2,000	3,000

Mass	*vii*	*viii*	*ix*	*x*	*xi*	*xii*
Cost	6K	10K	20K	30K	60K	100K

Magic Aumentation List

See *VCK 6: Wondrous Vehicles I* for more magical options.

Air Recycler If the vehicle is sealed, it has an unlimited supply of fresh air. *Cost:* ×0.5

Bridle of Burden-Bearing If the vehicle is drawn or mounted on the back of a creature, that creature's carrying capacity is doubled. *Cost:*×2

Chameleon Hull The vehicle can project an illusion which allows it to resemble an object or creature of the same size, with the same restrictions as the *major image* spell. *Cost:* ×100

Cloud Keel The vehicle can use water acceleration as air acceleration, granting it a flying (hover) speed. It cannot combine this with other forms of acceleration. *Cost:* ×3

Fharlanghn's Lines Each set of these animated ropes halves the crew requirements for one sailing rig component. *Cost:* ×½

Hull of Energy Protection Choose acid, cold, fire, lightning, or thunder. The vehicle has resistance against that damage tpye. *Cost:* ×3

Hull of Nondetection The vehicle can't be targeted by any divination magic or perceived through magical scrying sensors. *Cost:* ×3

Levitating Body The vehicle gains 5 Lift points. *Cost:* ×2

Lightning Turbine During lightning storms (nonmagical, except through a *control weather* spell), the vehicle gains 4 Power Points. The vehicle can include up to three lightning turbines.

Magic Armor Each structure component can have one application of this augmentation, increasing its AC by 1. *Cost:* ×0.5

Nondimensional Trunks Each cargo hold component can have one application of this augmentation. The cargo hold can carry ten times the normal cargo capacity without affecting the vehicle's laden weight.*Cost:* ×10

Sand Keel The vehicle can move through sand as though it were water. *Cost:* ×0.5

Self-Mending Hull When repairing the vehicle, the material and labor costs are halved, and twice the normal hit points are repaired each day. *Cost:* ×0.5

Spider Legs If the vehicle has a legs component, it gains a climb speed equal to its land speed. It can move along walls and across ceilings. *Cost:* ×2

Speedy Wheels If the vehicle has a wheels component, its Drag on land is reduced by 1 for each application of this augmentation. *Cost:* ×0.5

Skyrider's Platform The vehicle can be drawn through the air by flying creatures. The vehicle's laden weight is doubled for the purpose of calculating how many flying draft creatures are required. *Cost:* ×10

Stoneskin Hull The vehicle has resistance to nonmagical bludgeoning, piercing, and slashing damage. *Cost:* ×10

Wind-Favored Sails If the vehicle has at least one sailing rig component, it is always considered to be in strong favorable winds. In addition the ship's Dexterity in water increases by 2. *Cost:* ×20

Low-Gear Drivetrain

A wheel drivetrain or screw propeller may be a low-gear variant. A low-gear drivetrain improves power at low speeds at the expense of a reduced maximum speed.

Speed After you have calculated acceleration and speed, halve the speed.
Off-Road If used in conjunction with dreadnaught wheels or off-road wheels, the vehicle may ignore difficult terrain caused by mud, snow or sand.
Towing The vehicle can safely tow any number of loads.

No Helm

In most cases a vehicle that moves also requires a helm component so that a pilot can issue orders for moving the vehicle.

A vehicle drawn by other creatures must take the "no helm" option.

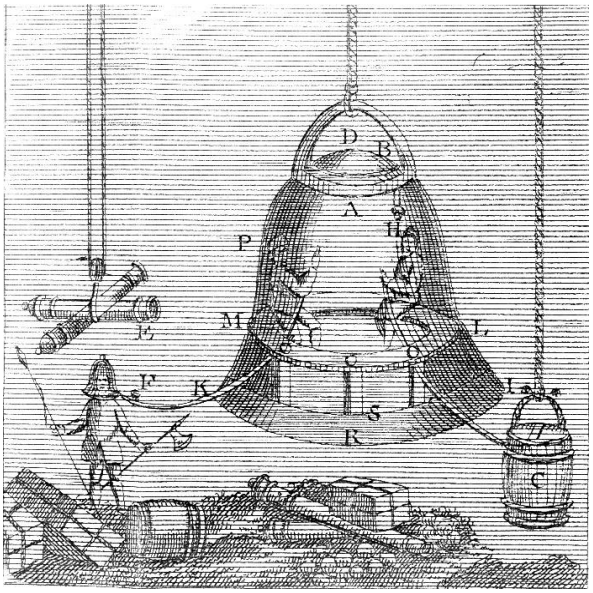
Furthermore, a self-powered vehicle can function without a helm if it has a crewed motive component. For example:

- A rowing boat without a rudder can use an oar component for steering.
- A powertrain component with at least one workspace.
- A muscle power component.

No Helm Penalties

If vehicle does not have a helm, it has the following penalties:

- The vehicle's Dexterity is reduced by 3
- Only one piloting maneuver can be performed by the driver.
- Only the *accelerate/decelerate*, *turn* or *ascend/descend* maneuvers can be performed.



Retractable Components

(Early Modern)

Some vehicle components can be designed to fold away, using auxiliary power included in the component.

A character can use a piloting maneuver to retract or extend the component. While retracted, the component does not function but cannot be specifically targeted. It can still be damaged through normal hit location determination.

Crew that work in the component must be provided with seating or quarters occupancy if they are to remain on the vehicle while the component is retracted.

Components Components that can be made retractable include: powertrains, arm, oars, sails, seating, maneuvering system, melee weapon, and wheels
Sails or oars are not considered to be exposed components when retracted. Note that this is not just furling the sail, but also folding away all the masts and rigging.
Seating, when retracted, allows that component to be used as a cargo hold. Each seating occupancy allows storage for 200 lbs of cargo.
Drag Retracted components do not generate Drag.
Cost The component has ×2 the normal cost.

Sealed

If the vehicle needs to travel through non-breathable mediums (such as underwater), it needs to be sealed with its own an air supply. The vehicle must have at least one structure component.

Occupants In a sealed vehicle, quarters and seating components have half the normal occupancy. Oars have half the crew and Thrust. The vehicle's occupants have of 1 hour of air.
Compressed Air If the campaign's level of technology allows it, air can be compressed into tanks using a steam engine or magic. This provides 8 hours of air (instead of 1).
Maximum Depth The vehicle's maximum safe underwater depth is determined by its Structure Points (SP).

Total SP	Multiplier	Layer
Up to 80	×2 ft.	Sunlight Zone
81–160	×5 ft.	Twlight Zone
161 or more	×10 ft.	Midnight Zone

Vertical Design

A vehicle with a vertical design has three body sections – upper, middle and lower – with the component slots distributed in a similar way to a vehicle with facing. Use this option for tall vehicles (e.g. humanoid or tower-shaped), or for buildings.

The slots are divided into upper, middle and lower sections:

Slot	Section
1–6	Upper
7–14	Middle
15–20	Lower

Vertical designs can be used with or without facing, as the AC for each section is the same regardless of orientation. If facing is used, fixed artillery weapons must be designated an arc. In addition, when an attack is made against the vehicle the attacker can target any body section.

Buildings A vertical vehicle without any locomotive components can be a building. Buildings do not have a speed or Dexterity score, but of course cannot be forced to move.

You can designate any number of components in the lower section to be underground. Underground components cannot be targeted (except by a burrowing creature or vehicle), and if hit, the closest above-ground component is hit instead. Only the following components can be underground: structure, atrium, cargo hold, quarters, power (any), or seating. Each underground component costs an additional 10 gp per laden tonnage of the building.

Streamlining

The vehicle's hydrodynamic or aerodynamic shape can be improved.

- Hydrodynamic streamlining can be *good* or *sleek*.
- Aerodynamic streamlining can be *good, sleek, superior, excellent* or *extreme*.

The Streamlining Levels table shows the following values.

Drag (Air, Water) The vehicle's air Drag (aerodynamic) or water Drag (hydrodynamic) is reduced by this value.
Strucutral Speed Limit Apply this multiplier to the vehicle's maximum speed limit due to structure.
Structure Cost The cost of the vehicle's structure components are multiplied by this value
Extra Hit Points and Constitution Bonus Divide the vehicle's total extra hit points and Constitution Bonus (from structure components) by this value.
Stall Points For a vehicle with fixed wings or ornithopter wings, aerodynamic streamlining adds Stall Points, increasing the vehicle's stall speed.
Strength For hydrodynamic streamlining only, the vehicle's Strength score in water is decreased by this amount.

A vehicle can have both aeroynamic *and* hydronamic streamlining, with different levels. The extra hit points divisor and constitution penalties stack.

Aerodynamic streamlining has the following limits. This does not affect hydrodynamic streamlining.

Aerodynamic Limits

Component	Limit
Sails	Normal
Fixed wings (before modern era)	Sleek
Gasbag	Sleek
Rotary wing	Good
Biplane or triplane	Good
Any other component that causes Drag	Good

Streamlining Levels

Streamlining	Drag	Structure Cost	Structural Speed Limit	Extra Hit Points and Constitution bonus	Stall Points	Strength (Water)
Basic	0	–	–	–	0	+0
Good	−2	×1.2	×1.2	÷1.2	0.5	−1
Sleek	−4	×1.5	×1.5	÷1.5	1	−2
Superior	−7	×2	×2	÷2	1.5	–
Excellent	−10	×3	×3	÷3	2	–
Extreme	−13	×4	×4	÷4	3	–

Statistics

Size, damage threshold and base hit points are already been determined by the vehicle's mass. You will also need to calculate the vehicle's other statistics such as speed and AC.

Ability Scores

The Body Mass table shows the vehice's base Dexterity and Strength scores.

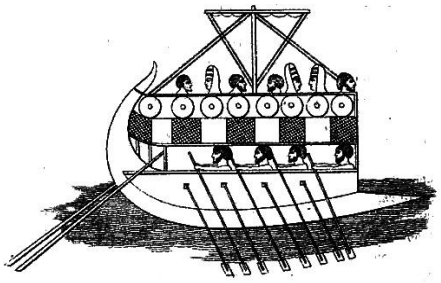
All adjustments are cumulative. For example, a 100-ton renaissance-era water vehicle with three sailing rigs has a Dexterity of 2 (base 7, −6 for water, +1 for renaissance) and a Strength of 17 (base 15, +4 for water, −2 for sails).

Undersized Components

An undersized helm, oars or wheels component reduces the vehicle's Dexterity score by the undersize penalty. Undersized wheels also reduce the vehicle's Strength score by the same penalty.

Drawn Vehicles and Rails

If the vehicle is drawn, or has rail wheels, the Dexterity of the vehicle cannot exceed 9.



Ability Scores on Land

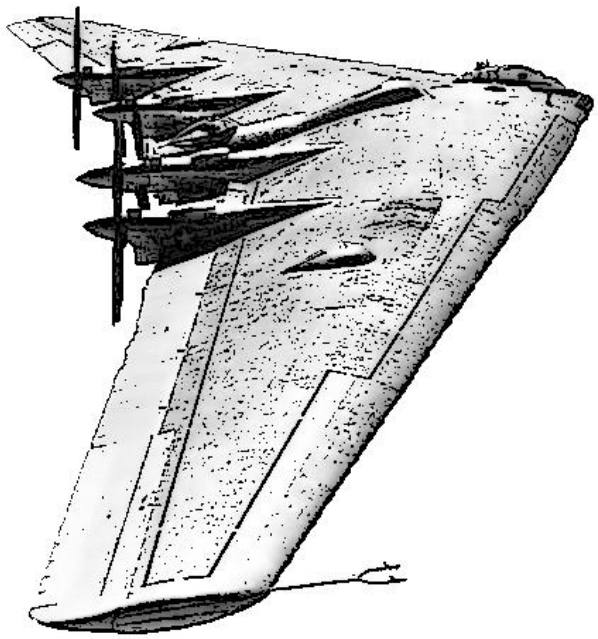
	Strength	Dexterity
Legs, Biped	+2	+3
Legs, Quadruped	+6	+1
Legs (Futuristic)	+2	–
Maneuvering System, Land	+1	+1
Runners	+6	+1
Wheels	+8	–

Ability Scores in Water

	Strength	Dexterity
Base Water	+4	−6
Water (Renaissance)	–	+1
Water (Industrial)	+1	+2
Water (Modern)	+2	+3
Maneuvering System, Water	+1	+1
Paddlewheel, Sidewheeler	–	+2
Each sailing rig (mass *iii* or *iv*)	−1/3	–
... (mass *v* or *vi*)	−1/2	–
... (mass *vii* or *viii*)	−2/3	–
... (mass *ix* or *x*)	−1	–
... (mass *xi* or *xii*)	−1½	–
Hydrodynamic Streamlining		
... Good	−1	–
... Sleek	−2	–
Wind-Favored Sails Enhancement	–	+2

Ability Scores in Air

	Dexterity	Strength
Fixed Wings or Ornithopter Wings	+0 to +11	+2
... Biplane	+2	−2
... Triplane	+3	−3
Maneuvering System, Air	+1	+1
Air (Early Modern)	–	+1
Air (Modern)	–	+2
Air (Futuristic)	–	+3



Dexterity Increase for Wings

A stronger airframe means that the aircraft can withstand greater stresses of high speed maneuvers. This table applies if the vehicle has:

- ornithopter wings
- rotary wings
- or fixed wings.

