HQC Aerolyth Ship Design Contest

Ship Designers Needed!

The Aerial Forces of the Hive, Queen and Country universe are locked in an arms race! Each nation seeks to field the best aerial vessels possible. New designs are constantly being sought and each ship makes all those that came before it obsolete relics.

Hive, Queen and Country is opening a design contest for would be aerial architects. The design rules are included below as are weblinks to examples of other designs. The prizes will include a rapid prototyped model of your ship and inclusion of the design in an upcoming Hive, Queen and Country product. You will receive full credit for the design in the product and a complimentary copy when it reaches print.

Good Luck and Good Hunting!

1 Submission

Contest participants will design an aerolyth ship (or class of ships) in the HQC setting using simplified design rules. Submissions should consist of:

- Drawings of the ship (top and side exterior view plus any additional pictures you want to include, such as drawings of the ship in action, floor plans, etc…)
- Ship design (see attached design rules)
- Description of the ship and how it fits in the HQC universe. This could include:
  - Which nation built the ship, and which use it
  - The ship's design process and operational history
  - Fictional accounts of the ship in action
  - Adventure ideas
  - Anything else you think might help!

The drawings do not need to be of schematic quality – i.e. don't worry about getting the measurements and dimensions exactly right, concentrate on making it look cool.

Submissions are due by October 15, 2011 and should be posted to the Hivequeen mailing list or emailed to hive.queen@aol.com. Submissions will be judged by Terry Sofian and Arun Rodrigues.

2 Prizes

The top 5 winning entries will receive a 3D printed model of your ship and their ship design may be included in future HQC publications. The scale of the ship model will depend on the size of the ship (see Section 3 on page 3). Ships will be modeled by Objects May Appear (http://shpws.me/CxJ).

3 Fine Print

By entering, the entrant gives permission to use the submitted material in an upcoming Hive, Queen and Country product. Winners will receive full credit for the design in the product and a complimentary copy when it reaches print.

Entrants also grant a non-exclusive license to produce a 3D printed copy of the winning design.

The contest reserves the right to change submitted material before inclusion in final product to fit with the setting.

You may enter and win multiple times.

If you have any questions, feel free to email hive.queen@aol.com for clarification.

3.1 Key Dates

Submission due date: October 15, 2011

Award Announcements: October 31, 2011

Prizes: November 18, 2011 (estimated. Exact date will depend on modeling, production and shipping time)

Quick Aerolyth Flyer Design Rules

1 Background

The end of the nineteenth century saw huge strides in the science of aeronautics. The most obvious example of this is the discovery of aerolyth – the miraculous anti-gravity mineral. The late Victorian Era saw constant improvement in aerolyth anti-gravity flyers. Before the turn of the century, aerolyth was being used to conquer the skies of Earth, Mars, and Venus.

1.1 The Greatest Inventions of the Age.

Flight has been one of Mankind's oldest dreams. For as long as men have had legends heroes and Gods have taken to the skies. But this ability existed only in legend until John Lubbock, later Lord Avebury, discovered, (or perhaps rediscovered) the secret of Aerolyth and became the first modern man to achieve those heights.

> *"It was during the most frightful thunderstorm that the amazing properties of the Stonehenge bluestone and the amazing knowledge of our ancient ancestors were revealed to me. My workmen were preparing to shift a large slab of bluestone, which they had carefully rigged to a jib with heavy wire rope. The most terrific bolt of lightning struck the gyn. For a moment I was rendered blind and when my sight finally returned I thought it had been permanently damaged. The huge block of stone was trying to pull the boom and steam traction engine skyward. I felt certain it was all some trick of the lightning until I heard my foreman begin swearing next to me. With a loud crack the thick wire parted and the immensely heavy boulder hurtled skyward. The front wheels of the Aveling splashed onto the muddy ground, being driven some many inches into it. Off into the low clouds the massive block sailed, disappearing completely from our view.*
>
> *The workmen and I ran forward, foolishly in retrospect. We stood next to where the block had lain these uncounted centuries, staring alternatively at the innocent seeming depression that had formerly housed it and into the gray clouds a few hundred feet above us into which it had disappeared. Rain splashed unheeded against our upturned faces.*
>
> *Suddenly we could hear a low whistle coming from within the overcast. For a second I did not know what to make of it. Then with wild fear I understood what the sound was! The whistle grew to gigantic proportions, seeming to us far louder than any of the thunder had been. We stood rooted in place, knowing not where the savage rock would land, but that if it struck us we would be smashed to jam. With the clouds so low I knew that it would strike almost as soon as it appeared, leaving no time for us to evade it. I did the only thing a sane man could do. I dropped to my knees in prayer. No sooner had my legs buckled than the rock plummeted to Earth landing with an almost subdued 'thump', which still threw us about like boats on the ocean. The great*

stone landed no more than a village green from where we huddled. With a mix of curiosity and caution, the second perhaps a little late, we slowly walked over to the stone. It appeared none the worse for its trip, save for some marks of burning left by the wire rope (of which there was nearly nothing left) and a coating of frost, which I surmised, must have indicated a very high flight indeed."

Skyward 1882 John Lubbock, Baron of Avebury

Aerolyth, as Lord Lubbock called his discovery, was perhaps the most important breakthrough of the later 19th Century. Upon this one discovery has been built the entirety of aerial navigation. Without it space travel would never have become a possibility. It first made the World smaller and then made it no longer unique. Soon after the events of that spring afternoon in 1865 Lubbock began experimenting with samples of bluestone at his family's estate. Although he was never able to determine the underlying scientific principals that cause the stones to resist gravity he was able to determine its properties and how they could be harnessed. By applying a current across the stone the force of gravity was not only neutralized but also actually opposed. The force of that opposition depended upon many things. Lubbock tested many samples of bluestone, as well as other rocks and minerals. Only bluestone, and not even every sample of it, would propel objects against the force of gravity. In his laboratory he quickly discovered the shape and surface finish of the stone had a great affect on its lifting capabilities. The polished bluestone, when cut into plates much wider and longer then they were thick, produced the greatest lifting force. Fixed into a rigid frame they could produce a lifting force many times their own weight. The ideal slab was no more then three inches thick. Lesser slabs had a disconcerting habit of shattering explosively; thicker one produced no additional lift. Explosions were also provoked if two slabs were mounted above each other in a gravitational field. A certain amount of current had to be supplied; increasing the current appeared to provide no additional lift but later experiments showed greater current allowed greater heights to be reached. Reducing it below a critical level meant that no lift at all was generated. It was certainly very perplexing and all the information had to be determined by experimentation, since no theory existed. In his laboratory, a converted stable Lubbock learned by trial and error. . It proved tremendously important for the plates to stay nearly flat to the surface of the Earth. Any change in angle of the plates from perpendicular to the flow of gravity would result in immediate lose of force from them. Above an angle of fifteen degrees force became negligible. Experiments also showed that placing one charged plate directly above another would result in both plates shattering violently. The larger the plates, the more dramatic the explosion would be.

Within a matter of months nations the world over were seeking to build their own vessels. Lubbock's patents were strong and he soon grew wealthy beyond even the dreams of the Rothschilds'. Other men grew rich mining the bluestone, from those rare deposits that could be provoked to lift. Flying ships became the rage of the era. The wealthy wished to own them, the armies and navies of the world experimented with them, and the great lines sought to supplement their huge steamship with smaller, faster "aeroliners". It was considered the height of fashion to be able to say, "Why yes, I've seen the coastline from 5,000 feet. Haven't you?"

1.2 The Mechanics of Aerolyth

Aerolyth is a naturally occurring form of igneous rock, related to dolerite. The special circumstances of its formation and its mineral composition are what give it unique contragravitational properties. Only magma that cooled underground in dikes has the correct crystal size and orientation to be useful. The crystals themselves are composed of an unknown element, which has so far defied analysis. These characteristics make the material so rare.

Even after the mineral has been located and mined it still has to be carefully cut and polished, to the same standard as the finest marble, for it to be most effective. The stone panels are most efficient when they are cut into plates between one and two inches thick. Each plate, after trimming and polishing, is carefully wrapped with heavy gauge copper wire. The copper wire is connected to a powerful direct current source. As soon as the current is applied the contragavitational effects begin. There is no discernable time lag. British engineers and stone masons quickly began cutting panels to a common size to ease the manufacture of ships and simplify lift calculations. These standard panels are eight feet by four feet in extent and provide a force of 48,912 Newtons. This means that depending upon the amount of load connected to the panel it will not just float above the planet's surface but will accelerate away from it. The amount of dead weight that the panel is carrying greatly affects this acceleration. Experiments showed that Aerolyth, which so confounds Newtonian physics on one level obeys it rigorously on another, the acceleration is precisely as would be predicted by the Newtonian equation of F=M*A. Standard panels have a weight of 889 pounds (404 kilograms). The panel can accelerate materials up to somewhat more than ten times its own mass away from the planet. At loads greater than that the force is unable to completely counteract the force of gravity.