Structure Points	Dexterity Increase
0 – 6	+0
7 – 12	+1
13 –18	+2
19 –24	+3
25 –30	+4
31 –36	+5
37 –72	+7
73 –90	+8
91 –108	+9
109 – 126	+10
127 – 144	+11

Hover Dexterity Increase

This increase applies to a vehicle's Dexterity score in the air if it can hover. If the vehicle also has wings, apply the best bonus between the hover and wing increases (do not apply both).

	Dexterity
Hover (Renaissance)	+1
Hover (Industrial)	+2
Hover (Early Modern)	+3
Hover (Modern)	+4
Hover (Futuristic)	+5

Speed

The vehicle might have components that grant the vehicle a speed; otherwise the vehicle is drawn (like a wagon, or mounted on the back of a great beast), or immobile (like a building).

The Air Speed, Water Speed and Land Speed tables are used to determine the vehicle's base speed. This is then modified by a Speed Multiplier. Use the following process:

1) **Base Speed** The Base Speed tables show what base speed can be achieved with the vehicle's total acceleration (for air or water) or Land Thrust.
2) **Speed Bonus** Total the vehicle's Speed Bonus for its mass category and streamlining. Deduct the vehicle's Drag.
3) **Speed Multiplier** Look up the Speed Bonus on the Speed Multiplier table to adjust the base speed.
4) **Check Speed Limits** The vehicle has a maximum speed limit of 5 mph per 1 Structure Point. If the vehicle has streamlining, apply the streamlining multiplier to this. Also note that aircraft have a maximum speed limit depending on their motive components.
5) **Finalize** Round down the final speed and acceleration to the nearest ½ mph (if less than 10 mph), 1 mph (if less than 50 mph) or 5 mph.

MPH and Feet

If a vehicle is involved in combat, it can be useful to know its speed statistic in feet, rather than miles-per-hour.

Multiply the vehicle's current speed in mph by 8.8 to get the vehicle's speed in feet-per-turn.

Travel Speed

The steps above give you the vehicle's *maximum* speed. For the purposes of overland travel, with its varying terrain and weather conditions, the DM should decide on a *travel speed*. This might be ×0.5 the vehicle's maximum speed for land vehicles, or ×0.75 for air and rail vehicles.

Drawn Vehicle

A vehicle can be pulled by creatures if it has wheels, runners or is in water. Use the laden weight of the vehicle and the carrying capacity of the draft creatures to determine how many creatures are needed. If the vehicle has wheels (travelling on a road), or is waterborne, halve the effective weight of the vehicle.

Acceleration

Acceleration is the amount the vehicle's speed increases when the pilot takes the accelerate piloting maneuver, or when its sails catch the wind.

Air and Water Acceleration Air and water acceleration is determined by which motive components were added to the vehicle.

Legs and drawn vehicles If the vehicle has legs or is drawn by creatures, it does not need to accelerate. It simply moves its speed.

Land Acceleration The Land Speed table gives the vehicle's land acceleration based on the vehicle's Land Thrust.

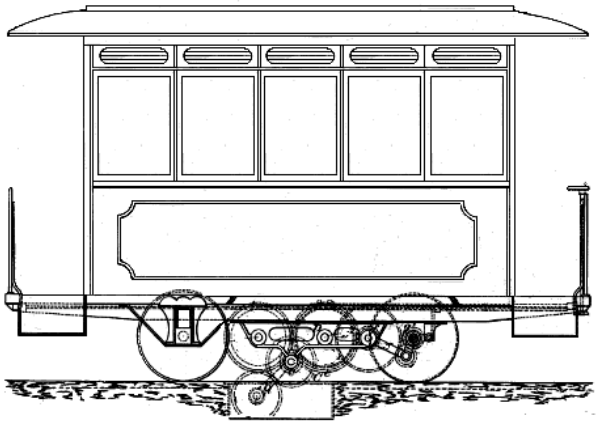
Deceleration

If a pilot takes the decelerate piloting maneuver, the vehicle slows down by an amount chosen by the pilot. The maximum safe deceleration depends on the vehicle's motive system:

Wheels 60 mph
Runners 30 mph
Legs can decelerate to a stop regardless of current speed.
Water Equal to 5 × the vehicle's Dexterity score in mph; half this with good hydrodynamic streamlining; quarter this with sleek hydrodynamic streamlining.
Air Equal to the 25 × vehicle's Dexterity modifier in mph (to a minimum of 5 mph).

If a pilot takes no action to accelerate or maintain a vehicle's speed, the vehicle will decelerate by itself at the end of the round.

An **air** vehicle will decelerate 5 mph
A **water** vehicle will decelerate 10 mph
A **land vehicle** will decelerate 30 mph



Stall Speed

Vehicles with fixed wings or ornithopter wings have a stall speed. This is the minimum speed required for takeoff and flight.

Calculating Stall Speed

An aircraft's stall speed depends on its number of Stall Points, and its Lift. Stall Points are derived from the vehicle's:

- Body Mass Category
- Streamlining
- Wing technology, size and arrangement

The total Stall Points can be a positive or negative, either increasing or decreasing the base stall speed of 70 mph.

Look the up total Stall Points on the Stall Speed table below to determine the vehicle's stall speed. If the Stall Points falls between two values on the table, use the intermediate value. For example, a vehicle with 3.5 Stall Points has a stall speed of 100 mph.

Lift Points

Each 1 Lift the vehicle has decreases the stall speed by one-third. For example, a vehicle's stall speed is 60 mph. One-third of this is 20 mph, so each 1 Lift reduces the stall speed by 20 mph.

If the vehicle's stall speed is reduced to 0 or less (i.e. by having 3 or more Lift points), it can hover.

Streamlining Stall Points

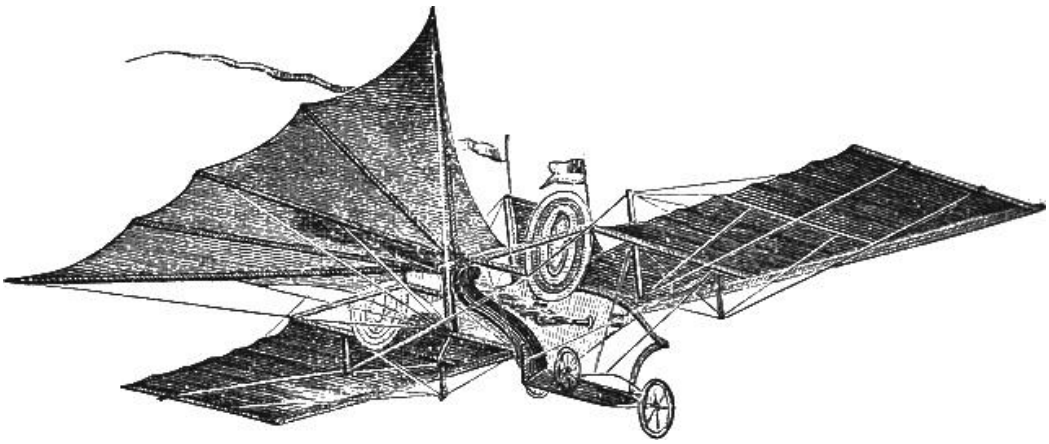
Streamlining	Stall Points
Normal	0
Good	0.5
Sleek	1
Superior	1.5
Excellent	2
Extreme	3

Stall Speed Multiplier

Stall Points	Stall Speed	Stall Points	Stall Speed
-15	14 mph	0	70 mph
-14	16 mph	1	77 mph
-13	17 mph	2	85 mph
-12	20 mph	3	95 mph
-11	22 mph	4	105 mph
-10	24 mph	5	115 mph
-9	27 mph	6	130 mph
-8	30 mph	7	145 mph
-7	33 mph	8	160 mph
-6	37 mph	9	180 mph
-5	40 mph	10	200 mph
-4	45 mph	11	220 mph
-3	50 mph	12	245 mph
-2	55 mph	13	275 mph
-1	65 mph	14	300 mph

Body Mass Stall Points

Mass	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	*xi*	*xii*
Multiplier	0	1	2	3	4	5	5.5	6	7	8	9	10



Air Speed

Air Acceleration

Component	Acceleration	Drag
Propellers (Industrial)	0.9 mph × PP	–
Propellers (Early Modern)	1.1 mph × PP	–
Propellers (Modern)	1.3 mph × PP	–
Rotary wing	0.5 mph × PP	3
Ornithopter wing	0.75 × PP	1 per component
Sky rig (lateen)	0.9–2.6 mph per component	1 per component
Sky rig (full rig)	1.2–3.6 mph per component	1 per component

Sky rigs show two values for thrust. The first is for a light wind, the second is for a strong wind. Optionally work out the speed for each point of sail.

Air Drag

Component	Drag
Monoplane	2
Biplane	4
Triplane	5
Gasbag	2 per component
Arm, leg, melee weapon, wheel, oar, screw propeller, paddlewheel or artillery weapon component	1 per component

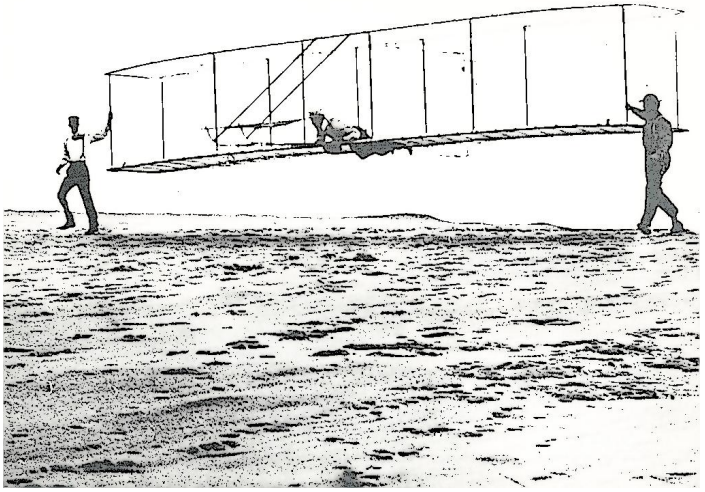
Maximum Speed

After all modifiers are applied, the vehicle cannot exceed the following speeds if it has the indicated component.

- Propellers: 600 mph
- Ornithopter wings: 600 mph
- Rotary wing (early modern): 150 mph
- Rotary wing (modern): 250 mph
- Gasbags: 90 mph
- Sailing rig: 90 mph

Base Air Speed

Acceleration	Air Speed (mph)	Acceleration (mph)	Air Speed (mph)
0.05	10	20	200
0.07	12	25	220
0.1	15	30	240
0.15	17	35	260
0.2	20	40	280
0.3	25	45	300
0.45	30	50	320
0.6	35	60	340
0.8	40	65	360
1.0	45	70	380
1.2	50	80	400
1.5	55	90	420
1.7	60	100	440
2.1	65	110	460
2.4	70	115	480
2.8	75	125	500
3	80	135	520
3.5	85	150	540
4	90	160	560
5	100	170	580
6	110	180	600
7	120	210	650
8	130	245	700
10	140	280	750
11	150	320	800
13	160	360	850
15	170	400	900
16	180	450	950
18	190	500	1,000



Water Speed

Water Acceleration

Component	Acceleration
Oars (average crew)	0.15 mph per component
Oars (strong crew, or average crew making power strokes)	0.2 mph per component
Oars (strong crew making power strokes)	0.25 mph per component
Paddlewheel, Simple	3 mph × PP
Paddlewheel, Feathered	3.5 mph × PP
Sailing rig (square, lateen)	1.4–4 mph per component
Sailing rig (full rig)	1.8–5.5 mph per component
Screw Propeller (Industrial)	3.5 mph × PP
Screw Propeller (Early Modern)	5.5 mph × PP

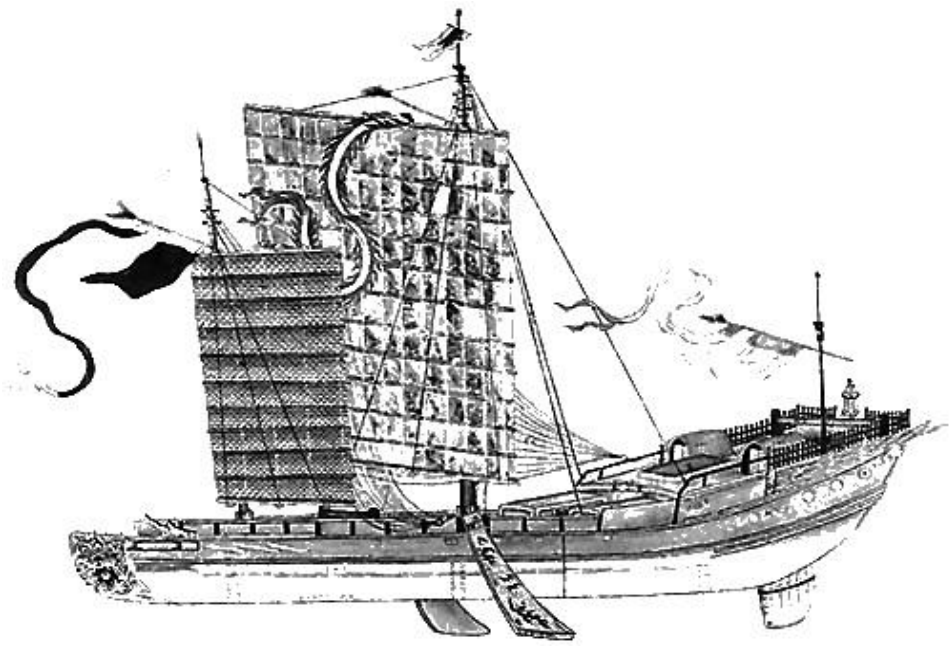
Sailing rigs show two values for thrust. The first is for a light wind, the second is for a strong wind. Optionally work out the speed for each point of sail.

Water Drag

Component	Drag
Paddlewheel, sidewheeler	1
Wheels	1 per component
Each leg, arm or melee weapon (if below water line)	1
Underwater	3

Base Water Speed

Acceleration (mph)	Water Speed (mph)	Acceleration (mph)	Water Speed (mph)
0.01	1	12	12
0.03	1½	15	13
0.06	2	20	14
0.1	2½	24	15
0.2	3	28	16
0.3	3½	34	17
0.45	4	40	18
0.6	4½	48	19
0.9	5	55	20
1.1	5½	65	21
1.5	6	75	22
1.9	6½	85	23
2.4	7	95	24
3	7½	110	25
3.6	8	125	26
4.2	8½	140	27
5	9	155	28
7	10	170	29
10	11	190	30



Land Speed

Drawn Vehicles

Vehicles pulled by creatures must have wheels or runners and a harness. The vehicle moves at the creature's speed, subject to the creature's encumbrance and the speed reduction caused by the wheels or runners due to terrain.

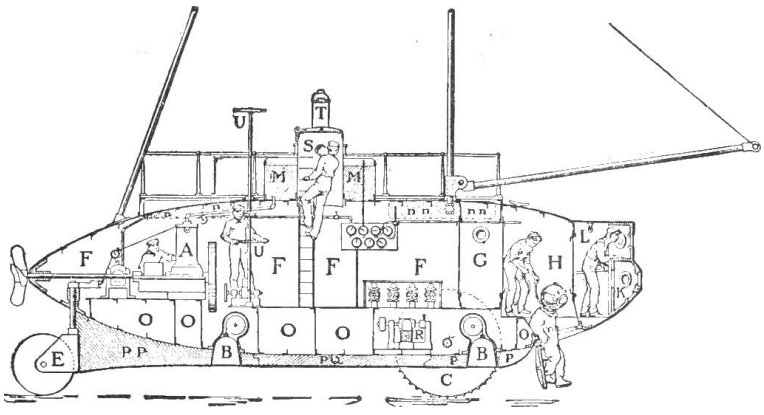
Land Thrust

Component	Thrust
Wheel Drivetrain	PP ×15
Simple Legs, Biped	PP ×0.1
Simple Legs, Quadruped	PP ×0.2
Superior Legs, Biped	PP ×1
Superior Legs, Quadruped	PP ×2
Sailing Rig	Water acceleration × 10
Propellers	Air acceleration × 10

Land Drag

Component	Drag
Runners	10
Wheels	6
Wheels (industrial)	3
Wheels (early modern)	0
Good aerodynamic streamlining or better	−1

If base land speed is 10 mph or greater, also include Drag from the Air Drag table (except wheels).



Base Land Speed

Land Thrust	Land Speed (mph)	Acceleration (mph)
0.01	1	0.3
0.04	2	0.6
0.08	3	1
0.15	4	1
0.4	6	2
0.6	8	2
1	10	3
1.5	12	3
2	15	4
3	17	5
4	20	6
6	25	7
8	30	9
11	35	10
15	40	10
18	45	10
23	50	15
28	55	15
33	60	15
40	65	20
45	70	20
50	75	20
60	80	25
65	85	25
75	90	25
85	95	25
90	100	30
110	110	30
135	120	35
155	130	40
183	140	40
210	150	45
240	160	45
300	180	55
375	200	60
450	220	65
540	240	70
630	260	75
735	280	85
840	300	90

Speed Multiplier

Add together all the Drag from components as shown in the Air Speed, Water Speed and Land Speed tables above. Subtract the Drag from streamlining and the vehicle's mass category. The result may be positive or negative.

The vehicle's base speed is multiplied by a value shown in the Speed Multiplier table below.

For example, a mass *v* aircraft has fixed wings and good streamlining. Total Drag is 2 (wings) −4 (mass) −2 (streamlining) = −4. Therefore the speed multilier is ×1.5.

Drag from Streamlining

Aerodynamic and hydrodynamic streamlining applies to air and water speeds respectfully.

Streamlining	Drag
Normal	0
Good	−2
Sleek	−4
Superior	−7
Excellent	−10
Extreme	−13

Drag from Mass

Mass	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	*xi*	*xii*
Drag (Air)	0	−1	−2	−3	−4	−5	−6	−6	−7	−8	−9	−10
Drag (Water)	0	0	−1	−2	−3	−3	−4	−4	−5	−5	−6	−7

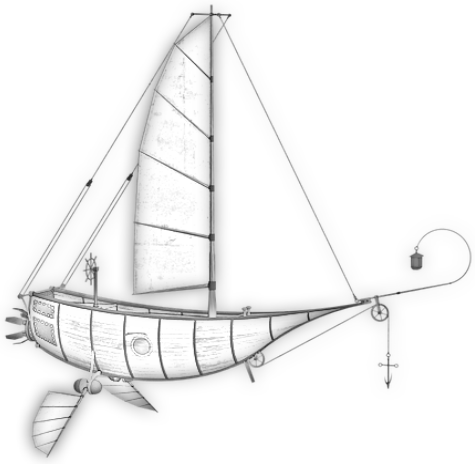
Note that there is no Drag to land speed for mass category.

Speed Multiplier (Positive Drag)

Drag	Multiplier	Drag	Multiplier
1	×0.9	11	×0.3
2	×0.8	12	×0.28
3	×0.73	13	×0.25
4	×0.65	14	×0.23
5	×0.6	15	×0.2
6	×0.53	16	×0.18
7	×0.48	17	×0.16
8	×0.43	18	×0.15
9	×0.4	19	×0.13
10	×0.35	20	×0.12

Speed Multiplier (Negative Drag)

Drag	Multiplier	Drag	Multiplier
−1	×1.1	−11	×3.1
−2	×1.2	−12	×3.5
−3	×1.3	−13	×4
−4	×1.5	−14	×4.3
−5	×1.7	−15	×4.8
−6	×1.8	−16	×5.4
−7	×2	−17	×6
−8	×2.3	−18	×6.6
−9	×2.5	−19	×7.4
−10	×2.8	−20	×8.2



Tip!

Speed multipliers are scaled so that applying separate measures of Drag gives the same result as those Drags added together. For example, Drag 5 (×0.6 multuplier) is the same as Drag 2 (×0.8) plus Drag 3 (×0.73).

This can be useful if you are adding loads (see Towing and Airlifting) after you have already finalized a vehicle's statistics.

Towing and Airlifting

A vehicle can pull or lift extra loads, reducing its maximum speed.

Loads For the purpose of these rules, one load has a mass equal to the mass of the vehicle. On land, the loads must have wheels or runners, or the vehicle must have arms. An air vehicle can only carry extra loads if it can hover.

- A land or air vehicle can safely tow a one-half load.
- A vehicle with 2 rail wheel components can safely tow one load.
- A water vehicle can safely tow one load.
- A vehicle with a low-gear wheel drivetrain or low-gear screw propeller can safely carry any number of loads.

Unsafe loads If a vehicle tows mass in excess of its safe limit, the pilot must make a maneuver check when the vehicle *accelerates*, *decelerates* or *turns*. The DC is 5 per load. On a failure, the vehicle crashes (for example, the wheels slip, the hitch breaks, or the load collides with the vehicle).

Lift An air vehicle's Lift is decreased by 3 for each load it is airlifting.

Speed While towing, the vehicle's maximum speed and acceleration is reduced, as shown in the Towing table. For example, if a land vehicle is towing 3 loads, its speed and acceleration is halved.

Streamlining A vehicle towing or airlifting cannot benefit from the Drag reduction of Sleek streamlining or better: it is limited to Good (−2 Drag).

Towing

Speed	Loads (Air or Land)	Loads (Water)
× 0.8	½	1
× 0.75	1	2
× 0.7	1½	3
× 0.6	2	5
× 0.5	3	9
× 0.45	4	13
× 0.4	5	15
× 0.35	7	23
× 0.3	9	36
× 0.25	10	48

Rate of Climb

A vehicle's rate of climb is the altitude the vehicle gains when the pilot takes the *ascend* piloting maneuver. Similarly, rate of descent is the altitude lost when the pilot takes the *descend* piloting maneuver.

Ascent

Wings A vehicle with fixed wings or ornithopter wings has a rate of climb of 5 feet per 5 mph of flying speed.

Lift Points If a vehicle has more than 3 Lift, its rate of climb is 40 feet per Lift that exceeds 3. For example, if a vehicle has 5 Lift, its rate of climb is 80 feet. This value is halved if the vehicle does not have a helm or has a rudimentary helm.

For ornithopter wings, add together the rate of climb from wings and Lift Points.

Magic Flight A vehicle that has a fly speed that does not rely on wings or Lift points (such as a cloud keel) has a rate of climb equal to its flying speed.

Descent

Controlled Descent A powered flying vehicle can safely descend 200 feet. An unpowered flying vehicle (gasbags, sails) can safely descend 60 feet.

Falling Descent A flying vehicle can simply fall at a rate of 500 feet. If it does so the pilot must make a DC 10 Dexterity (maneuver) check, becoming out of control on a failure. This kind of descent cannot be used with gasbags or sails (without crashing).