The maximum altitude to which an aerolyth craft can climb is determined by the amount of electrical power supplied to the panels and the planet one which the vehicle is located. The greater the electrical field that is applied the higher the panel may fly. There are four critical power levels. On Earth if the minimum power of one kilowatt is applied, the panel and its cargo can rise to a height of 2,000 feet above sea level. If additional power is applied the vessel will raise no higher until two kilowatts of energy have been input, at which time the vessel will accelerate upwards to 12,000 feet. The next altitude barrier is 45,000 feet which requires four kilowatts and finally a vessel can reach lower orbital altitudes of 600,000 feet or slightly over 100 miles above sea level. This altitude level requires tremendous electric energy. Sixteen kilowatts must be applied to every panel to reach this altitude. Once a vessel has crossed above the critical altitude its panels will cease to provide any force at all. This has proven very disconcerting to inexperienced travelers who find themselves suddenly plunged into freefall after being under substantial acceleration just an instant before.

Aerolyth appears to function on all bodies with a perceivable gravitational field. Sea level has become a rather malleable term now, with three different planets having oceans and Luna with neither ocean nor atmosphere. On Venus, the gravitation and sea level are similar to Earth and the effects of Aerolyth identical. Mars is much smaller, and the four levels are much lower being 1,000, 6,000, 22,500 and 300,000 feet respectively. Luna, being a tiny world, has levels set at 500, 3,000, 12,250 and 150,000 feet. Since Aerolyth in no way interacts with an atmosphere it functions as well on airless orb, such as Luna or perhaps Mercury. On alien worlds the force appears to be relative to that planet's gravitational forces, not those of Earth's. For all practical purposes the force on Venus is equal to that of those panels on Earth. On Luna the force is 8,152 Newtons and on Mars 16,304 Newtons.

1.3 Standard Body Design

Constructing an Aerolyth craft was no easy feat. Optimal alignment of the aerolyth panels required painstaking calculations and building a flying vehicle which would be fast, maneuverable, and sturdy required the best engineering effort of the day. By 1890, designers had begun to use standardized bodies to simplify this process. These bodies were pre-fabbed constructions that would include the hull, landing gear, engines, generators, batteries, aerolyth, control surfaces, and crew accommodations for 45 days. This would allow the designer to concentrate on selecting the payload for the ship, be it cargo, weapons, or other equipment.

In this design contest you will use a Standard Body to design an aerolyth ship (or ship class) from the 1890-1895 period.

1.4 Historical Background and Setting

1831: Chares Babbage's **Analytical Engine** is a success. Babbage's company (and a host of competitors) soon adapt mechanical computers to a variety of tasks, from controlling vehicles, organizing the census, to solving complex mathematical equations. As the machines become more successful, they push the bounds of manufacturing processes, leading to a number of other developments.

1863: Practical powered **heavier-than-air flight** possible with aerodynamic lift (Cayley) craft.

1861-1864: **American Civil War**. This conflict sees major use of computer controlled artillery and other new technologies. After the war the US loses interest in investment in advanced military technology for many years.

1865: John Lubbock discovers the anti-gravitational properties of **Aerolyth**

1893: Johnstown Flood. This flood sees the first major relief effort conducted by aerial vehicles.

1891-1893: The **First Hive War**. England suffers terribly under the alien invasion. Disasters like the Christmas Raid cast doubt on the outcome of the conflict, but a concerted effort ultimately wins the day. Aerolyth fliers and other technologies play a major role in the Hive's eradication.

1898-1902: The **Second Hive War**. The Hive returns, this time appearing in South America. It is a massive infestation, dwarfing the First Hive, and consuming whole countries. Eventually, a massive international alliance is able to turn the tide, but at an immense cost. Like the First Hive War, this conflict pushes the boundaries of available technology, especially in the area of flying craft.

1.5 Additional Resources

More background to the Hive Queen and Country setting can be found at:

- **http://games.groups.yahoo.com/group/Hivequeen/ :** Long running Yahoo! Discussion group
- **http://hivequeenandcountry.com** : Official web page
- **http://blackpigeonpress.com/vault/black-pigeon-press-inc/stars-of-empire-perfect-bound/ :** Sourcebook for the RPG
- **http://shpws.me/CxJ :** Objects May Appear
- **http://s871.photobucket.com/albums/ab273/afrodri/Airships/ :** Examples of HQC ships and models
- **http://s871.photobucket.com/albums/ab273/afrodri/HQC/ :** Examples of HQC ships and models

2 Ship Design Process

The simplified design process for the contest revolves around selecting a standard body, and then outfitting it with armor and other equipment. The design is limited by the mass, volume, power, and crew.

1. **Select a Standard Body** (Section 3)
2. **Choose the amount of fuel**: (Section 3.1) Calculate and record the mass and volume required.
3. **Choose the amount and type of armor** (Section 4): calculate and record the mass required for the armor
4. **Choose equipment** (Section 5): Record the mass, volume, power, and crew required for each added system.
5. **Check design constraints**: Total up the mass, volume, power, and crew requirements for the fuel, armor, and equipment. If they are less than or equal to the capacity of the chosen Standard Body, the design is valid. Otherwise, remove fuel, armor, or equipment, or add crew to

3 Standard Bodies

Select a Standard Body from the table below:

Dimensions, length x height x width (m)	Surf Area	Fuel (kg/hr)	Fuel (m^3/hr)	Speed (m/s)	Extra Crew	Extra Mass (kg)	Extra Volume (m^3)	Extra Power (kW)
17.08x2.2x2.44	170	100	0.086	16	9	19000	4	4
21.96x2.2x2.44	210	140	0.114	17	10	25500	27	7
21.96x2.2x1.82	180	100	0.086	20	8	4100	8	3
21.96x2.2x4.88	330	280	0.229	17	28	51700	39	14
29.28x2.2x3.66	360	280	0.229	19	19	44800	39	14
29.28x2.2x1.82	240	140	0.114	22	10	4900	29	4

Dimensions, length x height x width (m)	Surf Area	Fuel (kg/hr)	Fuel (m^3/hr)	Speed (m/s)	Extra Crew	Extra Mass (kg)	Extra Volume (m^3)	Extra Power (kW)
29.28x3x7.32	650	470	0.384	18	43	152700	457	20
39.04x2.2x3.66	470	380	0.315	23	70	55600	44	3
48.8x2.2x4.88	710	540	0.441	23	86	131300	235	25
48.8x4x9.76	1420	980	0.809	20	84	350500	1787	20
61x3x6.1	1150	790	0.654	23	86	244500	852	37
73.2x3x7.32	1550	1120	0.923	25	102	349000	1293	19
73.2x3x14.64	2670	2150	1.772	25	184	789900	2758	37
85.4x3x7.32	1810	1280	1.05	26	110	395000	1565	24
97.6x3x8.54	2300	1710	1.405	27	148	501500	2073	27
97.6x3.6x17.08	4160	3330	2.736	26	283	1159600	5651	53
122x4x10.98	3740	2640	2.168	27	215	751700	5258	36
122x4.8x21.96	6740	5270	4.337	25	447	1742800	13378	73
146.4x5x13.42	5530	3910	3.218	26	315	994400	10254	61
170.8x6x29.28	12400	9910	8.151	26	843	2728000	32682	141
170.8x5x14.64	6860	5000	4.112	28	404	1082600	13017	71

Note: To find the total crew, multiple ships whose “extra crew” cell is yellow by 4, and ships whose cell is blue by 2.

Scale: Winning models with a red “Dimension” cell will be in 1:1200 and 1:600 scales. Models with a purple cell will be available in 1:2400 or 1:1200 scale.

Example 1: A large flying battleship might use a 73.2x3x7.32 body. This ship can travel at 23 m/s (about 50 mph). It has 102 “extra” crew who can be used to man additional equipment. It also has 349,000 kg and 1293 m^3 of mass and volume for extra equipment. The generators produce 19 kW (19,000 Watts) of additional power which can be used to power the equipment.

3.1 Fuel

To select the fuel system:

1. Choose the number of hours of fuel and boiler water the ship should carry.
2. Multiply the number of hours by the number in column 3 (“Fuel (kg/hr)”) of the “Standard Bodies” table (Section 3) to find the mass of the fuel.
3. Multiply the number of hours by the number in column 4 (“Fuel (m^3/hr)”) of the “Standard Bodies” table (Section 3) to find the volume of the fuel.
4. Record the fuel mass and volume

Example 2: Continuing Example 1, the 73m ship consumes 1120 kg of fuel an hour, and this fuel requires 0.923 m^3 of volume. 48 Hours of fuel would require (1120*48) 53760 kg and 44 m^3. This leaves 295,240 kg of remaining mass and 1248.696 m^3 of remaining volume.

4 Armor

Select the type of armor from the table below, and also choose the thickness of the armor. If no armor is chosen, the Standard Body includes a medium canvas covering.

Covering	Density (kg / cm / m^2)
Oak	8
Concrete	24
Steel	79
Aluminum	27

Armor does not require any volume, power, or crew. To calculate the mass required, multiple the **thickness** of the armor (in cm) by the **surface area** of the ship (column 2 from Section 3) and by the armor **density** (column 2 in the table above). That is:

thickness * surface area * density

Example 3: Continuing Example 2, we choose 1.5cm of steel armor for the ship. The 73m ship has 1550 m^2 of surface area. The density of steel is 79 kg / cm / m^2. The total mass would be (1.5*1550*79) 183675kg. This leaves 111,565 kg of remaining mass, 1248.696m^3, 19000 Watts, and 102 crew for equipment.

5 Equipment

Note: These equipment lists are, obviously, incomplete. There are a great many other things one might want to include in an aerolyth ship, and entries are encouraged to do just that. Take these lists as a starting point, and if you think of something else you would like to add, feel free to. Try to make reasonable estimates about the mass, volume, power, and crew requirements, ideally including some sources. If you have any questions, feel free to email hive.queen@aol.com for clarification.