Diving Descent A powered flying vehicle can make a steep dive or vertical dive. A steep dive is a rate of descent of 500 feet plus the vehicle's speed in feet. A vertical dive is a rate of 1000 feet plus the vehicle's speed in feet. At the end of a dive, the pilot must make a DC 15 Dexterity (maneuver) check, becoming out of control on a failure.

Low-Lift Vehicles

These rules apply to vehicles with 3 or fewer Lift Points.

Level Flight If a vehicle has exactly 3 Lift Points, it can maintain a level altitude.

Gliding Descent If the vehicle has fewer than 3 Lift Points, it must descend at a rate of 100 feet (2 Lift Points) or 200 feet (1 Lift Point) each turn.

Bonus Lift

If a vehicle has less than 3 Lift, its environment may provide bonus Lift that may allow it to fly.

Updraft Ridges, mountains or coastlines may provide lift from thermals. A vehicle with wings, a gasbag or a sail has 1 bonus Lift from such an environment.

Ground Effect A vehicle with fixed wings, rotary wings or ornithopter wings has 1 bonus Lift within 10 feet of flat ground. This may allow a vehicle with 2 Lift to fly to a maximum altitude of 10 feet as long as it remains over flat ground.

Armor Class

The vehicle's armor class can be calculated in one of two ways: overall AC or facing AC.

Note that a vehicle's AC may change if one of its structure components is *destroyed*.

Overall AC

Use this option if the vehicle does not have facing, or if you decide the structure components represent protection that is spread out evenly.

The vehicle's AC is the average of its three best slots, rounded down. Use the vehicle's base AC in the absence of a slot with AC.

For example, a vehicle with 2 iron structure components has an average AC of (19 + 19 + 11) ÷3 = 16.

Facing AC

Use this option if the vehicle has facing. The vehicle has sections corresponding to its arcs – front (front arc), center (left and right arcs) and rear (rear arc) – and thus will have three corresponding AC values.

A section's AC is equal to the the highest AC of its slots.

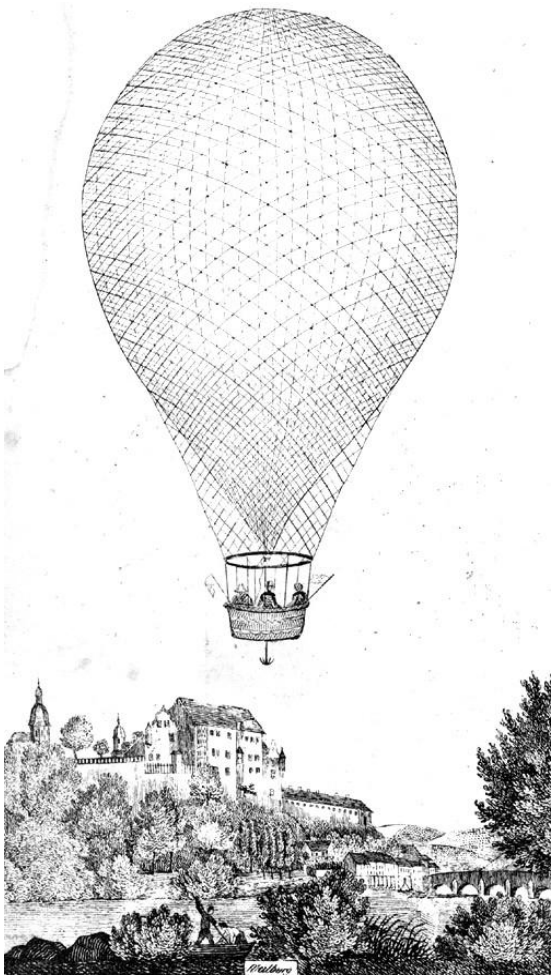
For example, an iron structure component in slot 10 gives the vehicle an AC of 18 in its center section.

Cost and Rarity

The purchase cost of the vehicle is simply the total cost of its components and options.

If the vehicle has magical properties, it also has a rarity. Total the cost of the following components and refer to the Magic Item Rarity table (*Dungeon Master's Guide* p. 135) to determine the vehicle's rarity.

- Mithral, adamantine, glassteel, darkwood or soarwood structure component
- Magical power component
- Magic augmentations
- At your option, any anachronistic technology (cannon artillery, steam engines, etc)



Vehicle Combat

A broadside from a warship, colliding racing cars, or an airship battling a dragon: While DMs are free to adjudicate vehicle combat as they see fit, the following optional rules utilize the systems described above.

Ability Checks and Saves

Dexterity (Maneuver) Check

A maneuver check is a Dexterity check made by the pilot of a vehicle, using the vehicle's Dexterity instead of their own. The pilot adds their proficiency bonus if they have the appropriate vehicle proficiency.

If you are the pilot of a vehicle, the DM might ask you to make a Dexterity (Maneuver) check to swerve out of the way of an obstacle, out-maneuver an enemy aircraft in a dogfight, or to turn the vehicle sharply.

Strength (Stability) Check

A stability check is a Strength check made by the pilot of a vehicle, using the vehicle's Strength instead of their own. The pilot adds their proficiency bonus if they have the appropriate vehicle proficiency.

If you are the pilot of a vehicle, the DM might ask you to make a Strength (Stability) check to regain control of a vehicle, or to maintain a steady course in a storm.

Constitution (Integrity) Saving Throw

An integrity saving throw is a Constitution saving throw made by a crewmember of a vehicle, using the vehicle's Constitution instead of their own. The crewmember adds their proficiency bonus if they have the appropriate vehicle proficiency.

The DM might call for a Constitution (Integrity) saving throw if the vehicle is moving faster its structural speed limit, diving deeper than its depth limit or suffers an internal explosion. Failure could mean that a component is *disabled* or *destroyed*.

Movement

A vehicle moves at the end of the pilot's turn. If there is no pilot, the vehicle moves on initiative 0.

Out-Of-Control

A vehicle might be out-of-control for a number of reasons: it might have no working helm, no conscious pilots, or it might have failed a maneuver check after a collision.

The DM is free to adjudicate what happens when a vehicle is out-of-control. Here are some suggestions:

- The vehicle decelerates by 10 mph and turns one step left or right (determined randomly).
- The pilot cannot take any piloting maneuver other than Regain Control.
- An air vehicle loses 1d6×10 feet of altitude. If the vehicle is out-of-control due to a failed maneuver check, and failed by 5 or more, it instead loses 1d6×100 feet.
- If a land vehicle is out-of-control due to a failed maneuver check, and failed by 5 or more, it suffers a rollover. In a rollover, the vehicle it takes collision damage as though it had collided with an object of the same size as itself.
- A water vehicle takes on water. Roll d6 and add the number of times the vehicle has taken on water. On a 6 or more, the vehicle begins to sink. If the vehicle is out-of-control due to a failed maneuver check, and failed by 5 or more, it takes on water twice.

Turning

When a pilot takes the *turn* piloting maneuver, they can make the vehicle perform a number of 45-degree rotations during its movement in a combat round.

The number of rotations that can be made is equal to the vehicle's Dexterity modifier, adjusted by the vehicle's current speed, as shown in the following table.

Current Speed	Number of Rotations
10 mph or less	+5
15 mph	+4
30 mph	+3
50 mph	+2
100 mph	+1
150 mph	+0
300 mph	-1
500 mph	-2
1,000 mph	-3
1,500 mph	-4
3,000 mph	-5
5,000 mph	-6

Slow Turn

If the number of turns is 0 or less, the vehicle can make slow turns over the course of 1 minute. The number of slow turns is equal to the number of turns + 4.

For example, a ship with a Dexterity of 1 is travelling at 10 mph. The number of turns is −5 (Dexterity modifier) + 5 (speed modifier) = 0. Therefore it can make 4 rotations of 45-degrees over a duration of 1 minute.

Hex Grid

If you are playing on a hex grid, a turn is a 60-degree rotation. Adjust the number rotations as follows:

Square Grid Rotations	Hex Grid Rotations
1	1
2 or 3	2
4	3
5 or 6	4

Sharp Turn

When you use a piloting maneuver to turn, you may use another piloting maneuver to make additional turns. Make a DC 15 Dexterity (maneuver) check for each additional turn. On a failure, the vehicle does not turn and becomes out-of-control.

Collisions

When you move a vehicle within 5 feet of another creature or object you can deliberately ram it. Other collisions might occur due to a failed maneuver check, or the uncontrolled movement of a vehicle with a destroyed helm or unconscious pilot.

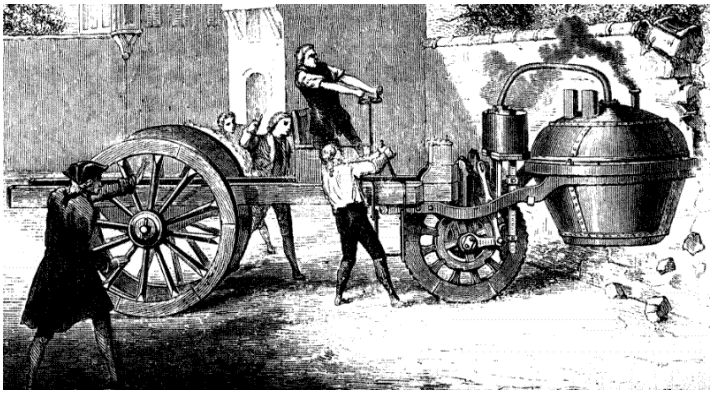
The base damage a vehicle takes in a collision depends on the size of the other creature or object: 1d6 (Medium), 3d6 (Large), 5d6 (Huge), or 8d6 (Gargantuan) bludgeoning damage. The damage is applied to a random component (see Hitting, below). If one vehicle is smaller than the other, it is shoved 10 feet in the direction the larger vehicle was moving.

A vehicle that takes any damage in a collision must subsequently make a DC 10 maneuver check to avoid losing control.

High Speed Collision Increase the damage by the base amount for every full 10 mph (90 ft.) of collision speed.

Ram A vehicle with a ram takes half damage if it rams another object.

Armor A vehicle takes half damage from a collision if its AC is higher than the other object.



Characters

Note which component each character is in. Components with a crew requirement or passenger capacity can be occupied by that many characters. A helm can also be occupied by one or more character at controls.

Each character takes a turn on their initiative as normal. If the vehicle has a pilot, it moves on their initiative; otherwise it moves last in the initiative order.

Piloting Maneuvers

If you are at a set of controls you can use an action on your turn to perform two of the following piloting maneuvers. A maneuver cannot be chosen more than once within a round.

Accelerate / Decelerate The vehicle's current speed increases or decreases by the value calculated in the Speed chapter.

Move A vehicle with legs can move its walking speed without needing to accelerate.

Turn The vehicle can turn during its movement: see Turning.

Ascend / Descend Increase or decrease the vehicle's altitude or depth.

Attack Make an attack with a melee weapon component.

Operate Use an arm component.

Activate / Deactivate Activate or deactivate a magical augmentation.

Regain Control Make a DC 15 Strength (Stability) check. On a success, you regain control of an out-of-control vehicle.

Power Actions

If you are in a workspace in a power-generating component, or in an adjacent workspace, you can use an action to perform one of the following tasks.

Allocate Power Reallocate the component's Power Points from one component to another. This can also be performed by a pilot in the helm.

Increase Power The character makes a DC 15 Intelligence check, adding their proficiency bonus if they have the appropriate vehicle proficiency. On a success, the component generates twice the normal Power Points for 1 minute. When the duration ends, roll a d20. On a 9 or less, the power component becomes *disabled*.

Repair Actions

A character in the same body section as a *disabled* component can use an action to attempt a jury rig.

Jury Rig If the character has the appropriate set of tools, they can use their action to make a DC 15 Intelligence check. On a success, the component is temporarily treated as functional.

It takes 1 success per mass category of the vehicle to finish a jury rig. Multiple characters can work on the same jury rig.

Whenever a jury-rigged component is stressed (as adjudicated by the DM: for example, when used in combat, or when the vehicle swerves or collides), roll a d20. If the result is less than 10, the jury rig ends.