5.1 Crew & Passengers

Extra crew (above what comes with the Standard Body) and passengers can be chosen from the table below:

Name	Mass (kg)	Volume (m^3)	Power (W)
Marine	575	3.5	30
Marine Equipment	25	0.17	0
Extra Crew	550	3.33	30
Passenger, Steerage	570	3.8	30
Passenger, 2nd Class	600	10	40
Passenger, 1st Class	950	45	100

Note: “Marine Equipment” converts an existing member of the crew into a marine. This means that it consumes one “Extra Crew” slot.

Example 4: Continuing Example 3. We add 20 Marines and 10 extra crew. The Marines would require (575*20) 11,500 kg, (3.5*20) 70 m^3, and (30*20) 600 Watts of power. The extra crew would require (550*10) 5500 kg, (3.33*10) 33.3 m^3, and (30*10) 300 Watts. After these additions, we have 94565kg, 1145.396m^3, and 18100 W for remaining equipment. Because we added crew, we have 112 crew for equipment.

Example 5: A ship has been designed and has 19 crew "left over". To equip these crew as marines would require (25*19) 475 kg and (0.17*19) 3.23 m^3.

5.2 Cargo Handling Equipment

Name	Mass (kg)	Volume (m^3)	Power (W)	Crew
Pulley System, 100kg capacity	10	0.5	300	1
Steam Shovel, 1000kg capacity	1000	4	1000	2
Mechanical Arm, 10kg capacity	40	2.5	480	2

Example 6: Continuing Example 4. We add 5 pulleys to help lower and retrieve troops and supplies to the ground. These pulleys require 50kg, 2.5 m^3, 1500W, and 5 crew to operate. This leaves 94,515 kg, 1142.896m^3, 16600W, and 107 crew for additional equipment.

5.3 Protective Systems

Beyond armor, other systems can be included to reduce the effects of damage or dangerous events (fire, boarding) to the ship. The mass and volume of some of these systems are based on the initial "Extra Mass" and "Extra Volume" for the Standard Body found in the table in Section 3.

Name	Mass (kg)	Volume (m^3)	Notes
Improved Component Location		30% of Extra Volume	Less critical components are used to screen and protect critical ones. Effects the whole ship.
Strengthened Hull 1	10% of Extra Mass	10% of Extra Volume	Collision damage is halved. Increase the mass used to compute damage points by 1.5 times the increased mass of the strengthened hull.
Emergency Lift System (1 Panel)	75	0.1	An emergency lift system deploys a small wing to provide aerodynamic lift equivalent to one aerolyth panel. It only functions on craft capable of maintaining a speed of 25m/s. It also limits speed to 30m/s.
Internal Defensive Positions	10% of Extra Mass	10% of Extra Volume	Internal defensive positions provide positions inside a ship to repel boarders. Ship counts at 'Fortified' for quick boarding actions.

Name	Mass (kg)	Volume (m^3)	Notes
Automated Defenses	2% of Extra Mass	10% of Extra Volume	V= Ship volume; Requires 50W + 10W * V and 4*V IPA. Equivalent to V/20 extra defenders. Requires a computer be installed.
Fireproofing	4% of Extra Mass	5% of Extra Volume	V=Ship Volume. The use of cutting edge materials (asbestos) to reduce the effect of fire by 20%.
Self-Destruction System (incapacity)	50	0.1	Self-destruction systems come in two forms. "Incapacity" systems destroy control linkages and computer systems only, making the ship unusable, but not completely destroyed. "Total" destruct systems reduce the craft to small pieces, making it totally unrecoverable.
Self-Destruction System (total)	Extra Mass/ 100	0.5% of Extra Vol.	

Example 7: Continuing Example 6. The ship adds Fireproofing. This requires 4% off the "Extra Mass" and 5% of the "Extra Volume" from the Standard Body Table in Section 3. This would be (0.04*349,000) 13,960kg and (0.05*1293) 64.65 m^3.

5.4 Other Payloads

Adventurous sorts might find themselves in need of all manner of equipment:

Name	Mass (kg)	Volume (m^3)	Power (W)	Crew	Notes
Repair & Replenishment Facilities					
Mini Shop	7000	8	1000	1	*Provides +3 to repair rolls.*
Field Shop	30000	25	3000	4	*Provides +5 to repair rolls. Increase repair rate.*
Secure Rooms					
Brig/Safe Room, 1 person	350	3.5	0	0	Secure holding cell with heavy reinforcement and a locking door. The difference between a brig and a safe room is if the lock is on the inside or the outside
Brig/Safe Room, 4 person	1700	25	0	0	
Concealed Door	20	0			External concealed door, possibly with hidden latch
Medical Facilities					
Medical Bay	5000	300	700	2	10 beds + stores, minimal surgical facilities and examination facilities. *Provides a +2 to medical treatments.*

Name	Mass (kg)	Volume (m^3)	Power (W)	Crew	Notes
Brunel "Hut"	24400	1265	3500	7	52 beds + stores, surgical room, and examination facilities. *Provides a +3 to medical treatments.*
Mobile Renkioi Hospital	512400	26500	80000	124	31 Doctors/physicians, etc… 93 nurses & assistants. 988 beds + stores, surgical room, sterile laundry, and examination facilities. *Provides a +5 to medical treatments.*
Recreational Facilities					
Musical Organ	2000	10	5000		A must have for super-scientists
Large Musical Organ	10000	45	19000		A must have for super-super-scientists
Laboratory Facilities					
Science Kit	50	1	500	1	Simple tools for investigation of a single field (i.e. chemical, electrical, biological). *Provides +2 to science rolls.*
Science Field Kit	250	6	2000	2	Modular container with Basic tools for investigation of a single field. *Provides +5 to science rolls.*
Biological laboratory	6000	180	4000	8	Support for 4 researchers, plus 4 assistants. Includes 60m^3 of specimen containment. *Provides +10 to science rolls.*
Library, Single Subject	1200	6	0	0	*Provides +2 to knowledge roll in a given knowledge Area*
Command Facilities					
Commodore's Flag Bridge	600	20	50	5	For commands of up to 3 ships.
Real Admiral Flag Bridge	4500	150	375	30	For commands of up to 10 ships..

Name	Mass (kg)	Volume (m^3)	Power (W)	Crew	Notes
Fleet Flag Bridge	27000	900	2700	150	For commands of up to 30 ships. Includes briefing rooms.

5.5 Weapons

There are some tough worlds out there, and it is often necessary for even merchant ships to carry a variety of weapons. To add a weapon system to a ship:

1. Choose Weapon (Section 5.5.1)
2. Choose Mounting (Section 5.5.2)
3. Choose the number of rounds of ammunition for the weapon
4. Compute the weapon mass and volume by multiplying the weapon's base mass and volume (Section 5.5.1) by the appropriate modifiers for its mounting (Section 5.5.2)
5. Compute the mass of the ammunition by multiplying the number of rounds of ammunition by the weight per round (column 5 in the table in Section 5.5.1).
6. Compute the volume of the ammunition by dividing the mass of the ammunition by 4000. The result is in m^3.
7. Compute the total weapons system mass and volume by adding the mass and volume of the weapon and the mass and volume of the ammunition.

Example 8: A QF 6-inch/40 naval gun (6600 kg and 5.5m^3) mounted in a turret requires (6600*1.5) 9900 kg and (5.5*2.0) 11 m^3. 100 rounds of ammunition would require (100*45) 4500kg and (4500/4000) 1.125m^3. The total system would require (9900+4500) 14400 kg and (11+1.125) 12.125 m^3. It requires 6 crew.

Example 9: A Maxim Gun (27.2kg 0.77m^3) mounted in a sponson requires 29.92kg and 0.847m^3. 1000 rounds would require 10kg and 0.0025m^3.

5.5.1 Weapon

Name	Mass (kg)	Volume (m^3)	Power (W)	kg/round	Crew
Small Venusian Railgun	430	0.12	4270	0	5.5
Maxim Gun	27.2	0.77	0	.01	3
Gatling Gun	270	0.80	0	.03	3
1-inch Nordenfelt gun	203	0.23	0	.21	
RBL 7 inch Armstrong gun	3657	3.1	0	49.5	5
BL 4-inch/25 gun Mk I	1148	2.5	0	11.4	4
BL 6-inch/25.5 gun Mk III	5000	4.4	0	45.36	5
QF 6-inch/40 naval gun	6600	5.5	0	45	6
11-inch 25ton RML	25000	28	0	243	33
RML 16 inch 81 ton gun	81000	75	0	763	75