Improve Performance Actions

A character one of the following components, or in a workspace adjacent to one, can use their action to improve the vehicle's maneuverability: legs, maneuvering system, oars (or seating for oars), wheel drivetrain, wings (rotary or ornithoper)

Improve Maneuverability The character makes a DC 15 Intelligence check, adding their proficiency bonus if they have the appropriate vehicle proficiency. On a success, the vehicle has advantage on the next Dexterity (Maneuver) check made before the start of the character's next turn.

Improve Stability The character makes a DC 15 Intelligence check, adding their proficiency bonus if they have the appropriate vehicle proficiency. On a success, the vehicle has advantage on the next Strength (Stability) check made before the start of the character's next turn.

Other Activity

Other typical tasks include:

- Contributing towards the operation of siege engines, or co-ordinating their attacks.
- Rescue creatures trapped by wreckage in destroyed components by making a Strength check (see below).
- Leap onto an adjacent vehicle.
- Launch a vehicle from a berth.
- Operating bilge pumps during stormy weather.

Attacking

Targeting

These considerations apply to any attack made against a vehicle.

Targeting Specific Components An attack with a melee weapon, or a ranged weapon within Normal range, can target a specific component, incurring disadvantage on the attack roll. If using facing, the component must be in the body section which faces the attacker. Exposed components can always be targeted regardless of facing, and have an AC of 11.

Targeting Crew Creatures on a vehicle may have cover as adjudicated by the DM. In general, creatures in a vehicle body section with no structure components have no cover. Creatures in an exposed component (such as sails or exposed seating) can always be targeted by other creatures (but not vehicle weapons).

Hitting

On a successful hit, you determine which component is hit.

If the target vehicle does not have facing, roll 1d20. The component in the corresponding slot is hit.

If the target vehicle has facing, the slot is determined with a 1d8 plus a modifier that depends on the arc that the attacker is in.

Arc	Slot Hit
Front	1d8
Left, Right	1d8 + 6
Rear	1d8 + 12

Damage

After determining the component hit, make the damage roll for the weapon.

Hit Points The vehicle's hit points are reduced as normal, taking into account damage threshold and resistances.

Disabled Components If the damage was taken was at least 10-percent of the vehicle's maximum hit points, the component is *disabled*.

Massive Damage If the damage taken was at least half the vehicle's maximum hit points, the component is *destroyed*. In addition, the component in an adjacent slot is *destroyed*.

Repeated *Disable* If a component that is already *disabled* is *disabled* again (for any reason), it is *destroyed* instead.

Repeated *Destroyed* If a component that is already *destroyed* is *destroyed* again, a different undestroyed component is *destroyed* instead. Choose a slot closest to the target slot.

Undersized and Oversized Components If a component slot holds undersized components, all the components in that slot are *disabled* or *destroyed*. An oversized component is not *disabled* or *destroyed* until half or more of the component slots it comprises of are *disabled* or *destroyed*.

Disabled and Destroyed Components

Destroyed and *disabled* components no longer function, and do not provide any of the associated benefits, with the following special cases.

Structure *Disabled* structure continues to provide its normal AC. *Destroyed* armor does not contribute its AC or Structure Points (maximum speed limit is reduced).

Berth Vehicles in the component may be damaged (see below). *Disabled:* Vehicles in the berth are unable to launch.

Cargo Hold *Disabled:* Half the cargo is lost (either destroyed, or spilled out of the vehicle). *Destroyed:* All the cargo is lost.

Helm *Disabled:* Half the control sets (rounded up) no longer function. In addition, the vehicle has disadvantage on Dexterity (manevuer) checks.

Weapons, Artillery Siege engines in the component may be damaged (see below). *Disabled:* Half of the siege engines (rounded up) are unable to make attacks.

Wheel The pilot must make a DC 15 Dexterity (maneuver) check. The check is made with advantage if the vehicle still has undamaged wheel components. The vehicle becomes out-of-control on a failure. If all the wheels components are *destroyed*, the vehicle crashes.

Volatile Components

Some components do not react well to being hit:

- An artillery weapon component that includes gunpowder weapons, hit by fire or lightning
- A gasbag component filled with lifting gas, hit by fire or lightning
- Cargo holds that hold volatile cargo, hit by fire or lightning

In such cases, the vehicle is considered to be vulnerable to the damage from that attack.

Creatures in Disabled and Destroyed Components

Even if a projectile or melee strike does not directly strike a creature within a hit component, they are still at risk from splintering or collapsing structures.

Each creature in a component when it is *disabled* takes 5 (1d10) bludgeoning damage.

Each creature in a component when it is *destroyed* takes 11 (2d10) bludgeoning damage. In addition, each creature either falls out of the vehicle or is restrained by the wreckage. A restrained creature can use an action to free itself from the wreckage with a Strength check, with a DC determined by the DM.

Vehicle Death Saving Throw (Optional)

If a Player Character is on a vehicle that drops to 0 hit points, at the start of each round the DM makes an vehicle death saving throw.

The purpose of this saving throw is to give the Player Characters chance to escape a collapsing vehicle or building; or to cast a spell that can restore some integrity.

Roll a d20. If the roll is 10 or higher, the save succeeds and vehicle continues to function with whatever working components it has left. Otherwise, the save fails and the vehicle begins to fall apart.

When a vehicle fails three death saving throws, it is destroyed. All remaining components become *destroyed*: the ship has sunk, the fort has collapsed to rubble, the airship is falling debris.

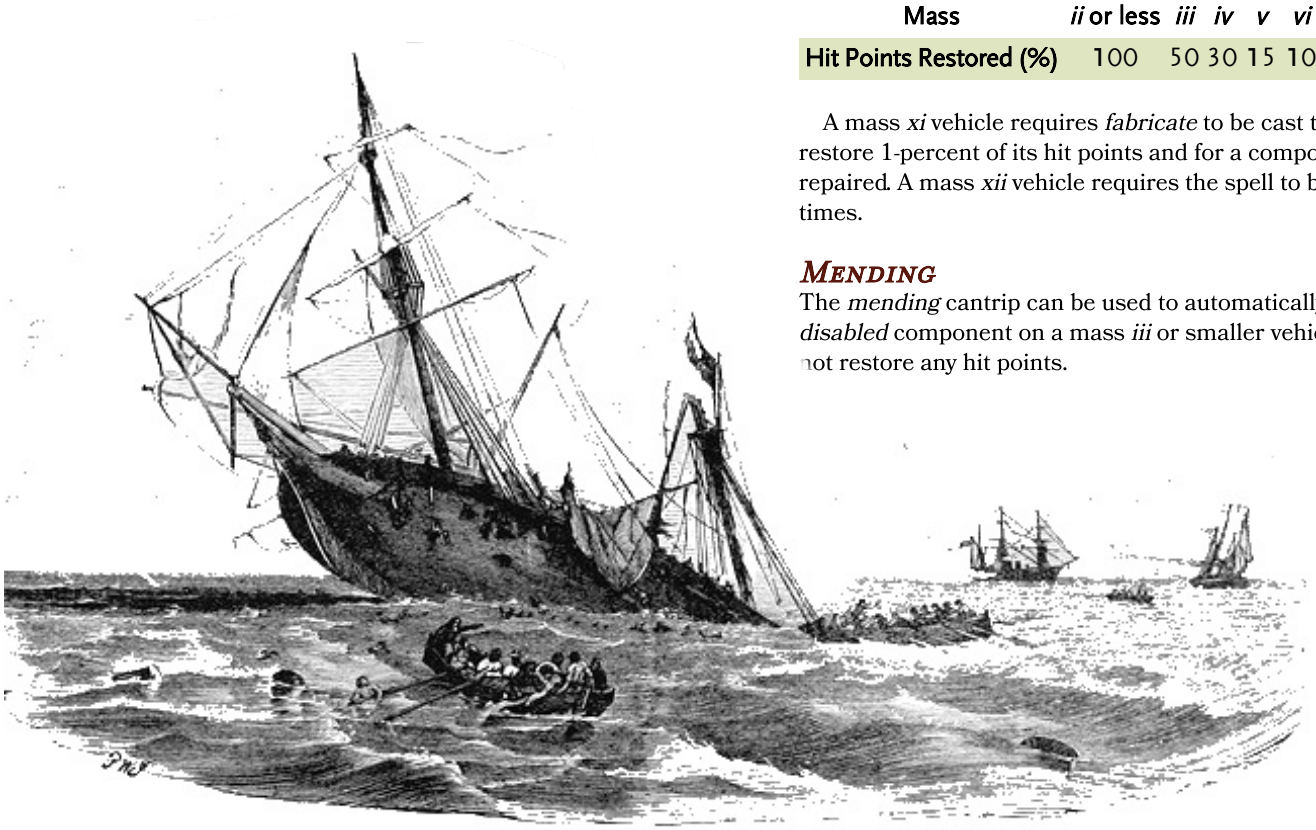
Unlike a death saving throw for a creature, the vehicle does not stabilize if a number of successes are scored. Keep rolling until the vehicle is destroyed or it regains any hit points.

Siege engines and Vehicles in Disabled and Destroyed Components (Optional)

Optionally you can keep track of the hit points of vehicles and siege engines held in berths and artillery components.

When a berth or artillery component is *disabled* or *destroyed*, also apply the damage taken to one of the vehicles or siege engines in the component. If this reduces it to 0 hit points, the excess is applied to the next vehicle or siege engine in the component until all the damage is allocated.

In addition, if the component is *destroyed*, roll a d20 for each undestroyed vehicle or siege engine in the component. On a 1–10, the object is trapped in the wreckage. On a 11–20, the object is knocked out of the vehicle.



Spells and Vehicle Damage

Disintegrate

The *disintegration* spell and similar magic can destroy a 10-foot cube of a Huge or larger object. As different components of a vehicle take up different amounts of space, this should be handled with DM adjudication. For example, an engine component might be quite compact, while a quarters component with the same mass is larger, as it includes a lot of empty space.

As a guide, when a vehicle is subject to a *disintegration* spell, use the following table to determine how many components are destroyed. For each destroyed component, the vehicle loses hit points equal to 10-percent of its maximum.

Mass	*ii* or less	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix* or greater
Destroyed Components	All	10	6	3	2	1	1*	0

* One component is disabled (not destroyed) on a mass *viii* vehicle.

Fabricate

The *fabricate* spell can be used to restore hit points to a vehicle, assuming that the broken parts of vehicle are still on board, or raw materials are available.

The spellcaster must be within range of a disabled or destroyed nonmagical component. As mentioned in the spell description, the spellcaster may also need to be proficient with the appropriate artisan's tools.

Once the spell is cast, the component is repaired and the vehicle recovers a percentage of its maximum hit points.

Mass	*ii* or less	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*
Hit Points Restored (%)	100	50	30	15	10	5	3	2	1

A mass *xi* vehicle requires *fabricate* to be cast twice to restore 1-percent of its hit points and for a component to be repaired. A mass *xii* vehicle requires the spell to be cast three times.

Mending

The *mending* cantrip can be used to automatically jury rig a *disabled* component on a mass *iii* or smaller vehicle. It does not restore any hit points.

Preparing the Journey

Crew

A vehicle is nothing without the people to operate it.

Minimum Crew A helm requires a pilot, and each component shows how many crew are required to operate it.

Workspace Crew A fully crewed vehicle will have one crewperson for each workspace.

Watchkeeping Multiply all crew requirements by the number of watches (2, 3 or 4) if the vehicle is making a long voyage over water and will not be stopping at night along the coast: watches must oversee the vessel around the clock.

Extra Crew. Optionally multiply all crew requirements by 2 or more if the vehicle is intended for battle (such as warships), or for very long voyages (such as exploratory expeditions). In such roles, crew losses are expected. Warships that expect to capture enemy vessels might double this number again!