Name	Mass (kg)	Volume (m^3)	Power (W)	kg/round	Crew
RML 17.7 inch	103000	100	0	910	90?
3-inch BLR	650	1.5	0	15	3
5-inch BLR (US)	2800	3.8	0	40	5
6-inch BLR (US)	5000	8.5	0	68	7
8-inch BLR (US)	12700	13.9	0	170	13
10-inch BLR (US)	26500	27.5	0	340	25
BL 12 inch naval gun	47000	35.0	0	324	38
12-inch BLR (US)	40000	32.8	0	580	36
BL 13.5 inch naval gun Mk I	67000	55	0	570	55
14-inch BLR (US)	68200	58.6	0	920	59
16-inch BLR (US)	100000	68.6	0	1400	86
1-pounder Rapid	33	.8	0	0.6	3
3-pounder Rapid	230	.9	0	1.8	3
6-pounder Rapid	363	1.0	0	3.6	3
Whitehead 15-inch Torpedo Launcher	410?	0.85	1000	410	1
Hotchkiss Revolving Cannon 37mm/5	209	0.75	0	0.5	3
Hotchkiss Revolving Steam Cannon 37mm/5	500	1.5	500	0.5	2
9 pdr Rocket Launcher	7	0.02	0	7	6
12 pdr Rocket Launcher	14	0.04	0	14	12
24 pdr Rocket Launcher	23	0.06	0	23	14
6 inch Rocket Launcher	68	0.2	0	68	18
9.2 inch Rocket Launcher	227	0.5	0	227	24
Mallet Mortar	43000	40	0	1200	48
Large Flamethrower	4450	4	0	40	10

5.5.2 Mounting

Mount Type	Mass Multiplier	Volume Muliplier	Definition
Turret	1.5	2.0	An enclosed rotating structure with 360 degree traverse
Barbette	1.25	1.75	A movable platform with a 360 degree traverse, but protection only in front of the gun.
Casemate	1.0	1.5	Protected gun which projects from a ship but has limited traverse (usually < 180-degrees)
External Fixed Mount	1.0	0.75	An immobile mount on the outside of the ship
Sponson	1.1	1.1	A weapon protruding from the side of the ship, with limited traverse. (e.g. casemate ironclads)

5.6 Communication & Sensors

A variety of communication, sensor, and computing devices can be carried. Plotting boards are used to track target movement and improve firing accuracy. Computers can do the same, as well as help automate and assist with other tasks.

Name	Mass (kg)	Volume (m3)	Power (W)	Crew	Notes
Stadiametric rangefinder	25			1	Less effective than a coincidence range finder
Coincidence rangefinder (1m base)	52	0.5		1	
CRF (2m)	173	0.6	0	1	
CRF (4m)	628	0.8	0	1	
CRF (8m)	2380	1.2	0	1	
Aldis Lamp	25	0.1	150	1	
Tube Blinker	21	0.01	90	1	Concealed communications (tight beam)
Homing Pigeon Coop (20 bird)	450	11	0	0.5	Homing pigeons provide one-way communication back to a known location.
Raven Coop (10 bird)	450	11	0	1	Trained ravens can provide more flexible, though more failure-prone, communication.
Heliograph	20	0.1	10	1	Only works during the day
Fog Horn	300	0.3	100	0	3.5 km range
“Grappling Telegraph” Gun & Key, 1km	106	1.1	150	1	1km Range, 1 round is 60kg.
24-in Arc Light	100	0.3	2700	1	*Provides +5 to Observe rolls at night up to 4000m*; Increases C_d*S by 0.5 m^2
Plotting Board MkI	2200	7.5	750	12	
Plotting Board MkII	3300	11	1200	13	
Plotting Board MkIII	4200	14	1700	15	

Name	Mass (kg)	Volume (m3)	Power (W)	Crew	Notes
Automated Plotting Board MkIII	4700	19	3200	10	Requires Computer be installed
Plotting Board MkIV	4650	15.5	2100	17	
Plotting Board MkV	5100	17	2400	18	
Gun Pointer	10	.01	10	0	Improves Aiming. Mass, volume, and power is per gun
Babbage Analytical-1891	8755	1.47	44490	1	28200 Instructions Per Minutes (IPM), high accuracy.
Babbage Small Analytical-1891	3328	0.07	870	1	5800 IPM
ABM Thinking Machine 5	139	0.04	70	1	3500 IPM, but lower accuracy

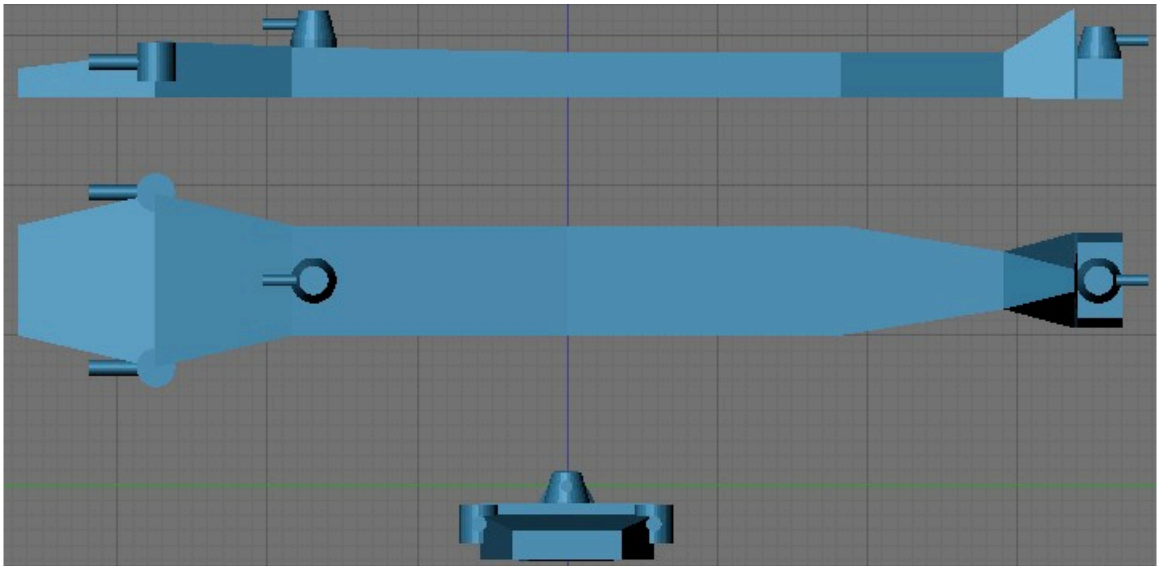
5.6.1 Radios

Radios, or wireless telegraphs, were just starting to be used by the mid-1890s. They cannot be used by an aerolyth craft in flight, but can be used if it has landed.

Mass (kg)	Volume (m3)	Power (W)	Crew	Max Range (km)
6803	15.9	33300	5	320
3781	8.8	18500	3	100

1 Example Entry: The HMS Sample

1.1 Ship View



Side, Top, and Front View of the HMS Sample

1.2 Ship Design

The ship is built using a 73.2x3x7.32m hull. This hull provides 349,000 kg, 1293m3, 19 kW, and 102 crew for equipment.

System	Crew	Mass	Volume	Power	Notes
Fuel		53760	44.304		48 Hours
Armor		183675			1.5 cm of Steel
Marines		11500	70	600	20 Marines
Extra crew		5500	33.3	300	10 Extra Crew
Pulleys	5	50	2.5	1500	5 Pulleys
Fireproofing		13960	64.65		
Medical Bay	2	5000	300	700	
Science Field Kit	2	250	6	2000	
Real Admiral Flag Bridge	30	4500	150	375	
QF 6-inch/40 naval gun in turret. 20 rounds ammo	12	21600	22.45		2 Guns
8-inch BLR (US) in Barbette, 10 rounds	26	35150	49.5		2 Guns
CRF (4m)	2	1256	1.6	0	2 Range Finders
Aldis Lamp	1	25	0.1	150	
24-in Arc Light	2	200	0.6	5400	2 Lamps
Automated Plotting Board MkIII	10	4700	19	3200	

System	Crew	Mass	Volume	Power	Notes
Babbage Small Analytical-1891	1	3328	0.07	870	
Marine Equipment	19	475	3.23		Equips an additional 19 crew as Marines, for a total of 39 Marines
Total	112	344929	767.304	15095	Crew, Mass, Volume, Power within bounds

The Mass, Volume, and Power are all within the bounds for the Standard Body. The crew is within bounds because of the 10 Extra Crew.

1.3 Ship Description

The HMS Sample was constructed by the Exemplar Shipyards in 1891 at the request of the Admiralty. Due to funding considerations, and concern that the next year's Parliamentary allocation would be small, the designers decided to use a 73m Standard Body. This allowed construction to being within a few months of the initial contract. Construction went smoothly. The ship was focused on providing long range fire support in fleet actions, though it would also carry a sizable Marine detachment and be capable of acting independently or in support of ground operations. For this reason it included a medical bay and scientific sample kit. It also had a rather advanced fire control system, with a Babbage machine, several range finders, and a Mark III plotting table readily adjacent to its Flag bridge. It was assumed that the Sample would not be deployed directly to the line of battle, but kept at a distance where it could pepper the enemy with long-range fire, or perhaps chase down stragglers.

Commissioned in early 1892, the Sample soon found itself committed to fighting the Hive in the First Hive War. It also found its tactical doctrine and pre-War assumptions to be sorely lacking. In its first engagement with Hive forces, flying Hive drones quickly surrounded it. The ship's guns were unable to track the swift moving creatures, and it was soon boarded. The Marine detachment was able to fight off most of the swarm while the craft withdrew, but the damage still required weeks to repair. Most of this time was spent at the Army HQ in Bathpool, where it served as a makeshift field hospital and artillery battery. This was, perhaps, its finest moment as even its meager medical facilities and accommodations were a welcome relief to soldiers coming off the Taunton Line.

The Sample did fight again in the daring Christmas raid, but was again almost overrun and severely damaged. It returned to Bathpool and did not fly again during the War. After the Hive was destroyed, the Sample was sold for scrap.