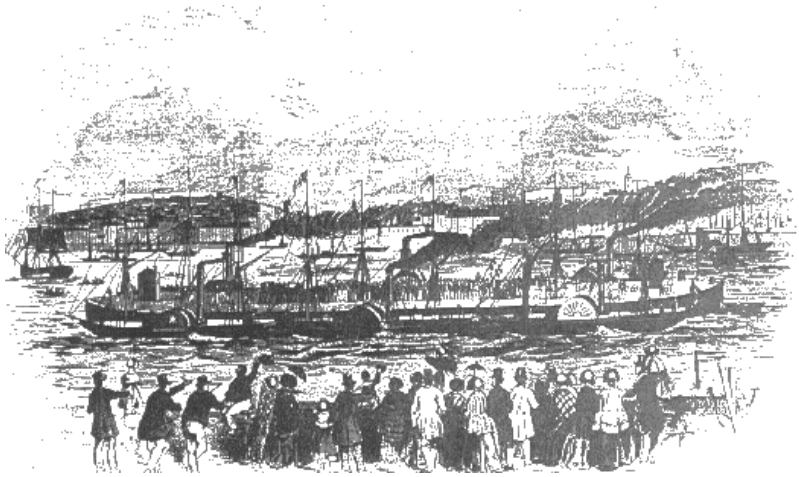
Optional Crew. Larger vehicles usually have a captain. Consider also:

- Soldiers
- Officers such as midshipmen or navigators
- Cargo or livestock handlers
- Artisans for workshops
- Purser, for paying the crew
- Cleric, doctor or barber-surgeon
- Nobles, in training to be captains; and pages (often children) in training to be crew

Repairs

Repairing a vehicle is described in the *Dungeon Master's Guide* (p. 119). In addition, for every 5-percent of the vehicle's base hit points restored, one *disabled* component is repaired. When the vehicle is restored to its maximum hit points, all *disabled* components are repaired.

Destroyed components must be replaced. If the replacement is crafted rather than purchased, salvaged parts from the old component provide one-quarter of its value in material costs.



Consumables

Supplies

A vehicle with a quarters component includes storage for 30 days-worth of food and water for each of its occupants. Replenishing this costs 20 gp per occupant.

Otherwise, food and drink for long voyages must be stored in cargo holds or steerage cargo. 300 person-days of rations and water uses 1 ton of cargo space, and costs 150 gp. Make a note of how many days voyage each ton of supplies will support, given a full crew with normal rations.

Ammunition

Replenishing ammunition has the following costs.

Ammunition	Cost per Shot
Ball and Powder, Cannon	216 gp
Bolt, Ballista	3 gp 5 sp
Stone, Mangonel	2 sp
Stone, Trebuchet	1 gp

Fuel

The fuel consumed by steam engines have the following suggested costs. Actual costs may vary greatly depending on the game world.

Fuel	Cost per ton	Cost per lb
Wood	10 gp	0.005 gp
Coal	40 gp per ton	0.02 gp

Cargo

A vehicle has a carrying capacity. This is equal to the vehicle's total cargo capacity from cargo hold components, and from steerage cargo in quarters and seating components.

Overencumbered. If the vehicle is carrying more than its carrying capacity, use the rules for towing to determine safe limits and how speed is affected.

Luggage. Each occupancy in quarters and seating components allows for approximately 200 lbs—enough for a typical person and a small amount of luggage.

Appendix A: Weapons

Presented here is a small selection of siege engines taken from *Vehicle Construction Kit Supplement 4: Artillery* and *Vehicle Construction Kit Supplement 5: Catapults*.

Traction Trebuchet

Large object

- **Armor Class:** 15
- **Hit Points:** 50
- **Damage Immunities:** poison, psychic

A traction trebuchet is a beam sling powered by a large team of people pulling on ropes. It launches a 12-lb stone on a high arc, so can hit targets behind cover.

It takes 3 rounds to load, aim and fire a traction trebuchet.

Trebuchet Stone *Ranged Weapon Attack:* +5 to hit, range 50/200 ft. (can't hit targetrs within 30 feet of it), one target. *Hit:* 33 (6d10) bludgeoning damage.

Mass	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	*xi*	*xii*
Cost	–	*	*	*	*	500	1,000	1,500	3,000	5,000	10,000	15,000
Weapons	–	*	*	*	*	1	2	3	6	10	20	30
Crew	–	*	*	*	*	60	120	180	360	600	1,200	1,800

Crew The pulling team takes up a lot of space: 8 seating components are required for the workspace! If half the crew are used, the trebuchet can launch the stone with half the normal and long range; alternatively a 6-lb rock can be used instead, dealing 22 (4d10) bludgeoning damage.

Furthermore, each Large creature on the pulling team counts as 2 crew, each Huge creature counts as 4 crew, and each creature with a Strength score of 20 or more counts for double.

Ammunition The component can hold a maximum of 60 stones per weapon. Stones can be found in the environment or purchased for 3 sp each.

Bombardelle, 20-pounder

Medium object

- **Armor Class:** 19
- **Hit Points:** 30
- **Damage Immunities:** poison, psychic

A bombardelle is an early form of breech-loading cannon that fires a stone ball with a charge of serpentine powder.

It takes 2 rounds to load, aim and fire a 20-lb bombardelle.

Bombardelle Shot *Ranged Weapon Attack:* +5 to hit, range 250/1,000 ft., one target. *Hit:* 26 (4d12) bludgeoning damage.

Mass	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	*xi*	*xii*
Cost	–	*	*	150	300	500	1,000	1,500	3,000	5,000	10,000	15,000
Weapons	*	*	*	1	2	3	6	10	20	30	60	100
Crew	*	*	*	2	4	6	12	20	30	60	120	200

Ammunition The component can hold a maximum of 15 stone balls per weapon. Each ball and powder charge costs 24 gp.

Appendix B: Examples

Let's Build an Airship

We'll make an airship that uses gasbags for lift and sails for propulsion. It will have hull that looks like a traditional sailing ship, with a lattice of sails extending to each side like wings, and a single round gasbag.

Body

We want the airship to be large enough to carry passengers and cargo on long voyages, but not so expensive that PCs cannot purchase one. We'll choose a mass *vii* body (60 laden tons). This gives us a damage threshold of 10, 100 base hit points, a base Dexterity of 8 and a base Strength of 13. We'll use the recommended sizes: a Gargantuan object, 50 feet long with a 15-foot beam and 1 deck.

Components

We need the following components.

Gasbag We need more than 3 Lift points for takeoff. Our gasbag is filled with lifting gas, so we need at least four components. We'll take five, so that we'll have a reasonable rate of ascent. 1 crew is required.

Sailing Rig The airship may be used for exploring rather than trading, so we'll choose the more versatile lateen rig as a sky rig, two components. 4 crew are required.

Helm We only need a rudimentary helm for steering. Ascent and movement are controlled by the gasbag and sail crew respectfully. 1 crew is required in addition to the helmsperson.

Quarters We need occupancy for the crew. As the vehicle will remain aloft around the clock, we need to use watchkeeping. With 3 watches, this is 21 occupancy (in hammocks). We'll also take 2 cabins and a chamber (a small saloon) for a total occupancy of 36. Therefore we need 6 quarters components.

This also provides 1 workspace, so we'll add 3 crew to run the quarters deck. We need another 3 bunks, so we'll add another component of hammocks.

Structure The airship has two wooden structure components, providing 12 Structure Points. Most ocean-going vessels have three, but we need a lighter hull to accomodate the gasbags. This gives a maximum speed limit of 60 mph (12 × 5).

Cargo hold We need at least one cargo hold to hold ballast. Any remaining slots can be used for cargo.

Crew and Supplies. The airship can carry 24 crew in hammocks and up to 4 people in cabins. It carries 30 days supplies, costing 600 gp.

Slot	Component	Cost (gp)
1	Wood structure	200
2	Helm (rudimentary)	600
3–5	Quarters	3 × 600
6	Cargo hold (3 tons)	0
7–11	Gasbag (lifting gas)	5 × 1,400
12–13	Sky Rig (lateen)	2 × 600
14–17	Quarters	4 × 600
18	Cargo hold (ballast)	0
19	Cargo hold (3 tons)	0
20	Wood structure	200

The table above shows the components we've selected arranged into the 20 slots.

Statistics

Cost 13,400 gp.

Hit Points 220 in total: 100 base, plus 120 from the wood structure (calculated 12 × 10).

Dexterity 8. There are no modifiers.

Strength 10 (calculated base 12, minus 4/3 from the sailing rig).

Constitution 11 (calculated base 10, plus 12÷12).

Rate of Climb The airship's rate of climb is 80 feet per round (calculated (5 − 3) × 40).

Armor Class Overall AC is 13, calculated (15 + 15 + 11) ÷ 3. Each gasbag and sail is an exposed component with an AC of 11.

Acceleration (Air) 1.8 mph (light wind) to 5.2 mph (strong wind), from two sky rig components.

Speed 30 mph (light wind) and 50 mph (strong wind). This was calculated as follows:

- *Base air speed:* 60 mph (light wind) to 100 mph (strong wind).
- *Drag:* 10 (from the gasbags) + 2 (from the sails) −6 (from mass *vii*) = 6.
- *Speed Multiplier:* ×0.53

Speed at other points of sail are:

- Reaching: 13 mph (light wind), 24 mph (strong wind).
- Running: 13 mph (light wind), 21 mph (strong wind)
- Bearing windward: 3 mph (light wind), 4 mph (strong wind)

The finished airship statblock looks like this.

Dimensions. 50 feet long, 15 feet wide, 1 deck.
Supplies: The quarters can hold up to 30 days of supplies, costing 600 gp.
Design Notes: Mass *vii* body (60 tons laden).

Crew

You can optionally note specific crew roles.

12 riggers (3 watches)
3 gasbag crew (3 watches)
3 helm crew (3 watches)
3 pilots (3 watches)
3 deck crew (3 watches)
Up to 4 officers or passengers

Combat

You can optionally note information that may be useful if the vehicle is engaged in combat, such as how damage affects components, and its turning performance. Unless otherwise specified, turning rotations are 45-degrees.

Damage. If a single attack deals 22 or more damage, a slot is *disabled*; if 110 or more damage, two slots are *destroyed*.
Turning. 1 rotation (at 50 mph), 2 rotations (at 30 mph), 3 rotations (at 15 mph)

Example Airship

Gargantuan object

Armor Class: 13
Hit Points: 220
Speed: 30 mph to 50 mph (broad reach); 13 to 24 mph (reaching or running); 3 to 4 mph (bearing windward)

STR	DEX	CON
10 (+0)	8 (−1)	11 (+0)

Acceleration (Air): 1.5 to 5 mph in broad reach
Crew: 24 to 28
Cargo: 6 tons
Cost: 13,400 gp

Slot	Component
1	**Wood structure**
2	**Helm** (rudimentary)
3–5	**Quarters** (18 hammocks)
6	**Cargo hold** (3 tons)
7–11	**Gasbag** (lifting gas)
12–13	**Sky Rig** (lateen)
14–17	**Quarters** (6 hammocks, 2 cabins, saloon for 5)
18	**Cargo hold** (ballast)
19	**Cargo hold** (3 tons)
20	**Wood structure**

Let's Build a Steam Wagon

This example introduces Power Points and powertrains.

This steam wagon is a three-wheeled design with the boiler and piston mounted over the front wheel, similar to Nicolas-Joseph Cugnot's *fardier à vapeur*. We will restrict outselves to Renaissance-era components.

Body

The *fardier à vapeur* weighed about 2.5 tons unladen. If we account for the weight of the driver and some cargo, we can use a mass *ii* body (3 laden tons).

This gives the steam wagon damage threshold of 5, 30 base hit points, a Dexterity of 11 and a Strength of 12. The steam wagon is Large, 10 feet long and 5 feet wide.

Components

We need the following components.

Helm The wagon needs to be controlled. At mass *ii*, this is a small helm.

Seating A small helm requires a seating component for the driver. Two other passengers can sit at the front. Therefore we need three seating component for three utilitarian seats.

Wheels We take standard wheels. Only one component is required.

Wheel Drivetrain The wheel drivetrain is a powertrain, so we use the powertrain rating rule. Power-to-weight is 1. Mass is 3 tons. We'll take two components.

- *Base* = 3 ÷ (3 × 1) = 1
- *Effective Components* = 2 − Base = 1
- *Rating* = 1 × 1 = 1; so we cannot allocate more than 1 Power Point to the powertrain.
- Because we want the steam wagon to pull a load, we will use a low-gear drivetrain.

Steam Engine At mass *ii* each atmospheric engine component generates a 1/12 Power Point. We will take 6 components, generating a 1/2 Power Point.

Structure We need at least 1 Structure Point to derive a maximum speed. The wagon is open-topped but has a wooden frame protecting the drivetrain. We will take two wooden structure components for 12 Structure Points.

Cargo hold Remaining slots can be used for cargo.

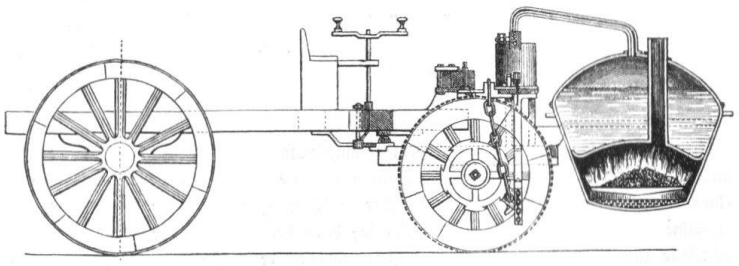
Firebox. The steam wagon has a lightweight undersized cargo hold that acts as a firebox for the steam engine. It has a capacity of 100 lbs. It takes 5 minutes to stoke the engine, then no stoker is required. It gives the engine an endurance of 40 minutes (1/2 Power Point × 1 hour ÷ 3).

Slot	Component	Cost (gp)
1–6	Atmospheric engine *Firebox* (in slot 1)	6 × 15
7–8	Wheel drivetrain	2 × 200
9	Helm	60
10–12	Seating (3 utilitarian)	30
13	Wheels, Standard	10
14–15	Wood structure	2 × 10
16–20	Cargo (1,500 lbs)	0

The table above shows the components we've selected arranged into the 20 slots.

Statistics

Cost 600 gp.
Hit Points 70 in total: 30 base, plus 12 × 3.5.
Speed 7 mph (60 ft.). The vehicle has 7.5 Land Thrust (wheel drive train with 1/2 Power Point) and 6 Drag (renaissance wheels), granting 13 mph. The low-gear drivetrain halves this.
Towing If the wagon tows one load (3 tons), it has an additional 3 Drag, reducing its speed to 2½ mph (20 ft.).
Acceleration 10 mph (per the Base Land Speed table).
Dexterity 11. There are no modifiers.
Strength 19 (calculated 11 base, plus 8 for wheels).
Constitution 11 (calculated 10 base, plus 12÷12 from structure).
Armor Class Overall AC is 13, calculated (15 + 15 + 11) ÷ 3.
Crew 1 driver, 2 passengers.



The following statblocks show how slots, components and statistics can be presented.

Damage Immunity. All the example vehicles have damage immunity to poison and psychic damage.

Lightweight components are shown in italics and occupy the last numbered slot if a range of slots is given (for exmaple, the steam wagon's rear cart wheels occupy slots 19 and 20).

Heavy Covered Wagon

A heavy wagon with a hide bonnet, wooden panelling, and a simple bench for passengers. A teamster drives the draft horses, walking alongside the wagon. This basic example uses a mass *i* body and does not use facing. Note that each seat must be oversized, as the minimum size for a seating component is mass *ii*.

The vehicle is drawn by draft horses. The carrying capacity of a draft horse is about a quarter of a ton (18 [Strength] × 2 [Large] × 15 = 540 lbs). The wagon has wheels, so its effective laden mass is halved (to 1 ton): therefore 4 draft horses are required.

Design Notes. Mass *i* body. No helm.

Combat

Damage. If a single attack deals 6 or more damage, a slot is *disabled*; if 32 or more damage, two slots are *destroyed*.

Turning. 4 rotations

Heavy Covered Wagon

Large object

Armor Class: 14
Hit Points: 65
Damage Threshold: 5
Speed: 40 ft. (Drawn by four draft horses)

STR	DEX	CON
19 (+4)	8 (-1)	11 (+0)

Cargo: 1 ton
Crew and Passengers: 1 teamster, 2 passengers
Cost: 90 gp

Slot	Components
1	**Wooden structure**
2	**Wooden structure**
3–4	**Seating** (utilitarian for teamster) *Harness*
5–6	**Seating** (utilitarian for 1 passenger)
7–8	**Seating** (utilitarian for 1 passenger)
9	**Cargo hold** (200 lbs, trunk under seats)
10	**Wheels, Standard**
11–20	**Cargo hold** (1 ton) *Flexible structure* (canvas)

Gnomish Submarine

This long iron-hulled vessel allows a team of gnomes cranking a spiral oar to travel quietly under the ocean's surface. It must come up for air after 1 hour. Two values for acceleration and speed are given, the first for normal operation and the second if the cranking team exert themselves.

Design Notes. Mass category *iii* (6 tons laden). Sealed.

Because the vehicle is sealed, the seating components have half their normal occupancy. A muscle engine team of 12 operators with an average of Strength 13 produce 156 Effort (rounded to 1/10 Power Point), or 312 Effort (rounded to 1/5 Power Point) if they exert themselves. The screw propeller and ballast are anachronistic, so their costs are multiplied by 10.

Drag is 3 (underwater) −1 (mass category), for a speed multiplier of ×0.8.

Crew

1 pilot
12 operators

Combat

Damage. If a single attack deals 29 or more damage, a slot is *disabled*; if 145 or more damage, two slots are *destroyed*.
Turning. 3 rotations

Gnomish Submarine

Rare Huge object

Armor Class: 18
Hit Points: 290
Damage Threshold: 5
Speed: 3½ mph (30 ft.) to 4½ mph (40 ft.) (underwater)

STR	DEX	CON
14 (+2)	6 (-2)	14 (+2)

Acceleration: 0.5 mph (5 ft.)
Maximum Depth: 55 ft.
Cargo: 600 lbs.
Crew: 13
Cost: 23,000 gp

Slot	Components
1	**Iron structure** (front)
2	**Helm**
3	**Cargo hold** (600 lbs)
4–9	**Seating** (6 workspaces)
10	**Iron structure** (center)
11	**Submarine ballast**
12–17	**Seating** (6 workspaces)
18	**Muscle engine** (+1/10 to 1/5 PP)
19	**Screw propeller**
20	**Iron structure** (rear)

Gun Tower

A two-storey defensive tower with three bombardelles. It has a small guardroom in the ground floor, and off-duty soldiers rest in a separate cabin. Fully stocking the stone shot and serpentine powder costs 1,800 gp.

Design notes. Mass *iii* (6 tons laden). Vertical design.

Gun Tower

Large object

Armor Class: 17
Hit Points: 100
Damage Threshold: 5

STR	DEX	CON
–	–	11 (+0)

Crew: 6 gunners
Cost: 920 gp

Slot	Components
1–2	**Stone structure** (upper)
3–8	**3 × Bombardelle, 20-pounder** (15 ammo each)
9	**Cargo hold** (storeroom for 30 ammo)
10–11	**Stone structure** (centre)
12–17	**Guardroom** (standard seating for 6)
18	**Magazine** (75 powder charges)
19–20	**Stone structure** (lower)

Jolly Boat

A jolly boat is a small clinker-built boat for transporting people and goods from shore to ship. Two rowers each operate a set of oars.

Design notes. Mass *i* (2 tons laden). No facing. No helm.

Jolly Boat

Large object

Armor Class: 13
Hit Points: 65
Damage Threshold: 5
Speed: 4½ mph (40 ft.)

STR	DEX	CON
15 (+2)	4 (-3)	11 (+0)

Acceleration: 0.5 mph (5 ft.)
Cargo: 800 lbs
Crew and Passengers: 2 rowers, 4 passengers
Cost: 82 gp

Slot	Components
1–2	**Wood structure**
5–8	**Oars** (2 crew)
9–12	**Cargo hold** (800 lbs)
13–20	**Seating** (utilitarian for 4 passengers)

Merchant Ship

A sailing ship for carrying cargo. It has a round hull and a square sail to follow trade winds.

Slot 2 demonstrates undersized components. To hold the ship's rowboat (1 ton laden) and jolly boat (2 tons laden), the ship has an undersized mass *viii* berth at the stern. A slot can contain two components of this size, so we can include a 5-ton cargo hold.

Dimensions. 80 feet long, 20 feet wide, 2 decks.
Design notes. Mass *ix* body (200 tons laden).

Crew

9 riggers (3 watches)
3 pilots (3 watches)
3 helm crew (3 watches)
3 deck crew (3 watches)
Sailmaker
Acolyte (the ship's "doctor")
Captain
Officer

Combat

Damage. If a single attack deals 40 or more damage, a slot is *disabled*; if 200 or more damage, two slots are *destroyed*.
Turning. 4 slow turns at 10 mph (over 1 minute)

Merchant Ship

Gargantuan object

Armor Class: 15
Hit Points: 400
Damage Threshold: 15
Speed: 10 to 13 mph (broad reach); 5 to 6½ mph (reaching); ½ mph (beating windward).

STR	DEX	CON
20 (+5)	1 (-5)	11 (+0)

Acceleration: Up to 4 mph
Cargo: 115 tons
Crew: 22
Passengers: 2 to 4 passengers in cabins, 6 passengers in bunks.
Cost: 12,210 gp (plus 140 gp for jolly boat and rowboat)

Slot	Components
1	**Wood structure** (front)
2	i. **Berth** (3 tons) ii. **Cargo Hold** (5 tons)
3	**Quarters** (10 bunks, sewer's workshop)
4–6	**Cargo Hold** (30 tons)
7	**Wood structure** (center)
8	**Sailing rig** (square)
9–13	**Cargo Hold** (50 tons)
14	**Quarters** (2 passenger cabins, 10 bunks)
15	**Wood structure** (rear)
16–18	**Cargo Hold** (30 tons)
19	**Helm**
20	**Quarters** (3 cabins, 5 bunks)

Golden Condor

A huge legendary ornithopter, resembling a condor, made from gold and powered by sunlight.

Design notes. Mass *iv* body (10 tons laden). Good streamlining.

- The ornithopter wings are rated for 29 PP, and are allocated 24 PP from the magic engines.
- Air acceleration is 0.75 × 24 = 18 mph
- The wings provide a Lift of 24 ÷ 8 = 3
- Base air speed is 190 mph. Drag is −2 (3 from ornithopter components, −3 from mass, −2 from streamlining), so the speed multiplier is ×1.2. The condor can achieve 225 mph (but not for sustained flight, see below).
- Stall speed is 0 mph (from 3 Lift), so the condor can hover.
- The gold structure provides 30 Structure Points. The maximum speed limit is 5 × 30 × 1.2 = 180 mph.
- Each gold structure costs 60,000 gp (instead of 50,000 gp) due to streamlining.
- The magic engines only operate in sunlight, so their cost is halved.
- The runners in slot 15 represent the Condor's "feet".

Combat

Damage. If a single attack deals 20 or more damage, a slot is *disabled*; if 100 or more damage, two slots are *destroyed*.
Turning. 2 rotations (at 180 mph), 7 rotations (at 10 mph)

Golden Condor

Legendary huge object

Armor Class: 16
Hit Points: 200
Damage Threshold: 5
Speed: fly 180 mph (hover)

STR	DEX	CON
13 (+1)	14 (+2)	12 (+1)

Acceleration: 18 mph (air).
Rate of Climb: 180 ft.
Crew and Passengers: 1 pilot, 6 passengers
Cost: 406,000 gp

Slot	Components
1	**Gold structure** (front)
2	**Helm**
3–6	**Seating** (6 standard)
7–9	**Magic Engine** (+12 PP)
10–11	**Gold structure** (center)
12–14	**Ornithopter Wings (futuristic)** (-24 PP)
15–17	**Magic Engine** (+12 PP) *Runners*
18	**Maneuvering System (Air)**
19–20	**Gold structure** (rear)

Elemental Locomotive

This rail-bound locomotive is powered by conjured elementals, usually one magma mephit or two steam mephits. The elemental furnace is contained within an iron cylinder to the front of the vehicle, behind which is the driver's station. To the rear is a cab for two wizards to travel in comfort. Their role is to conjure fresh elementals and defend the train.

Design notes. Mass *iii* body (6 tons laden).

Elemental Locomotive

Uncommon huge object

Armor Class: 18 (front), 15 (center, rear)
Hit Points: 180
Damage Threshold: 5
Speed: 40 mph (rail)

STR	DEX	CON
20 (+5)	9 (-1)	12 (+1)

Acceleration: 40 mph
Cargo: 1.2 tons (2,400 lbs)
Crew and Passengers: 1 driver, 2 wizards
Cost: 4,000 gp

Slot	Components
1	Iron structure
2	Elemental engine (+4 PP, conjured elemental)
3–7	Wheel drivetrain (-4 PP, low-gear)
8	Wheels, Rail
9	Helm
10	Wood structure
11–14	Seating (2 luxury)
15	Wheels, Rail
16–19	Cargo hold (1.2 tons)
20	Wood structure

Rolling Stock

The elemental locomotive can safely tow any number of loads. Each car presented below is a one-half load.

The train's maximum speed is reduced to 30 mph (2 cars), 25 mph (4 cars), 20 mph (6 to 12 cars), 15 mph (14 cars) or 10 mph (18 cars).

Design notes. All cars use a mass *ii* body (3 tons laden) and have no facing.

A car's maximum safe speed is 60 mph, since it has 12 Structure Points.

Coach. A coach carries eight passengers in comfort, and includes a latrine. This is an economy class coach. A first class coach has the same cost and carries 4 passengers in luxury seats, while a royal coach carries 1 passenger in an opulent seat.

Coach

Large object

Armor Class: 13
Hit Points: 75
Damage Threshold: 5
Crew and Passengers: 8 passengers
Cost: 340 gp

Slot	Components
1	Wood structure (6 SP)
2	Wheel, Rail
3–18	Seating (8 standard)
19	Wheel, Rail
20	Wood structure (6 SP)

Covered Goods Wagon. Also known as a boxcar, a covered goods wagon simply carries freight protected by walls and a roof.

Covered Goods Wagon

Large object

Armor Class: 13
Hit Points: 75
Damage Threshold: 5
Cargo: 2.4 tons
Cost: 50 gp

Slot	Components
1	Wood structure (6 SP)
2	Wheel, Rail
3–18	Cargo (2.4 tons)
19	Wheel, Rail
20	Wood structure (6 SP)

Powertrains Reference

Ratings

This appendix presents pre-calcuated powertrain ratings.

Each table gives you the rating of a powertrain by cross-referencing the number of components and the vehicle's mass category.

For example, if you have a mass *ii* vehicle with 3 modern ornithopter components, the powertrain is rated for 15 Power Points.

Legs

Simple Legs (Early Modern)

Components	1	2	3
Mass *i*, *ii*	1/10	1/5	1/3
Mass *iii*	1/10	1/2	1½
Mass *iv*	1/5	1	2
Mass *v*, *vi*, *vii*	1/2	1½	2½
Mass *viii* +	1	2	3

Simple Legs (Modern)

Components	1	2	3
Mass *i*	1/3	2	5
Mass *ii*	1/3	3	6
Mass *iii*	1½	4	7
Mass *iv*	2	5	8
Mass *v*	2½	5	8
Mass *vi* +	3	6	9

Simple Legs (Futuristic)

Components	1	2	3
Mass *i*	2	8	14
Mass *ii*	3	9	15
Mass *iii*	4	10	16
Mass *iv*	5	11	18
Mass *v*+	6	12	18

Superior Legs (Early Modern)

Components	1	2	3
Mass *i*, *ii*, *iii*	1/30	1/15	1/10
Mass *iv*	1/30	1/15	1/5
Mass *v*	1/30	1/4	1/2
Mass *vi*	1/15	1/3	1/2
Mass *vii*	1/5	1/2	1/2
Mass *viii*, *ix*	1/4	1/2	1
Mass *x* +	1/3	1/2	1

Superior Legs (Modern)

Components	1	2	3
Mass *i*, *ii*	1/10	1/5	1/3
Mass *iii*	1/10	1/2	1½
Mass *iv*	1/5	1	2
Mass *v*, *vi*, *vii*	1/2	1½	2½
Mass *viii* +	1	2	3

Superior Legs (Futuristic)

Components	1	2	3
Mass *i*	1/5	1/3	2
Mass *ii*	1/5	1	3
Mass *iii*	1/2	2½	4
Mass *iv*	1	3	5
Mass *v*, *vi*	1½	3½	5
Mass *vii* +	2	4	6

Ornithopter Wings

Ornithoper Wings (Early Modern)

Components	1	2	3
Mass *i*, *ii*	1½	3½	5
Mass *iii* +	2	4	6

Ornithoper Wings (Modern)

Components	1	2	3
Mass *i* +	5	10	15

Ornithoper Wings (Futuristic)

Components	1	2	3
Mass *i* +	10	20	30

Paddlewheel

Components	1	2	3
Mass *i*	1/10	1/5	1/3
Mass *ii*	1/10	1/5	1/2
Mass *iii*	1/10	1/2	1
Mass *iv*	1/5	1/2	1
Mass *v*	1/3	1/2	1
Mass *vi* +	1/2	1	1½

Propellers

Here, a "1/2" component represents a one-step undersized component.

Propellers (Industrial)

Components	1/2	1	2
Mass *i*	8	21	46
Mass *ii*	9	22	47
Mass *iii* +	12	25	50

Propellers (Early Modern or Later)

Components	1/2	1	2
Mass *i* +	20	40	80

Rotary Wing

Here, a "1/2" component represents a one-step undersized component.

Rotary Wing (Early Modern)

Components	1/2	1	2
Mass *i*	3½	11	26
Mass *ii*	4	12	27
Mass *iii* +	7	15	30

Rotary Wing (Modern)

Components	1/2	1	2
Mass *i*	11	26	56
Mass *ii* +	15	30	60

Rotary Wing (Futuristic)

Components	1/2	1	2
Mass *i* +	25	50	100

Screw Propeller

Screw Propeller (Industrial)

Components	1	2	3
Mass *i*	1/3	1½	3
Mass *ii*	1/2	2	3½
Mass *iii*, *iv*	1	2½	4
Mass *v* +	1½	3	4½

Screw Propeller (Early Modern or Later)

Components	1	2	3
Mass *i*	1½	4	7
Mass *ii*	2	5	8
Mass *iii*	2½	5	8
Mass *iv* +	3	6	9

Wheel Drivetrain

Wheel Drivetrain (Renaissance)

Components	1	2	3
Mass *i*	1/5	1/2	1½
Mass *ii*	1/5	1	2
Mass *iii*, *iv*, *v*	1/2	1½	2½
Mass *vi* +	1	2	3

Wheel Drivetrain (Industrial)

Components	1	2	3
Mass *i*	2½	6	10
Mass *ii*	3	7	11
Mass *iii*	3½	7	11
Mass *iv* +	4	8	12

Wheel Drivetrain (Early Modern)

Components	1	2	3
Mass *i*	6	14	22
Mass *ii*	7	15	23
Mass *iii* +	8	16	24

Wheel Drivetrain (Modern)

Components	1	2	3
Mass *i*	8	18	28
Mass *ii* +	10	20	30

Wheel Drivetrain (Futuristic)

Components	1	2	3
Mass *i* +	15	30	45

Powertrain Components Required

Sometimes you know how many Power Points you wish to assign to a powertrain, and need to know how many components should be added. The following method can be used instead of the Rating calcuation in the Powertrain chapter of *VCK*.

The number of components required depends on the maximum Power Points (PP) that can be allocated to the powertrain. Each powertrain has a power-to-weight value (PTW).

Base Components equals PP ÷ PTW.

Smaller powertrains have reduced power-to-weight. This is represented with a Mass Addend.

Mass Addend equals 3 ÷ (T × PTW)

Where T is the laden mass of the vehicle in tons (see the Body table in the Body Mass section).

If the Mass Addend is less than 0.1, it is negligable: treat it as 0.

Add the Mass Addend to Base Components to get the Required Components.

Round Up. If the result is more than 0.5, round the result *up* to the nearest whole number.

Undersized. If the result was between 0.34 and 0.5, you can use a one-step undersized component at half cost. If the result was between 0.21 and 0.33, you can use a two-step undersized component at one-third cost.

Lightweight. If the result was 0.2 or less, you can take the component as a lightweight component, at one-fifth cost.

Component Limit

There is a maximum limit to the number of required components.

Component Limit equals Base Components × 5

If the Required Components exceeds the Component Limit, reduce it to the Component Limit.

Bulky and Compact

Some powertrains are tagged as "bulky" or "compact". Adjust the calculations as follows.

Bulky:

- Mass Addend = 1 ÷ (T × PTW).
- Component Limit = Base Components × 10.

Compact:

- Mass Addend = 8 ÷ (T × PTW).
- Component Limit = Base Components × 2.5.

Example

To a mass *i* vehicle (2 tons) you wish to add modern light legs rated for 4 Power Points.

- The power-to-weight for modern light legs is 3 (bulky).
- Base Components = 4 ÷ 3 = 1.3
- Mass addend = 1 ÷ (2 × 3) = 1.5.
- The total is 2.8, rounded up to 3. This does not exceed the Component Limit of 13 (1.3 × 5 × 2).
- Therefore 3 leg components are required.

Appendix: Sailing Rig Speeds

The following tables show the *base speed* of a ship for each type and number of sailing rigs, point of sail and wind strength.

You still need to apply the Speed Multiplier (VCK p. 43): The table does not take into account drag from the ship's mass or streamlining.

Acceleration. The value in brackets is the ship's acceleration in mph-per-round. You can use this table as a reference for combining sailing rig acceleration with other forms of propulsion. The exact acceleration is shown for this purpose. When you create your vehicle statblock, you should round acceleration down to a managable value.

Acceleration is not shown for *beating windward*, as this is the ship's zig-zagging overall speed.

Square Rig

	Broad Reach	Reaching	Running	Beating Windward
1 Sailing Rig				
... Light Wind	5½ mph (1.4)	2½ mph (0.17)	4½ mph (0.7)	½ mph
... Strong Wind	8 mph (4)	4 mph (0.5)	6½ mph (2)	½ mph
2 Sailing Rigs				
... Light Wind	7 mph (2.8)	3½ mph (0.35)	5½ mph (1.4)	½ mph
... Strong Wind	10 mph (8)	5 mph (1)	8 mph (4)	1 mph
3 Sailing Rigs				
... Light Wind	8½ mph (4.2)	4 mph (0.52)	6½ mph (2.1)	½ mph
... Strong Wind	12 mph (12)	6 mph (1.5)	9 mph (6)	1 mph

Lateen Rig

	Broad Reach	Reaching	Running	Beating Windward
1 Sailing Rig				
... Light Wind	5½ mph (1.4)	5 mph (0.9)	4½ mph (0.7)	1½ mph
... Strong Wind	8 mph (4)	7 mph (2.6)	6½ mph (2)	2½ mph
2 Sailing Rigs				
... Light Wind	7 mph (2.8)	6 mph (1.8)	5½ mph (1.4)	1½ mph
... Strong Wind	10 mph (8)	9 mph (5.3)	8 mph (4)	3 mph
3 Sailing Rigs				
... Light Wind	8½ (4.2)	7 mph (2.8)	6½ mph (2.1)	2½ mph
... Strong Wind	12 mph (12)	10 mph (8)	9 mph (6)	3½ mph

Full Rig

	Broad Reach	Reaching	Running	Beating Windward
1 Sailing Rig				
... Light Wind	6 mph (1.8)	5 mph (0.9)	5 mph (0.9)	1 mph
... Strong Wind	9 mph (5.5)	7 mph (2.7)	7 mph (2.7)	1½ mph
2 Sailing Rigs				
... Light Wind	8 mph (3.6)	6 mph (1.8)	6 mph (1.8)	1½ mph
... Strong Wind	11 mph (11)	9 mph (5.5)	9 mph (5.5)	2 mph
3 Sailing Rigs				
... Light Wind	9 mph (5.4)	7 mph (2.7)	7 mph (2.7)	1½ mph
... Strong Wind	13 mph (16.5)	10 mph (8.2)	10 mph (8.2)	2½ mph